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Regional remote sensing

PROJECT FOR THE REGIONAL REMOTE SENSING CENTER, OUAGADOUGOU (CRTO)

REPORT OF THE MISSION FOR EVALUATION OF PHASE I

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~~I. INTRODUCTION~~

1. Terms of Reference of the Evaluation Mission

The report of the Technical Committee for 1977, the only basic document common to the four participants in the CRTO project, called for an in-depth evaluation at the end of Phase I. Although that phase has not yet been completed, it was necessary to proceed with such an evaluation within a reasonable time so that the sources of financing could make certain decisions about Phase II prior to the end of Phase I. It was therefore decided that the study would be made in early 1979. Without going into details, we note that the four members of the team appointed by the three donor countries and ECA agreed on a suitable date for the start of the operation, namely June 11. Each of them received, from the appointing authority, directives in accordance with its procedures for cooperation, and these were found to be entirely compatible. The work of the team therefore involved an on-site study of the operation of the CRTO in Ouagadougou. This was followed by a survey of the regional and national agencies actively involved in the field of remote sensing in the different countries, on the interest shown in them by CRTO and the results of their contacts with the Center.

For practical reasons the group was divided into two teams for the visits. The American and French members visited Ivory Coast, Togo and Guinea, while the Canadian and ECA members visited Senegal and Mali. The two teams shared the visits in Ouagadougou. Only capital cities were visited.

The team then met in Ouagadougou to draw up its evaluation report in accordance with the jointly established criteria.

2. Methodology

(a) At the CRTO the evaluation team held a series of individual and joint interviews with the Director, Assistant Director, administrative officer, experts and trainees; it also examined various statements and inventories; finally, it studied the work and reports of the trainees.

(b) With the assistance of the CRTO, UNDP, the French cooperation mission and USAID, the team drew up a list of agencies concerned in one way or another with remote sensing. The interviews took place in each agency and were based on the attached guide (Annex 1). The same annex lists the agencies and persons interviewed, and summarizes the essential points of each interview.

We would like to thank Mr. J. P. Ouédraogo, Director of the CRTO, Mr. R. Chipman, Assistant Director, and the representatives of UNDP, the French Cooperation Mission and USAID. In all cases they made our work easier. We are grateful as well to all those — too numerous to mention — who met with us and gave us much of their time.

I. EVALUATION CRITERIA FOR PHASE I

OBJECTIVES	CRITERIA
Regionalization	
(a) Promotional missions (African countries)	— appropriateness of missions undertaken
Objective: — participation	— results
— national laboratories	— degree of satisfaction
(b) Regional Management Committee (CRG)	— results
Establishment of the CRG	— degree of satisfaction
(c) Cooperative research (various agencies)	— results
	— degree of satisfaction
Objective: — cooperative research	
— integration of national laboratories	
Structure of the CRTO	
Organizational structure specified	— appropriateness of existing structure
	— quality of administration (including financial)
	— quality of technical supervision
	— quality of representation abroad
Liaison	
Technical Committee	— appropriateness of composition, representativeness
Structure	— compliance with terms of reference: councils
Objective: financial opinion	liaison
technical opinion	
Liaison	— frequency of meetings

~~Training~~		
Promotion	2 x 10 = 20 per year	— observance of parameters
Short training period	1 x 12 = 12 " "	— quality of resources employed — personnel
Long training period	1 x 6 = 6 " "	— physical
In-service training (project)	1 x 5 = 5 " "	— course content
Course at Canadian University	1 x 6 = 6 " "	— level of students (selection)
Equipment		— competence of students at end of study period
Premises		— follow-up of students
Personnel		— results of initial action
Certificate (recent objective)		
Assistance to users		
(a) Information Center		— appropriateness of resources employed — personnel
Photo library		physical
Print library		— level of utilization
Premises		— increase in number of users (countries, agencies, etc.)
Personnel		— users' degree of satisfaction
(b) Assistance for interpretation		— appropriateness of resources employed
Equipment		— level of utilization
Premises		— increase in number of users (countries, agencies, etc.)
Personnel		— users' degree of satisfaction

(c) Demonstration projects

Projects envisaged:
- cartography
- geology
- use of land and vegetation
- water resources

- appropriateness of projects (number, importance, etc.)
- degree of execution
- increase in number of participants (countries, agencies, etc.)
- participants' degree of satisfaction

II. ADMINISTRATION

2.1 Institutional Structure

2.1.1 The African Council on Remote Sensing and the Regional Management Committee

By Resolution 280 (XII), the Council of Ministers of ECA (February 1975) instructed the Executive Secretary to take all measures required for the establishment of an African center for the reception of remote sensing data by satellite.

Resolution 313 (XII) (March 1977) approved the establishment of African regional centers and the formation of an African Council on Remote Sensing.

The Government of Upper Volta (host country for a regional center) agreed to set up a temporary national institution responsible for the legal and financial affairs of the center.

It was also decided that the Government of Upper Volta would enter into bilateral agreements with the donor countries (Canada, France, United States) pending the establishment of regional and African institutions.

The meeting of representatives held in Ouagadougou (September 1978) proposed Articles of Agreement for the African Council on Remote Sensing. The functions of the Council would be to promote and coordinate all activities related to remote sensing in Africa. The Articles of Agreement provided for the formation of regional management committees which would serve as boards of directors of the regional centers.

The Regional Remote Sensing Center, Ouagadougou (CRTO) thus is part of a larger regional and African system.

It is impossible to pass judgment here on the appropriateness and effectiveness of these institutions, inasmuch as they are in the process of being established. Nonetheless, we would like to emphasize that the establishment of political institutions is generally a lengthy process.

For example, we recall that the meeting of representatives scheduled for February 1978 could not be held until September 1978. As a result of that meeting, it was decided that ECA would convene the first meeting of the African Council after approval of the Articles of Agreement by at least ten countries.

At the time of this mission ten countries had approved the instrument, and the inaugural meeting of the African Council on Remote Sensing was scheduled for the second half of August 1979.

The following countries have signed the Articles of Agreement of the African Council on Remote Sensing:

CAMEROON
EGYPT
UPPER VOLTA
KENYA
MALI
NIGER
UGANDA
SIERRA LEONE
TANZANIA
ZAIRE

This list is not definitive and more countries may adhere before or during the inaugural meeting of the Council.

2.1.2 Technical Committee

A Technical Committee was established to draw up a detailed timetable for implementation. This was done at the following meetings:

— Ouagadougou (Upper Volta), March 1977

— Ann Arbor (United States), May 1977

— Ottawa (Canada), July 1977.

Pending the establishment of a regional planning body, the Committee has continued to meet to coordinate the activities of the parties.

meeting in Ouagadougou	July 1978
meeting in Toulouse (France)	December 1978

With regard to the appropriateness of the Technical Committee, we note the absence of a technician from the United States and a representative of the Canadian source of financing. These absences could cause a delay in the drafting of the proposals and in the decision-making process.

The following tables show the projected timetable for the establishment of the institutions, as well as the actual implementation period.

1977 1978 1979

A S O N D J F M A M J J A S O N D J F M A M J J A S O N D

△ Final report of the Technical Committee

△ Convention between Upper Volta and Canada

△ Convention between Upper Volta and France (amendment not yet signed)

△ Convention between Upper Volta and United States (amendment signed in February)

△ Conclusion of legal agreement

△ Appointment of Acting Director

Meeting of African Council and Regional Management Committee

Meeting of △ Technical Committee

<u>Actual implementation</u>

	1977				1978											1979										
A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
△ Final report of the Technical Committee (Ottawa)																												
	△ Convention between Upper Volta and donor countries																											
		△ Conclusion of legal agreement																										
		△ Appointment of Acting Director																										
								△ Establishment of the African Council on Remote Sensing																				
									△ Meetings of	△ Technical		△ Committee															
														△ Installation of the Regional Board of Directors														

<u>Projected schedule of implementation</u>

2.2 Administrative Structure of the CRTO

2.2.1 Internal Organization

The internal organization (organizational structure) envisaged in Phase I is shown in the organizational chart on the next page.

The actual structure does not match the projected one in the following aspects:

-- The Regional Board of Directors has not been constituted for the reasons mentioned in paragraph 2.1 above;

-- There is no office of assistance for interpretation; this office was to be staffed by one expatriate and one African, who have not yet been recruited;

-- There is no office of information; the photo library has very few images of the region and the photographic laboratory faces difficulties in meeting requirements. Furthermore, the print library is in the initial stages of organization;

-- The office of assistance to users exists only for demonstration projects, which have been slow in getting started; also, it has no African counterpart personnel.

At each meeting of the Technical Committee CRTO officials presented an administrative and financial report on their activities. The Committee expressed its satisfaction with the administration of the Center in all cases.

The most important aspects are a serious shortage of personnel, the lack of a photographic laboratory capable of producing black and white and color photographs, and the lack of a documentation center that can better meet users' needs (MSS photographs covering the countries of the region, RBV photographs and a better equipped library).

FIGURE 2A

INTERNAL ORGANIZATION -- PHASE I

Board of Directors

Liaison Committee

Director
Deputy Director

Administrative Office

Office of Assistance for Interpretation

Support for Analysis — 1 expatriate
-- preparation of maps — 1 African
-- field work

Office of Information

Information center — 1 expatriate
-- photo library — 4 Africans
-- print library
Photographic laboratory

Assistance to Users

-- Projects
-- General assistance

3 expatriates
3 Africans
transient expatriates

Training

Courses — 1 expatriate
Promotion — 1 African
Shops — transient expatriates

Earth Station

Reception

Processing

2.2.2 Financing

No specific financing plan has been prepared for the Center.

The donors undertook to finance the establishment of the Center and its operation during an "interim" phase of three to five years at most.

