

PD-AA6-052

0880504-0420/ 628-0504

AGENCY FOR INTERNATIONAL DEVELOPMENT
PROJECT REVIEW PAPER FACESHEET

1. TRANSACTION CODE
A ADD
C CHANGE
D DELETE
A

2. DOCUMENT CODE
2

3. COUNTRY/ENTITY
OMVS

4. DOCUMENT REVISION NUMBER

5. PROJECT NUMBER (7 digits)
628-0504

6. BUREAU/OFFICE
A SYMBOL **AFR** B CODE **06**

7. PROJECT TITLE (Maximum 40 characters)
OMVS Basin Survey and Mapping Program

8. PROPOSED NEXT DOCUMENT
A **3** PP

9. ESTIMATED FY OF AUTHORIZATION OBLIGATION
A INITIAL FY **78** B FINAL FY **82**

10. ESTIMATED COSTS \$000 OR EQUIVALENT \$1 -

A. FUNDING SOURCE	FIRST FY			LIFE OF PROJECT		
	B. FX	C. LC	D. TOTAL	E. FX	F. LC	G. TOTAL
AID APPROPRIATED TOTAL			3,500			6,354
(GRANT)			3,500			6,354
(LOAN)	-	-	-	-	-	-
OTHER 1.						
U.S. 2.						
HOST COUNTRY	-	75	75	-	200	200
OTHER DONOR(S)			3,575			7,054
TOTALS						

11. PROPOSED BUDGET AND APPROPRIATED FUNDS \$000

A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH. CODE		E. FIRST FY 78		LIFE OF PROJECT	
		C. GRANT	D. LOAN	F. GRANT	G. LOAN	H. GRANT	I. LOAN
(1) AR	S-183	057	-	3,500	-	6,354	-
(2)							
(3)							
(4)							
TOTAL				3,500		6,354	-

12. PROJECT PURPOSE (Maximum 400 characters) IS IT DIFFERENT FROM PID

To complete the surveying and mapping of critical portions of the Senegal River Basin in order to assist the OMVS with the coordinated development of the Basin.

13. DATA CHANGE INDICATOR. WERE CHANGES MADE IN PID FACESHEET DATA, BLOCKS 12, 13, 14, OR 15? IF YES, ATTACH CHANGED PID FACE SHEET.

NO YES

14. PLANNING RESOURCE REQUIREMENTS (Staff/Funds)
\$30,000 for 3 p/m consisting of 1 geodesist, 1 cartographer/photographer and 1 project design officer.

15. ORIGINATING OFFICE CLEARANCE

SIGNATURE: *Harold S. Long*

TITLE: AFR/SFWA/OIC (A) Senegal Basin States

DATE SIGNED: MM | DD | YY **11 | 2 | 78**

16. DATE DOCUMENT RECEIVED IN AID/W. OR FOR AID/W DOCUMENTS. DATE OF DISTRIBUTION

MM | DD | YY **11 | 2 | 78**



DEFENSE MAPPING AGENCY
TOPOGRAPHIC CENTER
WASHINGTON, D.C. 20315

REPLY TO
ATTENTION OF:

DMATC-PPO(40110)

15 JUL 1976

Mr. David Shear
Director, Office of Central and
West Africa Regional Affairs
Agency for International Development
Department of State
Washington, D.C. 20523

Dear Mr. Shear:

As requested by USAID, enclosed is the final plan addressing the mapping and geodetic survey requirements for the Senegal River Basin Project in West Africa. This final version parallels the original draft prepared by DMA technicians who visited the project area under USAID sponsorship last May. At the request of Mr. Hal Gray from your office, a few modifications were made in the final proposal to reflect budget constraints.

The proposal has been reviewed by other elements and can be considered a reasonable plan for incorporation in your overall planning document. Slight modifications may be appropriate in the future and can easily be accommodated as circumstances dictate. If any questions arise after your review of the document, please feel free to contact Mr. Morrow of this Center.