Other possible sources of financing are:

— Participation of the member States and associated members of the African Council on Remote Sensing;

— Services to users.

Such services, involving the sale of images or participation in development projects, could provide the Center with some income. The registration fees of nonmember countries or of certain agencies could be another source of income.

Other projected sources of income:

Source	1979
Members' contributions	US$60,000
Contracts	10,000
Registration fees (trainees from nonmember countries)	7,500
Sale of images	1,000

During the phase just completed the Center benefited from financing provided by donors with the participation of the Government of Upper Volta (host country for the Center). The participation of member States and intergovernmental agencies (associated members) in the African Council will take place only after the meeting of that Council, which will decide upon rates and forms of payment.

Income from services to users has been virtually nil since these services have not been developed as planned.

The registration fees of trainees have been paid by some agencies but such income remains insignificant. This is justified by the fact that the Center had to offer facilities to agencies wishing to have their personnel trained in the use of remote sensing.

2.2.3 Personnel and equipment

2.2.3.1 Personnel

The following table lists the personnel envisaged for Phase I and the list of personnel actually on duty at the Center.

POSITION	Expatriate or African	Personnel Envisaged 1978	Personnel Envisaged 1979	Personnel in service 1978	Personnel in service 1979
Director General	A	1	1	1	1
Assistant Director General	Exp. C.	1	1	1	1
Administrator	A	1	1	1	1
Librarian	A	0.5	1	1	1
Assistant Librarian	A		1	-	-
Photographic technician	Exp. U.S.	1	1	-	-
Photographic technician	A	0.5	1	-	-
Training	Exp. F.	2	2	2	2
Training			0.5		-
Applications	Exp. F.	2	2	2	2
Applications	Exp. U.S.	1	2	-	1 arrived in June
Applications	Exp. C.		2		
Secretary-Office of the Director	A	1	1	1	1
Secretary-typist	A	1	1	1	1
Auxiliary personnel	A	5	6	14	14
Total professionals	Exp.	6	9	4	4 and a 5th in June
	A	4	6.5	4	4
Total auxiliary personnel	A	6	7	15	15

2.2.3.2 Equipment and premises

2.2.3.2.1 Equipment

This section lists the equipment used in training and assistance for interpretation, as well as vehicles.

Equipment envisaged:

— Training equipment

* Audiovisual equipment
* Individual sets of photointerpretation equipment (to be issued to each trainee)
* Equipment for field measurements, for calibration of satellite measurements
* Equipment for recording measurements

— Image analysis equipment

* Equidensitometer
* Instruments for measurement
  - aerial distances
  - relief (for aerial photographs)
* Transfer equipment

— Vehicles

* All-terrain vehicles

Equipment on hand:

— Training equipment

* Drafting equipment
* Light tables
* Pocket stereoscopes

-- Image analysis equipment

* Mirror stereoscope

* Diazo

* Optiscope

-- Photographic laboratory equipment

* Black and white enlarger

* Minor dark room equipment

-- Vehicles

* Two agency cars (504)

* One Citroën pickup truck (2 HP)

1 canvas covered pickup (404)

1 Renault "Super Goelette" automobile

All equipment specified as necessary is on hand or on order. The remaining problems are the acquisition of an all-terrain vehicle and the possibility of making color prints in the photographic laboratory.

2.2.3.2.2 Premises

During Phase I it was planned that all personnel would be housed at the site.

However, it was decided that the premises would be expanded by January 1979 so that the Center could have a better equipped and more functional photographic laboratory and a more spacious information center (photo and print libraries) to hold more material.

The plans on the following pages show the present premises and the expansion planned for January 1979.

PHASE I

BUILDING PLAN

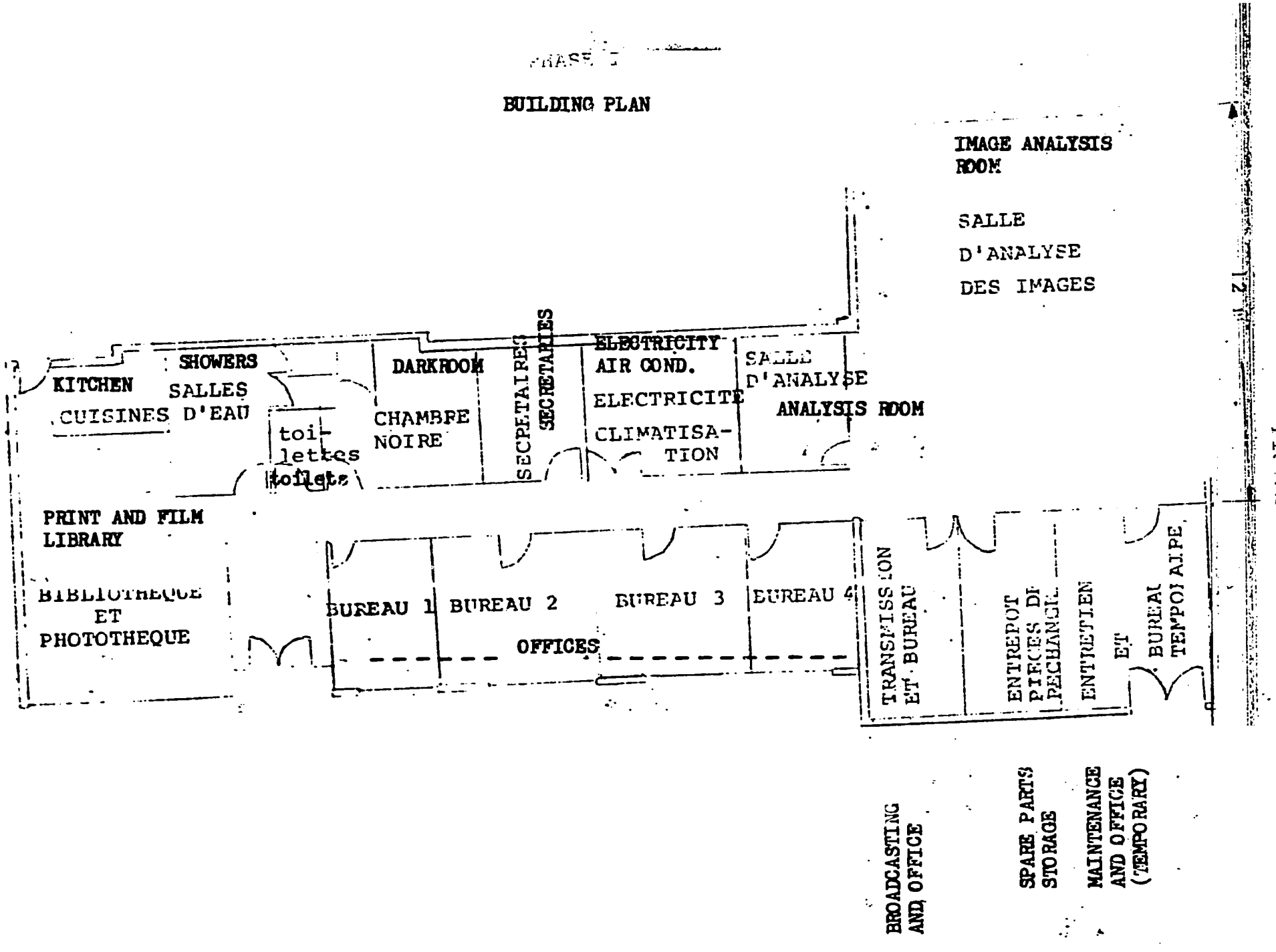
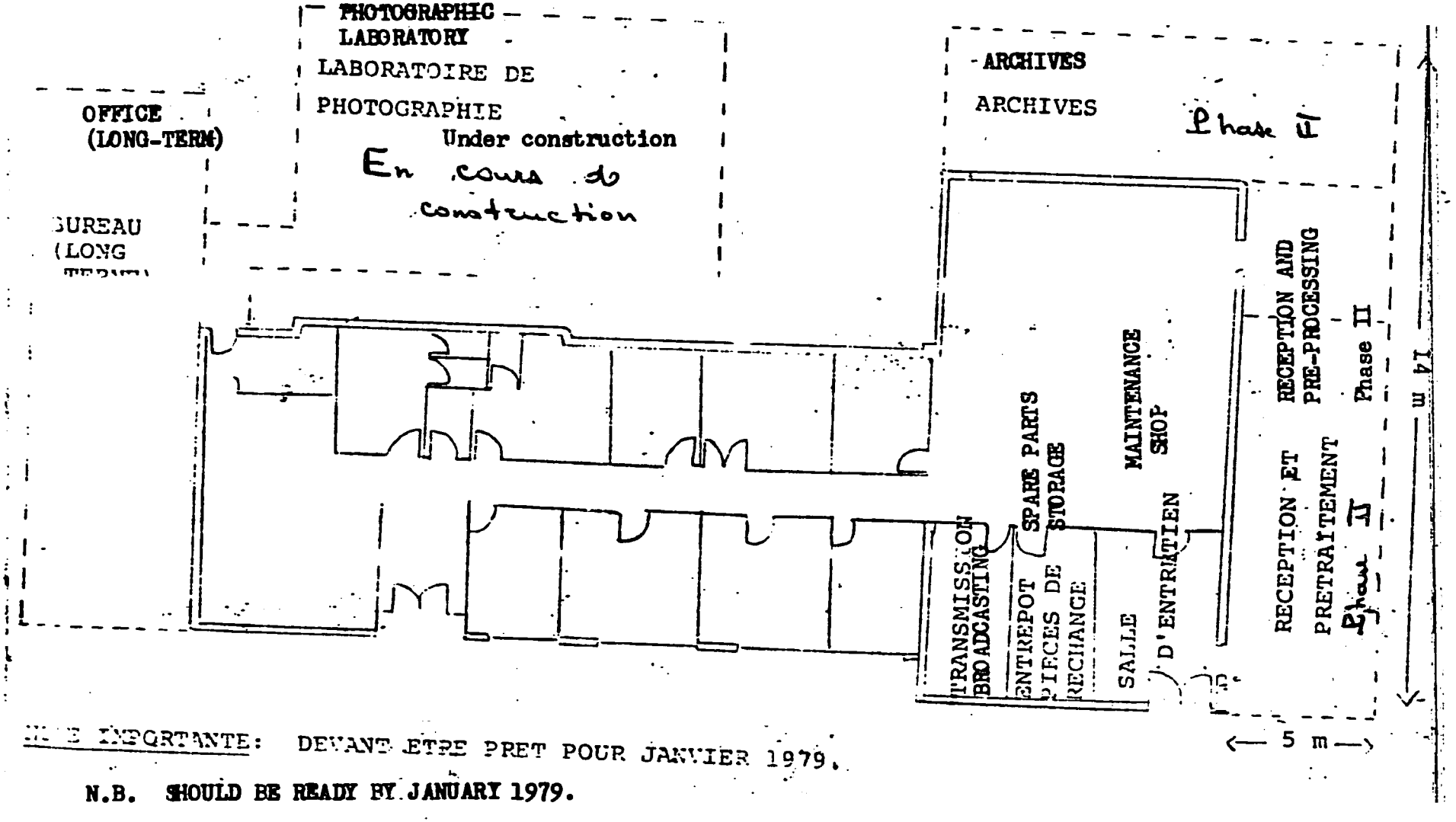


FIGURE 6

REPARATION DES LOCAUX

PHASE II

BUILDING PLAN



NOTE IMPORTANTE: DEVANT ETRE PRET POUR JANVIER 1979.

N.B. SHOULD BE READY BY JANUARY 1979.

FIGURE 7

Conclusion

The evaluation mission was not able to visit all countries of the region in the time available. It unanimously recognizes the willingness of the countries visited to take part in the regional remote sensing program.

The mission hopes that the Center will be regionalized in the very near future and believes that at the inaugural meeting of the African Council the adherence of many countries of the region will become effective and the Regional Management Committee will be established.

The mission finds that the Center now lacks qualified personnel (particularly for several sectoral projects), training equipment, and above all a well-equipped photographic laboratory and images of the region so that users may be made aware of its services and so that their real needs may be met.

II. RESULTS OF PHASE I

While keeping in mind that Phase I of the project has not yet been completed, it is proper at this time to note what we observed from the outset: the United States contribution in the form of technical personnel, which was to account for 37.5% of the total, has not yet materialized. We also note that the promotional campaign began in January 1978 and the first photographic laboratory equipment arrived in February 1978.

3.1 Services envisaged for Phase I in the 1977 report of the Technical Committee

3.1.1 Training

Plans called for training of 24 technicians per year in two short courses, half of which would offer the possibility of a longer course immediately afterward.

3.1.2 Promotion

Plans called for an introduction to remote sensing for high-level personnel, representing a total of eight weeks for ten countries.

3.1.3 Assistance to users

Assistance to users was to be provided in five ways:

- Advisory services — selection of appropriate images and recommendations on interpretation.
- Access by users to the equipment and facilities of the Center.
- Assistance in the implementation of remote sensing projects not undertaken within the context of the CRTO.
- Assistance in the preparation of remote sensing projects.
- (Optional) Operational programs in countries lacking sufficient personnel or equipment to undertake them alone.

3.2 Results

3.2.1 Training

Thirty-one students have taken the short course, and 15 the supplementary course, all at the CRTO. One went to Paris after his short course and six went to Laval University in Quebec, Canada, for a four-month course (January-April 1979). In addition, two students from Upper Volta are taking the long course (one year) in projects, one in the field of ecology management and the other in cartography (see the attached list of trainees and their organizations).

3.2.1 Promotion

Ten countries (Niger, Senegal, Mali, Guinea, Cameroon, Gabon, Togo, Liberia, Sierra Leone and Gambia) were visited by CRTO personnel on promotional missions from January 1978 to May 1979. Two short missions also were sent to Nigeria and Ivory Coast. Missions to prepare meetings of regional agencies interested in remote sensing also have been undertaken by several high officials of Upper Volta.

3.2.3 Assistance to users

3.2.3.1 Advisory services

- The CRTO provided Togo with technical documents to assist that country in the preparation of an agricultural inventory.
- Mali received a list of available images, which is to be used for a project on fauna.
- BRGM purchased images for a geological cartography project in Upper Volta.
- The University of Benin purchased images for its Department of Geography.
- The University of Reims (France) purchased images for a project on wind transport of sand.

3.2.3.2 Assistance for implementation of remote sensing projects not undertaken within the context of the CRTO

— Study of dam sites for the National Office of Dams and Irrigation (ONBI) of Upper Volta. This project consists of an inventory of existing dams, identification of possible sites, demarcation of irrigated areas and determination of the extent of surface water, showing volumes of water.

  This study has now been completed and the CRTO will train a team from ONBI in the application of data.

— Hydrological map showing the hydrographic network and waterholes for a Canadian highway construction project in French-speaking Africa. The initial report has been completed and a complementary study is under way.

— Regional geological map at 1/500,000 covering certain regions of Upper Volta, Mali and Niger. Interpretation has been completed and the map will be printed in France.

— Experimental program to evaluate local possibilities of numerical processing of Landsat data. This study, undertaken with CENATRIN (the Upper Volta information agency) has shown that existing facilities do not permit coverage of large areas.

— Several small-scale studies have been conducted for specific purposes, including analysis of a possible dam site for the University of Ouagadougou, a study of brush fires, and a study of the human habitat in the Mare des Hippopotames region of Upper Volta.

In summary, we find that the CRTO is close to fulfilling its objectives for Phase I, taking into account the delay caused by the absence of the American experts, the slow delivery of images from the EROS Center, and the

fact that the evaluation was made 18 months and not two years after the start of operations.

IV. GENERAL SITUATION

We now turn to an assessment of the implementation of the CRTO project as a whole and the point it has reached, in order to answer the key question: Have the conditions necessary and sufficient to undertake Phase II been met? If not, what are the possible solutions?

Our study of the Center's achievements and the survey made in the principal countries of the region should enable us to respond to the best of our judgment. Both positive and negative aspects have been found, which we enumerate and discuss below. We then present the overall balance sheet in its major aspects.

4.1 Negative aspects

1. Impossibility of giving the CRTO regional status (a difficult problem in the matter of staffing), until the African Council on Remote Sensing and the Regional Management Committee have been established.
2. Insufficient and unequal promotion. Too many agencies are still inadequately informed.
3. Lack of information facilities available to the CRTO.
4. Inadequacy of training at the following levels:
   - supervisory personnel
   - programs
   - selection of candidates
   - equipment
5. Lack of expatriate specialists (one French, two American).
6. Delay in the establishment of the photographic laboratory.

7. Insufficient documentation (library).
8. Lack of data processing facilities.
9. Lack of counterpart personnel.
10. Insufficient ability to use future data.
11. Difficulty in obtaining images, hence the difficulty in interesting possible users.
12. Lack of follow-up of trainees.
13. Lack of (minimum) resources for the trainees at the end of the course.
14. Failure to consult Africans in the selection of projects.
15. Limitations of satellites — need for supplementary instruments.
16. Need for a commitment to use the future range of satellites (Landsat, D, Spot), hence the need for supplementary financing.

4.2 Positive aspects

1. Obtaining of the ten signatures ensuring the establishment of the African Council on Remote Sensing and the Regional Management Committee in the very near future.
2. Interest shown by high officials at the political level.
3. Interest shown by most of the persons contacted (technical and administrative levels).
4. Existence of regional and national research and planning agencies.
5. Existence of remote sensing offices attached to research and planning agencies.
6. Awareness of certain priorities at the regional and national levels.
7. Evidence of the application of remote sensing to the priorities stated.
8. Use of remote sensing in projects under way.
9. Evident application of remote sensing in integrated projects.
10. Need for immediate periodic data (dynamic management).

11. Need for centralization of information.
12. Need for promotion of African participation as senior supervisory staff. (decision-making level).
13. Need to immediately begin the introduction of African technicians to remote sensing, provided that the delay is not too great.
14. Valued utilization of CRTO services (despite their limitations):
    - training
    - assistance to users.
15. Need for images systematically expressed.
16. Use of the knowledge acquired by some trainees.

4.3 MAIN POINTS OF THE EVALUATION

Certain findings should be emphasized because they involve aspects that are bound to affect the evaluation at one point or another when our "Solomons" hand down their judgment. We discuss them in the usual categories: promotion, training, and assistance to users.

Promotion

This has not reached the expected level, on the whole because of the lack of resources. It can be said that the CRTO has made the best of its possibilities. Unfortunately, it was in the situation of a salesman who tries to sell a product not found in the market (except for training). That is why we had the impression, in nearly every case, that our survey respondents found us likeable enough but not always very useful. Once again the need for training was expressed, but the impossibility of following this up in view of the respondents' priorities, which generally were limited to a desire for periodic and rapid information, made them wonder about the value of such an effort. Hence the contradictory conclusion: it is reasonable that the sources of

financing would wish to be assured of the interest of the agencies concerned with remote sensing before setting up a station, but it is just as logical that a station would be necessary before the unique services that it can provide are proposed. Hence the importance of finding the equilibrium point at which we could say that the Africans are determined to use such a station. That they can benefit from it is unquestioned, in the opinion of experts in the field. To deny this would be to ignore what has been done thus far. We must then consider whether they will take advantage of it. We are convinced that they will do so, while admitting that the "fathers" of the CRTO project have undoubtedly been optimistic about the pace of Africanization. The absence of counterpart personnel attests to the difficulty of convincing the agencies employing talented African technicians to assign them to the CRTO. The reasons include those we have mentioned above, plus the fact that until regionalization has become a reality it will be difficult to assure the members of CRTO regional status and to give the Center itself genuine authority in its dealings with the agencies contacted. Therefore, it is with great satisfaction that we note the forthcoming establishment of the Regional Management Committee, which naturally will have to work hard to put an African stamp on the organization. We must insist on the need for this stage.