Sincerely,

WALTER M. LEECH
Deputy Director, Programs,
Production and Operations

Enclosure
As stated



SENEGAL RIVER BASIN SURVEY AND MAPPING PROPOSAL AND TERMS OF REFERENCE

Introduction

In order to meet the Congressional mandate "to develop a long term comprehensive development program for the Sahel", priority attention must be given to the need for basic resource data in the various river basins. The planning of irrigation, drainage and flood control projects, which will be a very important part of long term Sahelian area development, can only be done on a sound basis attractive to donors and investors when adequate information exists on topography, suitability of land for farming, water supply, susceptibility to flooding, other physical resources and human and economic resources.

The "long term comprehensive development" mandated by the Congress has further implications. Basin-wide and regional master plans identifying potential projects need to be prepared. Experience has shown that contour maps to a scale of about 1:10,000 or, in other cases, 1:20,000, are generally needed to identify irrigable lands and to make feasibility designs and estimates for alternative projects. Lacking such maps, individual projects might be built which would later prove incompatible with effective development of the river basin.

A.I.D.'s interest in participating in the agricultural development of the Senegal River Basin has been demonstrated in several ways. The Agency has carefully studied the Senegal River Basin Development Authority's Indicative Basin Plan. (The Authority's French acronym is OMVS). This forty-year master plan envisages a total investment of \$3.5 billion into four sectors of development: agriculture, dams, ports and navigation. A.I.D.'s program concentration has been largely on agricultural development and also on training and human resource development. The Agency has reported to Congress that its participation in other, more infrastructural, aspects of the Plan should not be excluded. In its report to Congress, "Implementation of 'New Directions' in Development Assistance", dated July 22, 1975, Administrator Parker reported, "there will continue to be occasional large scale infrastructure projects which A.I.D. will consider important enough to finance if they contribute to overall agricultural production goals for the poor majority. An example ... is the Senegal River Basin Development (OMVS) loan ... the first stage of a coordinated multinational effort to regulate the waters of the Sahel region. Major mainstream dams, irrigation works, port development and basic infrastructure will ultimately be involved. Especially in Africa this need for A.I.D. to join with other donors in support of critical major infrastructure may recur and should be considered on its merits."

The development of irrigated agriculture and the control of flooding in the Senegal River Basin requires new surveying and mapping. Existing maps of the area are small scale (1:50,000 and smaller), lacking in detail, and incomplete in their coverage of the areas where, according to the Indicative Basin Plan, major developments will occur. Existing surveys in the basin are, in many areas, not related to a common horizontal reference point or elevation datum. This lack of adequate topographic information, if not corrected, will lead to more costly and less satisfactory projects within the basin; in fact, in the absence of better topographic information, some potentially feasible gravity irrigation projects may not be identified, and some development may occur which is incompatible with optimum resource use.

Justification for Survey/Mapping of Portions of the Senegal River Basin

The planning of development in a river basin must be comprehensive. This is required both by logic and by our appropriations legislation (see Foreign Assistance and Related Appropriations Act of 1974, Section 101). Only through detailed knowledge of the resources of a river basin can comprehensive planning occur. This planning must include consideration of the remaining basin area, alternative projects within the basin, and consideration of how these alternatives may be affected. It is not usually adequate (although it is often done for reasons of economy and a shortage of capital) to survey and map only a limited project area when planning a new irrigation perimeter or other project.

Development of major river basin projects requires feasibility studies with reasonably firm estimates of project costs and benefits (Foreign Assistance Act of 1961, Section 611). Such estimates can only be based on surveys, preliminary engineering designs and quantity estimates. Experience has shown that reliable cost estimates cannot be made without mapping in the 1:10,000 or 1:20,000 range or without surveys of suitable accuracy.

Detail and accuracy of maps are measured in terms of their horizontal scales and their contour intervals. The smaller the contour interval and the larger the ratio of distance on a map to corresponding distance on the ground, the more detailed and accurate is the map, and the less field surveying required to supplement information on the map. It is of greatest interest, therefore, that each step in the mapping process be undertaken so that the most accurate and detailed maps consistent with needs can be produced.

The OMVS has asked A.I.D. to finance the triangulation and mapping of the Basin area, or at least of key portions thereof. The technical proposals contained herein have been prepared by two consultants from the U.S. Defense Mapping Agency on the basis of a four-week TDY to Dakar and points within the Basin area. For the survey aspect of the project, they have proposed utilization of the traverse system in lieu of the triangulation requested by the OMVS, since modern traverse methods are more accurate, and less expensive.

Purpose of the Project

The purpose of this project is to provide the OMVS with critical horizontal and vertical data required to put all mapping in the area on a common system, to enable it to undertake whatever studies and implementations are envisaged to realize the objectives of the Indicative Basin Plan. These data will be required for the planned irrigation projects, dams and ports, and for studies of forestry and natural resources. This will be accomplished through precise leveling and horizontal networks, followed by large-scale mapping.

Precise leveling is the first requirement because gravity-powered irrigation is planned for several regions in the Basin. The present leveling is inadequate for this purpose.

Horizontal control is the second requirement. The only existing control in the area is the net of astronomical stations established by the French National Geographic Institute (IGN) over 20 years ago for the 1/200,000 maps. This net was an expedient just adequate for that scale. This control is not reliable for large-scale mapping; therefore, a precise horizontal network needs to be established.

The third requirement is procurement of aerial photography for the purpose of producing class A photomaps and orthophotomaps. The length of the aerial photography flying season is based on numerous cloud-free days with very good visibility. This limits the flying season to the January to March period.

The fourth requirement is the production of maps from aerial photography. This includes the establishment of geodetic control to position the maps vertically and horizontally.

Description of the Project

The project consists of two phases. The first is the establishment of a precise geodetic traverse connected to the 12th parallel at Kayes, Mali, passing through the Senegal Valley beyond the Guiers

Lake and then rejoining the 12th parallel near Thies, which lies about 40 kilometers east of Dakar. At the same time, basic first order levelling will be carried out. This is necessary because there are several local horizontal and vertical networks that do not meet the required standards and are not based on a common datum. These first phase activities will support the second phase activity, which is the aerial photography, mapping surveys and photogrammetric mapping. The mapping operations will begin with the aerial photography.

Aerial photography will be procured for the mapping of ten selected sites along the Senegal River Basin. (see attached map with sites delineated.) Aerial photography will consist of:

1.) 1:9,000 scale panchromatic photography to be used for vertical data. Two cameras will operate simultaneously; thereby producing two rolls of original film.

2.) 1:18,000 scale panchromatic and color-infrared photography flown simultaneously. The panchromatic photography will be used for aerotriangulation to provide photogrammetrically-derived control for the 1:9,000 scale photography. In addition, it will be used as a base for the orthophoto and photo maps. The color-infrared will be useful for delineating hydrological features and vegetation.

3.) The entire Basin will be flown from the Delta to Kayes at a scale of 1:50,000. Again, panchromatic film and color-infrared will be exposed simultaneously. This will provide an overview of the entire Basin for purposes of supporting the Indicative Plan's proposed projects in navigation, forestry, positioning of levees and dams, identification of types of crops, diseased or dead vegetation, and areas subject to flooding and other relevant studies.

Terms of Reference for the
Establishment of a Precise Geodetic Control

Vertical Control: The number of gravity powered irrigation projects being planned and/or implemented dictates the need for precise leveling. The existing first order leveling is two decades old and many of the benchmarks have been disturbed. As a practical matter it is better and possibly cheaper to establish new first order leveling than simply to check the existing benchmarks. Existing benchmarks are too far apart; spacing for the new leveling should seldom exceed one kilometer between benchmarks.

In addition to establishing new first order leveling along the road between Kayes and Saint Louis, leveling should be transferred across the river in the mapping areas of Bakel, Matam, Kaedi, Salde, Bogue, Podor and Richard Toll.

Horizontal Control: The next priority is the establishment of a precise horizontal framework to which all mapping surveys can be attached. This framework will consist of a precise geodetic traverse similar to the 12th Parallel Survey and will be connected to the 12th Parallel Survey near Kayes and Thies. This precise traverse will follow the Senegal Valley from Kayes to the vicinity of Rosso, Mauritania, before turning south toward Thies. The exact path of the precise traverse will be one that combines sound surveying practices with economy of operation.

The 12th Parallel Survey (Traverse) specifications were written about ten years ago to employ electronic distance measuring equipment (EDME) designed and manufactured several years before that. Those specifications were drawn up to yield a horizontal accuracy of one part in a million. Comparisons of that traverse with triangulation indicate that the one part in a million goal was achieved. With the EDME available today similar accuracies could be obtained with less effort.