With further regard to this matter of African involvement, it is also important to note the attitude of key persons such as the Minister of Agriculture, Waters and Forests and the Minister of Public Works of Guinea, who presided at the meetings held during our team's visit to that country. This has given official approval to remote sensing activities in Guinea. The same is true of the Chairman of the Planning Commission of Togo.

In summary, promotional activities have been modest but the results to date are nonetheless significant. Moreover, the evaluation mission was actually

in good part a promotional mission, and there is no doubt that much progress has been made in this aspect. The Africans are hopeful. Can we disappoint them? The moralist will say no, the technician will say by no means.

Training

The record is most positive in this aspect. Some of the deficiencies have already been mentioned, but they can readily be overcome. One of the main problems is the insufficient number of candidates, and hence the impossibility of making a selection that would permit greater uniformity in the level of the trainees. Nonetheless, study programs are being developed normally, and a course in English will begin in the near future. The course held in Canada (Laval University, Quebec) has not had the anticipated results, but will at least have served to identify some mistakes that should be avoided. Moreover, the students who have taken it will have their eyes open to reality, as regards remote sensing and in other areas as well. The positive aspect of the operation certainly cannot be disregarded. The major weakness of this activity is undoubtedly the lack of physical resources, instructional materials and a photographic laboratory, and some limitations of the supervisory personnel; some of the experts have not yet arrived as planned. Even if they were not assigned to the training unit, it is easy to see that in a center of this kind the contribution of all to training activities would be expected, in one form or another. The Center has therefore suffered from these absences, which have adversely affected it in all areas of activity. It is worthwhile stating again that an early solution to this problem will enable it to offer its services to potential users with better facilities and thus much more authority.

We therefore conclude, taking into account the resources put to use, that training activities have been successful in systematically meeting the needs expressed in our interviews.

Assistance to users

This activity is based on three types of resources:

-- the print and photo libraries

-- the photographic laboratory

-- the technicians.

Our findings here are quite negative since the print and photo libraries are very inadequate, the photographic laboratory has not yet been installed, and some experts or technicians are not present. Hence, assistance to users has been limited to small projects often decided upon abroad, which therefore have not responded to African priorities. The lack of the photographic laboratory in particular (and, to be sure, of its staff) has severely limited the CRTO's potential, whether in the area of promotion, training or assistance to users. It is obvious that as soon as these deficiencies have been overcome -- and the news is good in this regard since the American technicians are en route and the photographic laboratory is under construction -- the Center will be able to expand its coverage immediately. The problems of acquiring photographs are not unrelated to the problem mentioned above, namely that they are images from different points in time when they are not simply old.

Thus, the balance sheet is rather negative but the actions now under way and some corrections that are easy to make in the area of documentation should permit a clear improvement in the situation in a few months.

It is unquestionably fair to note once more that the CRTO has done the best that it could in this regard with the resources available to it.

Summary

Phase I of the CRTO project has fulfilled some of its objectives, particularly in the category of training, but has fallen far short of meeting some others. In general, this deficiency is due to the non-receipt of resources as envisaged at the outset, which should be available in the near future. Accordingly, the overall assessment is positive and it seems obvious, after all the meetings we held, that there will be a great demand for CRTO services as soon as it has a sufficiently broad range of services to offer.

V. RECOMMENDATIONS

On the basis of our evaluation mission, we believe that the program should be continued. The delays and deficiencies found suggest the need for a one-year extension of Phase I. The important needs expressed by the users and the absence of regular and up-to-date information underscore the need for construction of the station without delay. Under present circumstances, it is advisable to step up the program of activities and installation of facilities for a year. The reorientation of some actions also appears to be necessary. We will not go into detail here, but merely will present the broad outlines, leaving the specific study to the Technical Committee.

1. Structures

1.1 Regionalization should be accelerated and extended to more countries. Only in this way can the problem of the status of counterpart personnel be resolved, and the Center attain a level of activity justifying the investments made and planned.

1.2 The Technical Committee (or Liaison Committee) should include managers and technicians at each meeting, for each country; in addition, the various

categories of users should have more representation on the Committee. The Committee therefore should be expanded to include other scientists and representatives of users in order to monitor and evaluate the project on a continuing basis.

1.3 Cooperation should be intensified on three levels:

— with the agencies responsible for major fields of application, such as CILSS, CIEH, etc. (CIEH wishes to sign a protocol); this would result in a better definition of projects, support for teaching, and a more thorough interpretation of data;

— with scientific, research and teaching institutions. A special effort should be directed toward cooperation with research institutes and large intergovernmental teaching institutions in Ouagadougou (University, EIER, etc.). Active and extensive participation by ORSTOM was recommended by many of those surveyed.

— with agencies that can contribute to the financing of the project. In particular, EDF could make a contribution to the construction of the reception center.

1.4 It was found that several projects assisted by the donor countries were using Landsat data and simultaneous air coverage. The quality of some projects and the results obtained from remote sensing and photointerpretation make it all the more unfortunate that there has been no cooperation with the CRTO. We therefore recommend better coordination between the CRTO and projects using remote sensing and supported by the donor countries. In this context, the trainees could take part in applied research, benefiting from high-level supervision.

2. Information and Promotion

2.1 Both to convince national authorities of the usefulness of remote sensing and the importance of the station, and to keep the study units of the agencies and ministries informed, promotional efforts should be increased. Informational seminars should not be limited to extolling the merits of remote sensing. They should also deal with such problems as the complementarity of remote sensing tools (including aerial photographs) and conventional methods; the importance of including remote sensing in services; the multidisciplinary approach; problems faced by users in the proper utilization of remote sensing; and forms of cooperation with the CRTO.

2.2 The information and promotion program can take several forms, some of which were envisaged in the Technical Committee's report of July 1977. Seminars lasting several days, organized at the initiative of heads of technical units, should be held as soon as possible. The methods may vary: multidisciplinary by countries (e.g., in Ouagadougou). Some seminars could be held as part of conferences. An evaluation of applications of remote sensing to hydrology could be presented at the CIEH conference scheduled for February 1980.

2.3 The most important conditions for the success of the information and promotion effort are:

- regular reporting by the CRTO on its possibilities, available images, activities, and results of demonstration projects;
- determination of the state-of-the-art of applications of remote sensing in priority areas (plant resources, water resources, land development) on the basis of an inventory and an analysis of experience in Africa;

~~— audiovisual exhibits presenting African examples;~~

— the assistance of a specialist in communications.

3. Training

The training program has been conducted with a great deal of energy and dedication, despite the material difficulties. Nonetheless, a number of deficiencies are evident. In response to the requests of the countries, training should be diversified and improved.

3.1 Diversified training

(a) The country's objective is to have:

— specialists trained in the use of all remote sensing resources (satellite data, aerial photographs) and in the complementary use of tools so that they will be capable of selecting instruments and methods and putting them to operational use;

— technicians who should receive, in addition to instruction in interpretation, more intensive training in photochemical processes (as well as data processing) and in cartography, together with complementary instruction in applications.

These objectives suggest the need to organize training sessions by levels, and perhaps by fields of application.

(b) It is strongly recommended that the CRTO assist schools (especially EIER) and universities in the introduction of remote sensing as part of their study programs. In return, the CRTO could benefit from assistance in the form of complementary instruction.

3.2 Expanded content

(a) All users stated that the trainees would benefit from more intensive training in the interpretation of aerial photographs and in the complementary use of tools;

(b) A better balance between theory and practice and between classroom work and field work seems necessary;

(c) A project should be executed by one team.

(d) Finally, special attention should be given to the analysis of information and its presentation for the purpose of decision-making.

3.3 Conditions of satisfactory operation

(a) The formation of an instructional collection of examples from Africa, and production of multiple copies of course materials;

(b) The availability of photographic laboratory resources and of facilities for observation in the field (equipment, vehicles);

(c) More extensive and higher-level supervision. It seems essential that two persons be assigned full-time to the promotion and training programs. The director of training should have the following qualifications: competence both in remote sensing and in one of the major fields of application (plant resources, water resources, land development); teaching experience; research experience in Africa. The training programs should also be assisted by two photographic and data processing engineers and the heads of the demonstration projects. Finally, temporary use should be made of skills available locally;

(d) Level of trainees and selection criteria: diplomas received, importance of remote sensing for the agency, quality of the project.

4. Assistance to Users

This has suffered from the lack of resources (photographic laboratory, images, documentation) and the failure to reach agreement with users on the definition of projects. The additional year must make up the present lag. Otherwise, the CRTO risks losing some of its credibility.

4.1 Print and photographic libraries

(a) The print library should be better equipped with basic documents in the various fields and with documents and periodicals dealing with remote sensing. Subscription to a service such as Informascience of CNERS would seem appropriate. Thereafter, CRTO staff should select the texts to be acquired;

(b) Photo library. In view of the needs expressed and the projects under way, it is essential that the CRTO:

— acquire images for all of West Africa;

— subscribe to EROS in order to obtain regular information on the data gathered and to acquire images;

— take all measures to gather and obtain MSS and RBV data for project regions.

4.2 Equipment

We recommend the rapid installation of data processing facilities and an image plotter in the CRTO. This seems essential in view of the quality of the data and the nature of the studies under way or planned. The minimum function of such a system is to make possible improved images and appropriate plotting of study areas.