Although first and/or second order horizontal ties from the main traverse to the supplementary stations would be adequate, precise traverse would be best for the basic control because of the distance it must be extended. If first order basic horizontal control were used, the misclosure when reconnecting to the 12th parallel near Thies, could be as high as 3 meters (one part in a hundred thousand) as compared to less than a meter for precise traverse. If the misclosure for first order triangulation or traverse did turn out to be as high as 3 meters it would either leave serious doubts as to whether a gross blunder existed somewhere in the work, or it could ultimately cost more than precise traverse in the long run to show that the error was really the allowable systematic error of one part in a hundred thousand permitted in first order work (and not a blunder).

Since all future mapping and survey work in the area will use these precise traverse stations and supplementary stations as a reference, it will be good long term investment to establish a good, closed precise geodetic traverse for the first horizontal control for the region in the first place rather than seek cheaper, more expeditious methods which would most likely have to be redone and readjusted in the future.

Additional horizontal survey stations will be established and connected to the precise traverse by appropriate methods to give first or second order accuracy. These stations will be at convenient locations for the future mapping surveys of this project and each will have an azimuth mark, visible from tripod height on its side of the river. Also, at intervals not to exceed 30 kilometers, such a point will be established across the river from the main traverse. Furthermore, an auxiliary microwave traverse (with some astronomical control) around the delta area north of Saint Louis will have to be tied at both ends to the precise traverse.

Once the basic vertical and horizontal framework has been established, the aerial photography flown and picture points selected (see following section for terms of reference on aerial mapping photography), the mapping surveys will begin. These surveys will connect about 95 horizontal picture points to the horizontal framework and about 3100 vertical picture points to the precise leveling. These surveys for mapping control will require a lot of field work. The 3100 vertical picture points will entail about 990 kms. of second order leveling, 110 kms. of third order leveling, and 4300 kms. of less precise leveling. Once these surveys are completed the maps can be made.

Development of navigation up the Senegal River will require channel surveys, Though ultimate development will await construction of the dam at Manantali and regulation of the flow, some improvement of the channel can begin before then. These channel surveys would take advantage of the survey stations established during this project.

Terms of Reference for the Aerial Mapping Photography

The aerial mapping photography serves a twofold purpose. Its function is to produce 1:10,000 scale, one meter contour interval photomaps or orthophotomaps of ten areas in the Senegal River Basin. These areas, delineated on the map attached to this proposal, are located in the regions of: 1) Aftout es Sahel; 2) Rosso-Lac Rkiz-Lac de Guier; 3) Podor; 4) Bogue; 5) Salde; 6) Kaedi; 7) Matam; 8) Bakel; 9) Karakoro River; and 10) Kayes. These areas were specified by OMVS officials as meriting the priority, within the framework of the Indicative Basin Plan, of being flown for large-scale photogrammetry. The attached map also indicates, for each area, the size in square kilometers.

The color-infrared photography and the small scale black and white (panchromatic) photography are for hydrological, forestry, range management and other studies to be conducted according to the work plan of the OMVS during the next ten years.

The recommended mapping plan is as follows:

1.) The first season of 90 days duration (January - March) must be devoted to flying the 1:9,000 scale and 1:18,000 scale photography. Every effort must be made to fly the two scales in usable, concentrated blocks. In this way, actual mapping can begin after picture point control is established. The 1:9,000 scale photos will be flown at 1,372 meters (4,500 feet) altitude and the 1:18,000 scale at 2,743 meters (9,000 feet).

a.) The first photography to be flown will be the 1:9,000 scale, panchromatic photography - two cameras operating simultaneously to yield two original negatives. In the same areas the 1:18,000 scale photos shall be obtained. Similarly, two cameras will operate simultaneously, one with color-infrared and the other with panchromatic film.

b.) The aircraft must be capable of mounting two 152 mm. focal length cameras. The controls of one camera should be set to operate automatically the other camera. The cameras must be of recent design to obtain maximum resolution, minimum distortion, and accommodate all film types.

c.) The 1:18,000 scale panchromatic photography will be used for aerotriangulation and to make the final photomaps and orthophotomaps. The color-infrared, exposed in the other camera, will be a valuable tool for hydrology, vegetation, geology, navigation and other purposes.