It goes without saying that the installation of such equipment presupposes the availability of an engineer.

4.3 Demonstration projects

(a) The selection of projects should be based on the following principles:

— inclusion in priority fields indicated by users (use of land and plant resources; water resources; land development);

— joint agreement with users;

— physical possibilities of implementation, which presupposes agreement with agencies having a sound infrastructure and facilities for study on the ground.

(b) Worthwhile projects

— The most important project is that prepared by Mr. Boudet and Mr. Malacamp as part of a CRTO-CILSS cooperative program. It not only covers a region (the Sahel) that merits full study, but also concerns an spect (evolution of plant cover and pasture management) requiring the repetitive data that present and future satellites are in a position to supply.

— A second worthwhile project focusing on agriculture could be that of the Directorate of Rural Statistics of Ivory Coast, extended to neighboring regions of Upper Volta and Mali. This project is well conceived and, in particular, envisages the complementarity of satellite, aircraft and ground resources. The agency concerned has personnel and financial resources for aerial surveys. CRTO participation would be in the acquisition, processing and interpretation of Landsat data (1/4 image).

— A special project should be devoted to the inventory and management of water resources in a Sahelian and Sudano-Sahelian region. The CRTO should be called upon to draw up such a project in cooperation with CIEH and AGRHYMET.

— Finally, a project should be aimed at integrated studies for the preparation of a land development plan. The project already initiated by the Directorate of Rural Development of Ivory Coast seems to meet this objective, and offers two further advantages. On one hand, an important and sound program of interpretation of aerial coverage and mapping is being carried out; this will provide significant and exhaustive reference information for the evaluation

of Landsat data and the development of a methodology for interpretation. On the other hand, covering a forest-savannah region (MAN region, 1/3 image), this project makes it possible to deal with the problems of a new climatic zone of interest to all the coastal states.

4.4 Personnel and equipment

The entire program of assistance to users can succeed only with sufficient and qualified personnel, installation of photographic and data processing equipment, and the regular acquisition of MSS and RBV data.

We therefore recommend that all measures be taken to ensure that:

— in regard to staffing, the donor countries assign to CRTO four or five persons with competence both in remote sensing and in the priority fields of application, and the African States appoint an equal number of counterpart personnel;

— the installation of the photographic laboratory and the data processing unit is carried out as quickly as possible and two expatriate specialists and two African counterparts are assigned on a full-time basis.

In conclusion, we mention two points that concern the CRTO only indirectly.

1. Progress in the regular utilization of remote sensing data requires not only the training of supervisory personnel and technicians and the supply of data, but also the availability of a minimum of physical resources for trainees returning to their countries and a plan for the equipping of user agencies. In this regard, a study should be made to determine an appropriate image processing system, and we invite the donor countries to assist the countries which have evinced a desire to obtain such equipment.

2. It seems that insufficient attention has been given to socioeconomic aspects; this is understandable. The needs expressed suggest that there should be thought and research in this direction, particularly on the manner in which societies interpret and use resources.

CONCLUSION

The evaluation mission believes that the program should be continued and the station should be built, taking into account the interest expressed by the States, the needs manifested by users, and the capacity of present -- and above all future -- satellites to meet a great number of needs. Cooperation oriented in particular toward integrated projects should logically make use of remote sensing, which is precisely the tool that responds best to such an orientation, and at less cost as numerous studies have shown. Any halt or delay in activities would result in disillusionment and a loss of credibility for a period that is difficult to predict.

Nonetheless, the accumulated delays, the deficiencies observed, a lack of connection between projects and requirements, the need to produce quality images, etc., lead us to recommend an intermediate stage of one year between Phase I and Phase II. That year should be one of stepped-up and improved activity, and the CRTO should be provided with more resources so that it can better respond to the needs of users. During that year the studies required for the implementation of Phase II should be carried out.

ANNEX 1

GUIDE FOR INTERVIEWS WITH OFFICIALS OF AGENCIES INVOLVED IN APPLICATIONS

1. Presentation:

   (a) Evaluation mission

   (b) The CRTO project and its two phases:

   — Phase I: promotion, training, demonstration projects, assistance to users, etc.

   — Phase II: station, equipment, services for users, training, etc.

2. Elements for evaluation of Phase I activities

   (a) Knowledge of the CRTO and any contacts:

   — How? Information, promotion

   — Training and projects

   — Assistance and advice to users

   (b) Knowledge of remote sensing: where? when? how?

   (c) Prior use of remote sensing and, if appropriate, evaluation of this technology and comparison with conventional methods

3. Aspects of interest for Phase II

   (a) Discussion of established programs of earth observation satellites and of the network of receiving stations

   (b) Analysis of information requirements of the agency

   — Regular activities, projects, long-term programs

   — Nature of information sought, details, frequency, periods

   (c) Comparison of needs/possibilities of remote sensing

   (d) Attitude regarding the availability of data and their use and interpretation

4. Analysis of the role of the CRTO

   (a) Supplier of data and services

   (b) Training and advice to users

   (c) Agency/CRTO relationship

COUNTRY: UPPER VOLTA

AGENCY	FUNCTION	PERSON INTERVIEWED	CONTACT WITH CRTO	PROJECTS AND INFORMATION SOUGHT	POSSIBILITIES OF IMMEDIATE ACTION BY CRTO	LONGER-TERM FORECAST
Directorate of Stock-raising and Animal Production	Development of pasture resources	M. Sionne Director Animal husbandry specialist (AID)	Yes--Cooperation desired	1. Village stockraising: allocation of space between farming and pastures 2. Monitoring of pastures and water resources in the Sahel Complementarity of satellite data, aerial photographs and ground network	1. Training: one long-term trainee 2. Cooperation in the project for pastures and ecological monitoring	Subject to demonstration of feasibility regular provision of data and possibly some processing Refresher and advanced training

COUNTRY: UPPER VOLTA

AGENCY	FUNCTION	PERSONS INTERVIEWED	CONTACTS WITH CRTO	PROJECTS AND INFORMATION SOUGHT	NEED OR POSSIBILITY FOR CRTO ACTION	PROJECTION OF NEEDS TO BE MET BY CRTO
AVV (Upper Volta, Ghana, Benin)	Planning and execution of projects for development of the Volta river valleys	M. Sorgho Simer Director Gl M. A. Ouédraogo Director of Studies	Occasional. Present capacity not known	20 year program—integrated studies (soils, hydrogeology, land use, ...) on suitability, constraints and development plans at scales of 1/200,000 and 1/50,000 — monitoring of forests and tree planting, spontaneous agricultural settlement, erosion. Annual and five-year evaluations. Experience in the use of Landsat (improved images) with USAID, Earthsat and ADB	— Advisory services in the use of remote sensing — Tests of measurements of variation — Training in remote sensing and photography (one trainee now studying hydrogeology in France)	Regular provision of image data for monitoring of development projects -- Advisory services in the analysis and interpretation of these data
CENATRIN	Data processing	M. Compaore, Director M. Bamogo, Deputy Director	Work with CRTO in the improvement of images (test); little knowledge of the overall ob-	Wishes to continue the experiment with numerical processing (in a small area)	Study of a method for cooperation in data processing aspects	

EIER	Training of engineers and development	M. Veridique Director	Few contacts; not informed on recent developments	Water resources, rural development, irrigation	Introduction of remote sensing in third year, 20 hours; possibility of one year of specialized training for the best candidates. Training of instructors	Introductory session for instructors Development of the 20-hour course (25 third year students) — Acceptance of two to four students in specialized fields
ONBI	Management of water resources and irrigation	Director Gl	Contacts in certain projects (inventory of dams, sites, basins), but little knowledge of the CRTO program. Better coordination desired in order to take ONBI criteria into account.	— Inventory of water resources for all of Upper Volta — Monitoring of dams twice a year. — Site study as part of watershed management	Training of supervisors and technicians not only in remote sensing but also in the interpretation of aerial photographs. — Technical assistance and advisory services.	Provision of images for the entire country at least twice a year — Assistance in interpretation until ONBI has trained supervisory and technical personnel

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Institute of Statistics and Demography	Generation of economic and social data; population	Director	A trainee has been assigned to the CRTO (A. Gomina). Uninformed about remote sensing, its possibilities and its limits, and on the structure and purposes of the CRTO.		Wishes to become familiar with and test the use of aerial photographs and remote sensing as a basis for sampling in population censuses, especially in rural settlement areas and large urban centers.	Set up a file of information on problems
ONCHO (United Nations program) (Intergovernmental)	Monitoring of human ecology in all valleys of the Volta (Upper Volta, Togo, Ghana, Benin) with eradication of onchocercosis	M. Bazin	Knowledge of remote sensing by Earthsat.	20-year program with monitoring of: — physical parameters: climate, hydrology — population movements and land development — Onchocercosis and public health	Training — Possible technical assistance and data interpretation, if feasibility is demonstrated.	Collection and regular provision of data (20 years)

CIEH	Hydrological studies and water resources management	M. Gagara Secretary G1 Two technical advisers	-- Not sufficiently familiar with all activities of the CRTO program. — Develop relations under a protocol to be submitted to the Council of Ministers (Feb. 1980)	All information — Climatic — Hydrological — Plant coverage — Hydraulic balance Priority for the Sahel AGRHYMET	— Training -- Association of ground networks with weather satellites and ground satellite resources. -- Presentation of the state of the art of remote sensing and hydrology (seminar -- Feb. 1980)	-- Provision of images and possibly some processing, especially for the Sahel — Advanced training
DSA Directorate of Agricultural Sciences	Studies of plant production for all of Upper Volta	Director G1 Director of Plant Production and Statistics	Little contact. They do not know where the project is and the services that the CRTO can provide now and in the near future.	-- Integrated studies, especially medium and large-scale soil mapping of development zones. — Monitoring of soil use — Agricultural statistics (status at various points in time, particularly July 1-15 each year)	— Training in remote sensing and interpretation of aerial photographs and their complementarity with static methods. — Wish to carry out an experiment in cartography and statistics on soil use and agriculture. Two levels of measurement, with tests of stratification and complementarity of remote sensing and statistical instruments.	-- Training in aerial photography and remote sensing. -- Regular provision of data if its feasibility is demonstrated and the continuity of observation is guaranteed.

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NATIONAL OFFICE OF METEOROLOGY	Hydrology; Meteorology; Aerial meteorology	Director General	Good contacts. Two persons trained and a third scheduled.	— AGRHYMET — Climatology, — Watershed management and runoff factors — Hydrological balance	— Training — Coordination with measurement instruments: soils, meteorology (radiation measurement, radio beams, atmospheric sampling, neutron sampling)	— Basic and advanced training — Provision of data
CILSS Intergovernmental Committee for the Campaign Against Drought in the Sahel	Coordination of studies on drought problems in the Sahel	M. Diallo	Informed and has contributed to promotion	— Contacts with states for training — Seminars — Projects with CRTO for ecological monitoring	Ecological monitoring	Joint projects
IG-HV Geographical Institute of Upper Volta	— Inventory of existing maps — Aerial photography — Cartography and topography	M. Sandwidi Director General M. Bazie Assistant Director General	Well informed; participation in cartography project	— Training; coordination with CRTO	Mosaic-screen mapping	very close cooperation

BUVOGMI Upper Volta Office of Geology and Mines	Geological and mineral studies and surveys; cartography, geology	M. Traore Deputy Director General (mining engineer)	Trainee sent to CRTO	— Specialized training in geological cartography and mineral surveys	— Training — Acquisition of photographs	— Training — Joint projects

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COUNTRY: TOGO

AGENCY	FUNCTION	PERSON INTERVIEWED	CONTACT WITH CRTO	PROJECTS AND INFORMATION SOUGHT	POSSIBILITIES OF IMMEDIATE ACTION BY CRTO	LONGER-TERM FORECAST
PLAN	Development: Identification of projects and monitoring (entire country)	M. Aziaha, Chairman of the Commission for the Fourth Plan M. Gomez, Director of Infrastructure	None	1. Knowledge of agricultural resources and land use 2. General inventory of water resources for development 3. Population statistics 4. Study of 12 major rural development projects 5. Infrastructure and impact studies	— Training of supervisory and technical personnel in all methods of photointerpretation and remote sensing — Cooperation in an experiment to identify two priority aspects: — Agricultural resources — Water resources	— Basic and advanced training — Provision of data and assistance for interpretation, if feasibility is demonstrated — Assistance in outfitting an interpretation unit
Directorate of rural engineering	— small and medium-scale rural works — information center	M. Lawson, Deputy Director, in charge of works	three trainees; no possibility of using remote sensing at present because of a lack of minor equipment	— Integrated study on preparation of rural development plans — Monitoring of projects — Watershed management	— Support for trainees through supply of minimum equipment enabling them to use remote sensing, and supply of improved images — Complementary training in interpretation of aerial photographs and image processing — Advisory services	— Training — Equipment — Provision of data and assistance to users.

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Directorate of Agricultural Statistics	— Statistics on soil use and plant production (the entire country)	M. Gbeblewo, Director General	Familiar with CRTO (contact with J.P. Ouédraogo) Wishes to be kept informed on the development of CRTO and of the services that it can provide	— Evaluation of results of agricultural investments — Statistics on forests and clearing — Statistics on crops and their development	— Training of one supervisor and 1-2 technicians (all techniques) — Wishes an experiment on statistics with remote sensing as the basis for sampling, aerial photography and earth sampling.
UNDP	Financial and technical assistance for the project	M. Duho, Assistant Project Director	Familiar with CRTO but wishes to be kept informed on a regular basis	1. Master plan for water resources in Togo for purposes of overall management. 2. Data on villages—basis for statistical and economic studies.	— Knowledge of potential of remote sensing in these fields. — Advisory services to executing agencies.
Directorate General of Urban Development and Housing	Housing and urban development	M. Di Felli Deputy Director	None. Wishes to be informed. Wishes to know about photointerpretation and its possibilities	1. Process of urbanization, particularly spontaneous settlements (CSB, COS, etc.) 2. Integrated studies for the urban development plan 3. Sampling base for socioeconomic survey.	— Training, emphasizing interpretation of aerial photographs rather than remote sensing. — Advisory services in the use of photographs.

INSTITUTE OF GEOGRAPHY	Teaching	Two professors — physical geography and human geography	Little knowledge of CRTO services	1. Training 2. Participation in cartography and geomorphology projects and study of human geography (urbanization, agrarian structures)	1. Assistance in the introduction of remote sensing in the teaching of geography. 2. Traineeships for instructors and third-year students.	

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ANNEX II

UNIVERSITY OF REIMS
Teaching and Research Unit
in Literature and Human Sciences
Laboratory of Regional Physical Geography
and Studies of Sedimentary Rocks
57 Rue Pierre Taittinger
51100 Reims

June 16, 1979

Mr. Max Guy
GDTA
31000 Toulouse

Dear Mr. Guy:

Mrs. Mainguet, who is ill, has not been able to take part in the sending of this report, which was prepared prior to her hospitalization.

She has not been able to read it, since she is still too exhausted. However, she felt that it might be useful to you in its present state, and has asked me to send it to you.

Sincerely yours,

s/ (illegible)

REPORT OF THE MISSION OF APRIL 10 TO 24 REGARDING

THE REGIONAL REMOTE SENSING CENTER, OUAGADOUGOU

At the request of Mr. J.-C. Deniaud of the Ministry of Cooperation, and Mr. Max Guy of GDTA (Group for the Development of Aerospace Remote Sensing), we carried out a training mission to the University of Ouagadougou in order to draw up an evaluation of the accomplishments, problems and projects of the Regional Remote Sensing Center, Ouagadougou.

We gave lectures at the university each morning, devoting our afternoons to the Remote Sensing Center itself. During the three-day strike at the university we visited the trainees of the Center in the field, with the kind assistance of Mr. Chipman.

We interviewed the following officials:

— Mr. Jean-Pierre Ouédraogo, Director General of the Center.

— Mr. Ralph Chipman, Deputy Director.

— Mr. Jean Malacamp, Chief of the Monitoring Project (comparison of a sequence of images over time).

— Mr. François Ribot, Chief of organization of introductory traineeships.

— Mr. Jean-Michel Brosse, Chief of the Geological Cartography Project.

— Mr. Serrière, Chief of the Topography-Cartography Project.

The questions we asked were concerned with three aspects:

1. Are the African States interested in the Center? Has their interest been maintained after the first year?
2. What are the results of the training — in the pedagogical area and in the area of practical organization?
3. Does the Center function properly?
4. The problem of replacement of European and American supervisory personnel by Africans.

I. BASIC PURPOSES OF THE CENTER

In September 1978 a meeting of representatives was held to establish an African Council on Remote Sensing under the sponsorship of the Economic Commission for Africa (ECA). The Articles of Agreement of the Council were signed by seven African States: Senegal, Mali, Togo, Cameroon, Gabon, Upper Volta and Guinea. Its entry into force requires adherence by ten States. Five States in addition to the first seven have stated their intention to participate. A meeting of the African Council was to be held in early June, followed by the meeting to establish the Regional Management Committee of the Ouagadougou Center.

The status of the Ouagadougou Regional Center is shown in the following table:

CATD (African Council on Remote Sensing)

2 Remote Sensing Centers:	3 Training Centers
-- Ouagadougou	-- Cairo
-- Kinshasa	-- Ile d'Ifé
	-- Nairobi

The Ouagadougou Center is not really a regional center at present, since it has the status of an interim national center.

Phase I of the operation of the Center has the following objectives:

1. To train specialists in remote sensing:

   -- Training of users of satellite images.

   -- Training of Center personnel.

   Two training periods, lasting three and six months, are planned each year.

   Fifteen trainees have been selected from 25 candidates, the other ten being placed on a waiting list.

In the first period 16 trainees were recuited from Senegal, Mali, Togo, Gabon, Upper Volta, Cameroon and Guinea. The first three months were devoted to an introductory period for the 16 trainees. After the practical phase seven candidates left; nine continued, six of whom went to Canada to continue their studies. All trainees are fellowship students.

The second phase of the training is set aside for a selected group; this group will provide the "counterpart personnel" who will succeed the foreign advisers. Theoretically such an arrangement seems ideal, but our contact with the trainees in the field (we shall speak of this later) does not assure us that they have the necessary training for the purpose. Moreover, the best of them will undoubtedly be called back to their home countries.

2. Establishment of a service of assistance to users involved in development

This service is now supported by the following facilities:

— A modest photographic laboratory inherited from CNES. A new laboratory financed by the United States is under construction. Unfortunately, the permanent American staff promised by the United States has not yet arrived. An animal husbandry specialist and a photographic engineer have spent three months each in Ouagadougou. At this date no trained person from Upper Volta is available. Only one technical assistant in demographic statistics is in a position to do this work; he is taking a course in English at ENA at the Center's expense. A specialist in documents and a secretary are taking the same course.

— A documentation center directed by an official from Upper Volta. Our visit to this Center showed that it is quite modest, and entirely insufficient for specialists to be able to study in Ouagadougou. Even the site seems too small for adequate expansion of the documentation center.

3. In-project training

Fellowships can be awarded to foreigners for work in Ouagadougou within specific projects.

Four projects financed by France were started this year. We studied each of them in order to ascertain their accomplishments and problems.

II. ACCOMPLISHMENTS OF THE CENTER

1. The "Geology" Project

This is a geological mapping project, directed by Jean-Michel Brosse, mineral geologist and photographic geologist of BRGM in France. Mr. Brosse is to train a geologist from Upper Volta in remote sensing and, with his assistance, draw up a geological map of the Sahel at 1/500,000 (half East Hombori, half West Ansango). This region has been selected because:

— It covers several countries: Upper Volta, Mali and Niger.

— It makes up a geographical unit: the Sahel.

— It constitutes a geological unit: the Birrimian.

— Finally, BRGM has a permit for mineral exploration there.

The work began with traditional structural interpretation. However, problems arose at the outset:

— Mr. Brosse arrived on July 15 and did not receive his first images until November 1.

— There also was a long delay in the arrival of the mirror stereoscope.

— The absence of an African counterpart. Mr. Brosse believes that in this regard the project has failed. Actually, an African was to be provided with training so as to make maximum use of satellite images and earth verification, and not to prepare a geological map, since excellent geological documents already exist (Reichelt's map).

The first phase consisted of the preparation of a structural mineral map, but there was also a methodological purpose: to make maximum use of satellite images and earth verification. In a second phase this document is to be complemented by a hydrological map. Mr. Brosse, who did the work alone, by the end of April had prepared 100% of the hydrogeological model and 50% of the geological interpretation model, expecting to finish by the end of May. These maps will be accompanied by a final report and a manual.

Mr. Brosse spent six months in the field conducting mineral surveys for BRGM in this region, plus tours of one month and six weeks this year. He therefore believes that he has a good knowledge of the region from the morphological and geological standpoints, and thus excellent preparation for the training that he will pro But all of this has been lost by the Center.

The mapping aspect is covered by six Landsat satellite images. However, the six images are much too heterogeneous and have given rise to major problems of assembly, particularly for the hydrographic network where the heterogeneity of images in terms of quantity and quality of information has slowed the pace of the work.

Mr. J.-P. Ouédraogo, Director of the Center, informed us of a possibility of future collaboration between an Ivory Coast technician, Mr. Oye, and a Cameroonian trained by ITC (Netherlands), as well as a major practical problem: the amount of the fellowships. For example, in Mali the trainees lose their salaries at the end of three months of training, even though they are adults with careers and family responsibilities.

2. Ecological Monitoring Project

The project initially covered three countries (Mali, Upper Volta, Niger) and was to have been implemented within the context of the CLISS. In addition,

several international agencies were interested in this project: USAID, UNEP and the CRTO. At a coordination meeting it was decided that a permanent specialist in pastures was necessary. The proposals of USAID, which were too complex, could not be accepted. Canada, also interested in the project, wished to make it part of the AVV project (Development of Volta valleys). Laval University sent two of its students.

The negotiations with CLISS on ecological monitoring are now under way, but the necessary decisions have not yet been taken. The Center actually had decided to interest local agencies concerned with development. Unfortunately coordination is still being discussed and there has not yet been any true cooperation. The project has been greatly delayed, and has had to be reoriented: the idea of coordination has had to be abandoned in favor of a dam project.

The monitoring project is still bound up with the CLISS. It is directed by Jean Malacamp, an engineer-physicist from GDTA. An Upper Volta counterpart has been assigned to the project; he is an agronomist writing his thesis under Mr. Ray, professor of Toulouse University. In an interview with Jean Malacamp we were informed of the status of this project and its difficulties.

The purpose of the project, like that of the other three, is to promote remote sensing from space and to train an African specialist.

The subject — monitoring (comparison of a sequence of images over time) — is understood by Jean Malacamp as follows: given the variable photographic treatment of satellite images, comparison among them is impossible. Only data processing can be used on the basis of magnetic bands, which requires:

-- <u>geometric corrections</u>: superimposed pixels (given the unchanging terrain of Upper Volta;

— radiometric correction in order to obtain an absolute setting, since the sensors get old and the transparency of the atmosphere is difficult to ascertain.

Mr. Malacamp wanted to make the setting over the areas of densest vegetation, inasmuch as the level of radiance is constant (zero). This objective has not been fulfilled because the program for dynamic enhancement was too costly; the computer time would have been twice as long as in France. At present, data processing is impossible with the resources available in Ouagadougou. Since the magnetic bands have not yet arrived the work must be done on the basis of images.

The monitoring project itself has not yet begun. The hope that it can be carried out is linked to the Meteosat center which is to be installed in Dakar. That installation will have a mini-calculator and a visor:

— The mini-calculator should operate faster than the computer at Ouagadougou because it will be oriented by the Landsat and Meteosat calculations;

— The visor will plot the images on film according to the magnetic bands. At present, however, the Center sends its bands to France for plotting. The problem is in knowing whether Dakar can respond more rapidly than Paris, given the fact that this will eliminate the Ouagadougou stage.

Not all the financing for the Meteosat center at Dakar is yet available. If it is obtained, Jean Malacamp would wish to be the chief engineer for this operation.

Since the substitution of the initial monitoring project with other more modest ones, three aspects have been studied for the National Office of Dams and Irrigation:

— inventory of dams (too many agencies are responsible for this work and many dikes have broken);

— monitoring of dams: seasonal monitoring of those whose water surface is known; drawing of volume-height curves. The National Office of Water Resources is interested in the volume-height ratio for the Ombela dam (water supply for Ouagadougou);

— siting of new irrigation dams in watersheds of 100 to 200 km^2 and study of the contraction of valleys. Calculation of the hydromorphic zone for 3 km downstream from the dam to identify the irrigable area. CIEH is interested in this aspect.

3. Cartography Project

This project is directed by Mr. Serrière, cartographer from IGN, France.

It consists of preparation of a physiographic map of Upper Volta at 1/500,000 using Landsat satellite images:

— Beginning with the most detailed possible layout of the hydrographic network, which makes up the ossature of the terrain. With regard to this parameter, satellite images represent a great advance in precision compared to the coverage of topographic maps at 1/200,000;

— Bringing into relief all geomorphological aspects that can be identified on satellite images (the major difficulty here is the impossibility of using stereoscopic techniques, especially in regions with such weak topographical contrasts);

— Relocating all villages. Mr. Serrière realizes that all are not visible on satellite images, and therefore wishes to use other documents to complete the inventory. Only some sections of trails are visible on the satellite images — essentially when their reflectance is different from that of the surrounding area — which leads to the use of documents other than the

satellite images. In order for the user to be aware of this, Mr. Serrière proposes different figures depending on the source of information.

4. Training of Specialists in Remote Sensing

(A) Types of training

There are several types of training at present:

a. A technical orientation which is intended to provide information to officials in order to familiarize them with financial aspects and the various possibilities: presentation of an African case.

According to Mr. J.-P. Ouédraogo, Director of the Center, this type of training is positive. The basic problem is the technical level of the trainees.

b. Training in short courses consisting of a three-month initiation and practical programs of three months. Two programs have been conducted in this first year.

We will discuss the problems of this type of instruction in a special section.

c. Long courses, a type of training which has not yet been implemented at the Center.

d. In-project training. France has provided the project staff this year. Unfortunately, there has been a problem in finding African counterparts.

Two difficulties arise, first of all that of traineeships, which at present are awarded by the Center. Mr. Ouédraogo would like to have the States take over. Secondly, because of the slow administrative procedures, there are problems in finding counterpart personnel. A number of young people have been presented; the Center intends to send official representatives, through the Ministries of Foreign Affairs, to encourage candidates.

(B) Training of Remote Sensing Interpreters; Problems of Study Programs

We found that the training of specialists in remote sensing interpretation raises the most problems. For this reason, we sought the views of Mr. Ouédraogo, Director of the Center, and Mr. F. Ribot, IGN engineer in charge of training in this field; finally, we went into the field with Mr. Chipman to spend a day with the trainees. We do not wish to conceal the fact that the training seemed inappropriate to us for the following reasons.

1. Interview with Mr. J.-P. Ouédraogo, Director of the Center.

— He believes that the courses are too theoretical, that there is not enough practical work and comparison with documents and the earth;

— He believes that the professors' assignments are too short;

— He would like to see multiple copies made of lectures in view of the problems that the students face in taking notes;

— He believes that there is still a lack of proper instructional sequence in the courses, not always an understanding of theories, and sometimes redundant teaching which causes a duplication of work. In this connection, Mr. Ouédraogo mentions the recruitment of future mission chiefs, in the hope of bypassing the institutional framework. For example, he recommends that a request be made to FAO;

— With regard to the practical organization of the courses, the problems are less obvious since a large vehicle will be available to transport trainees in the field. Mr. Ouédraogo believes that an all-terrain vehicle of the land-rover type, assigned exclusively to the Center, would be necessary.

2. Interview with Mr. F. Ribot, Director of Training. Mr. Ribot arrived on January 25 to organize the introductory phase which was to begin on February He succeeded Mr. J. Dizier of GDTA, who left last December.

Mr. Ribot believes that the program envisaged by Mr. Guy is not well suited to the African context, mainly because the introduction to photo-interpretation, which should serve as the basis for training, has not been provided (60% of the people are unable to assemble a stereo pair). This gap in training cannot be overcome at the Remote Sensing Center, because it was decided at the outset to deliberately omit the aspect of photointerpretation.

Without such photointerpretation, the problem of interpretation at a small scale such as that of satellite images becomes almost insurmountable; hence the pedagogical need for more flexible programs referring to large scale. Up to the present, however, the Center has chosen to refrain from purchasing photographic missions. Moreover, no inventory of aerial photographic coverage exists for Upper Volta.

It seems to us that the Center may be placing too much emphasis on satellite images and is not trying to obtain sufficient complementary information from other aerial documents.

Unquestionably, Mr. Ribot by himself cannot handle the entire organization of the courses and the organization of field work as well. At least during the initiation period, he should be assisted by an African.

Aside from Mr. Brosse, geologist, there is no specialist in earth sciences; this is another deficiency.

Moreover, the qualifications of the trainees are too varied; too many disciplines are represented. To serve the needs of all, a group of persons familiar with all earth sciences and human sciences is needed, so that on the basis of a common body of knowledge, the course can be divided into several small modules.

The absence of teaching materials and multiple copies of documents, despite the three runs made this year by Messrs. Ribot, Malacamp and Chipman, is an inconvenience for the students.

3. Contact with Students in the Field

The trainees complete their initial training with four days in the field. Mr. Chipman was able to accompany us for a day and a half in the Kaya region.

— Physical organization

Inadequate housing and feeding of trainees. When they arrived the only place available was the Kaya Veterans' Home, which was in a squalid state of neglect (nauseating stench of bats, even with doors and windows closed). Having refused this place, they were obliged to sleep on the campground where there was such a lack of water that they were able to wash during only two hours in the middle of the night. As for meals, nothing suitable had been provided. The prices charged in the camp were too high, and the students had to find food for themselves elsewhere.

— Practical organization of field work

The trainees had to use a small van, Mr. Ribot's agency vehicle, and an old 404 pickup. Mr. Ribot arrived in the field at the same time as the students, finding that there had been no prior preparation. But how can the same person be with the trainees in Ouagadougou and at the same time carry out field preparation requiring 15 days of work with an all-terrain vehicle? It is inconceivable that a period of work in the field had not been previously and carefully studied.

Mr. Ribot had the excellent idea of dividing the 15 trainees into five groups, each responsible for part of the Kaya region. This wise proposal has not been entirely beneficial for the students, since Mr. Ribot could work with only one group at a time.

We found that the trainees were very serious and motivated. Unfortunately, some questions showed us that their general education and basic training were

totally insufficient. We are not convinced that all of them know how to read a topographical map, but we believe that most of them are unacquainted with simple topographical terms. We would therefore suggest that the teaching of remote sensing be preceded by a much more modest introductory course in the simple language of earth sciences and human sciences (e.g., review of such simple topographical terms as basin, valley, plain, plateau, hill, mountain, etc.; terms of geology and soil sciences). In botany there is no problem: knowledge of the Latin nomenclature is surprising.

This initiation into the scientific language could be accompanied by a very modest photointerpretation module, followed by field work.

In this report we have not tried to rank the difficulties, but we are convinced that a facility such as the Remote Sensing Center in Ouagadougou is bound to face difficulties related to equipment, instruction, finance, supervision and information.

— Equipment: Problem of the acquisition of a computer

Nothing in the future development of the Center is opposed to the installation of a sophisticated IBM computer, provided that it is accompanied by personnel who can operate and maintain it. It is essential that the personnel of the Center, overwhelmed with work and insufficient in number, devote half of their time to the computer. The same is true for any type of equipment no matter how simple (visor , etc.).

The Center still lacks simple equipment (a single mirror stereoscope, received very late).

— Instruction

It is impossible for one person to be responsible for the training of 15 students. Moreover, we believe that this number is too great, that nine trainees would be easier to supervise and train. A permanent African director of training is absolutely necessary.

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In addition, a careful consideration of the procedure for introducing the trainees to the abstract concepts required for the reading of satellite images is indispensible. We ourselves, four years ago, established a program of instruction in remote sensing at the University of Reims and tested several methods, observing their weaknesses and strengths. It is absolutely necessary that the students become accustomed to moving from one scale to another, including the earth-scale.

If action is to be effective, the trainees cannot continue to be recruited from so many disciplines. Too many are represented. Recruitment should be based heavily on educational level.

— Financing: The Center has been adversely affected by the arrival of financing at four different times: France has a fiscal year from January-December, Canada April-March, and the United States November-October.

Funds are disbursed by the States or by the Center, and during the first three months just completed the trainees faced problems of finances.

— Supervision: A year after the opening of the Center the promised American experts (animal husbandry specialist and agronomist) have not yet arrived.

Supervision of the trainees is completely inadequate.

Recruitment of counterpart personnel raises great problems and no project should be initiated without an African counterpart.

Finally, the replacement of European or American supervisory personnel by Africans should become one of the key objectives of the Center.

— Information: Messrs. Ouédraogo and Chipman have made a great effort to publicize the Center at the political level in ministerial circles. Unfortunately, within the development agencies all the work remains to be done.

An inquiry to the Director of INRAN at Niamey, Mr. Zachari Guerba, indicated how much he regretted the lack of information about the Center.

Mr. Malacamp is responsible for technical information in Upper Volta. He has showed an information film at the military school, the Ministry of Public Works and the Embassy of France, but up to the present has not done so in the other interested countries.

s/ Monique Mainguet

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ANALYSIS OF ITEMS RECEIVED

CANADA

Item	Projected (to be provided by sources of financing)	Actual (to be provided by Center)
1. Personnel	US$540,000	1977/78 Can$ 35,000
Operation		1978/79 Can$190,000
Traineeships		1979/80 Can$ 85,000
Studies		Can$310,000
Projects		Available
		Can$540,000
2. Personnel	1 Assistant Director General	ADG arrived October 1977
3. Equipment (equipment plus construction)		1977/78 Can$ 4,000 (office equipment)
4. Other		

ANALYSIS OF ITEMS RECEIVED

UNITED STATES

Item	Projected (to be provided by sources of financing)	Actual (to be provided by Center)
1. Personnel:	US$1,361,000	1978 US$ 525,000))avai
Operation		1979 US$ 783,000)
Traineeships		US$1,308,000
Studies		1978 US$ 92,100))expe
Projects		1979 US$ 64,000)
2. Personnel	1 Photographic technician	Photographic engineer 3 months
	1 Expert in Application (1978)	Animal husbandry specialist 3 months
	2 Experts in Application (1979)	
3. Equipment (equipment plus construction)	Images	1978 US$ 245,000))avai
	Photointerpretation equipment	1979 US$ 217,000)
	Photographic laboratory	US$ 462,000
	All-terrain vehicle	1978 US$ 130,800))expe
		1979 US$ 104,500)
		US$ 235,300
4. Other		

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ANALYSIS OF ITEMS RECEIVED — FRANCE

Item	Projected (to be provided by sources of financing)	Actual (to be provided by Center)
1. Personnel Operation Traineeships Studies Projects	US$811,000	Operation CFAF5,000,0 Total CFAF124,000,000 available
2. Personnel	1 Director of Training 2 Experts in application	Director of Training December 1977 - September 1978 January 1979-present Geologist July 1978- present Information specialis July 1978-present Transient experts
3. Equipment (equipment plus construction)	Teaching materials Maps Interpretation equipment Office equipment	Teaching materials Maps Interpretation equipm Automobile and pickup Office equipment Photographic equipmen CFAF 26,000,000 avai
4. Other		

ANALYSIS OF ITEMS RECEIVED — UPPER VOLTA

Item	Projected (to be provided by sources of financing)	Actual (to be provided by Center)
1. Personnel Operation Traineeships Studies Projects	US$129,000	1977: CFAF 15,000,000 1978: CFAF 44,000,000 1979: CFAF 56,000,000
2. Personnel	1 Director General 1 Manager 6 Auxiliary Personnel 1 Documents Specialist	DG: Sept. 1977-present Manager: March 1978-pr Documents specialist: June 1978-present Secretary to Director plus secretaries: Auxiliary personnel: 6 custodians 4 chauffeur-mechanics 2 laborers Office personnel
3. Equipment (equipment plus construction)	Premises for station Office equipment	2 agency vehicles 1 service vehicle Total: CFAF 5,050,000 Office equipment and machines: CFAF 1,100,0 Premises for station
4. Other		

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TIMETABLE

ITEM	SOURCE	1977	1978	1979	Remarks
Funds	Canada	Can$ 39,000	Can$ 190,000	Can$ 85,000 expended Can$214,000 still available	Total Can$540,000
	France		CFAF 150,000,000 available and expended	CFAF 50,000,000 (to become) available	Total CFAF200,000,000
	USAID		US$770,000 available US$222,900 expended	US$1,000,000 available (in addition to US$525,000 US$168,500 expended	Total US$1,770,000 US$391,400 expended
	Upper Volta		CFAF 55,000,000 available CFAF 30,000,000 expended	CFAF 56 million (in process CFAF 9,190,000 expended	Total CFAF 111,000,000 CFAF 39,290,000 expended

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TIMETABLE

ITEM	SOURCE	1977	1978	1979	Remarks
Personnel	France	Director of Training - December	Director of Training Jan.-Sept. Geologist July-Dec. Information Specialist July-Dec. Transient Experts	Director of Training January Geologist Information Specialist Transient Experts	
	USAID			Photographic Engineer June Animal Husbandry Specialist June Forestry Specialist ?	
	Upper Volta	Director General Sept.-Dec.	Director General Manager March-Dec. Documents Specialist July-Dec. Secretary to Director Sept.-Dec. Auxiliary personnel	Director General 1 Manager 1 Document Specialist 1 Secretary to Director 2 Auxiliary Personnel 14	

TIMETABLE

ITEM	SOURCE	1977	1978	1979	Remarks
Equipment	Canada	Office equipment			
	France		Instructional materials; Interpretation equipment; Office equipment; Maps; Automobile and pickup		
	USAID		Images Documents	Images (ordered) Photographic laboratory equipment; Interpretation equipment	
	Upper Volta	Building Furniture 1 Service Vehicle	2 agency vehicles 1 service vehicle Office furniture and machines		