d.) In the aerotriangulation photography, vertical picture points will be established in each corner of a stereoscopic pair of photographs, commonly known as a model. A picture point is a photo-identifiable, pin-pricked, described, non-monumented geodetic point, positioned vertically, horizontally or both. The number of vertical picture points for the 1,700 photos covering the ten areas will be about 3,150. The number of horizontal/vertical picture points will be about 95. The horizontal/vertical points will be placed in the corners and perimeters of the aerotriangulated blocks. The purpose of aerotriangulation (not to be confused with ground level triangulation, which in this proposal will not be undertaken in favor of traverse,

the more modern and technologically more accurate method) is to derive photogrammetric control both horizontally and vertically, as opposed to ground geodetic control. Aerotriangulation derives many points on the map from a few ground established points.

e.) The aerotriangulation photography, totalling 1,700 photos, will be divided into manageable blocks depending upon the method of aerotriangulation, size and shape of the area. The density and distribution of the control is for modern analytical block adjustment methods using the MUSAT program. (MUSAT is Multiple Station Analytical Triangulation).

f.) Prior to this adjustment, four passpoints will be selected in the corners of each model of the 1:9,000 scale photography. Passpoints are photo identifiable points. The horizontal and vertical values are derived photogrammetrically through the aerotriangulation MUSAT procedures. The selected passpoints will be transferred to the 1:18,000 scale photography. After aerotriangulation each 1:9,000 scale photo will have horizontal and vertical values for each passpoint. Use of this method reduces the requirements for ground geodetic control to a quarter of the normal requirement which results in substantially lower costs. The 1:9,000 scale photography is then stereo-compiled in a high accuracy stereo plotter for the one meter contour interval. In addition, OMVS recommends a dashed line representing half meter supplemental contours for flat areas and numerous spot elevations determined photogrammetrically, especially in depressions and elevated areas. Spot elevations will be accurate to 20-25 centimeters.

g.) The 1:18,000 scale photography will be used for the actual photomaps and orthophotomaps. The use of the 1:18,000 scale photo instead of the 1:9,000 scale photo for the maps results in substantial savings. In very flat areas, such as is characterized in much of the lower valley of the Basin, photomaps are advisable. The photography will be rectified and then positioned for a mosaic. These photomaps will be true maps; the scale will remain constant throughout the map. In areas of terrain relief, (even low hills are considered relief), orthophotomaps will be produced. The orthophoto procedure rectifies the photo and removes relief displacement so that the scale remains constant. The orthophotomap, like the photomap, is, in every sense, a map. According to terrain relief, each photograph or map sheet area must be examined for determination of producing a photomap or orthophotomap.

2.) The second season's operation, lasting about 45 days in January and February, will complete the large scale photography and the 1:50,000 scale, 152 mm. focal length camera lens photography. As is the case for the first season's work, two sets of simultaneously obtained photography, panchromatic and color-infrared, will be used for flooded land studies, forests in the river valley that may be destroyed, agronomy, range management and vital navigation surveys. This photography will cover the entire Senegal River Basin to Kayes Mali.

It is possible that this operation could be carried out during the first season if no logistical, shipping or climatic difficulties arise. The likelihood of all three factors playing no interruptive role is slight enough that this proposal realistically envisages the need to complete the total task in two seasons.

3.) The final maps, totalling about 270 in number, will be orthophotomaps or photomaps on a photographic print base of suitable thickness, stability and durability. The maps will be the color of the prints, black and white. Superimposed on the maps will be an appropriate grid, names, contours and spot elevations. The actual map interior size of the sheets will be three minutes by three minutes, or about 56 cm. North-South and 54 cm. East-West. The overall size of the sheets with margins and legends may be 70 cm. by 64 cm.

4.) Final Products to be delivered to the OMVS. (Quantities are approximate)

a.) Prints, 4 each

1:9,000 scale panchromatic photography

1:18,000 scale panchromatic photography

1:18,000 scale color-infrared photography

1:50,000 scale color-infrared photography

1:50,000 scale panchromatic photography

b.) Film - Rolls

1:9,000 scale panchromatic photo - 2 each

1:18,000 scale panchromatic photo - 2 each

1:18,000 scale color infrared photo - 1 each

1:18,000 scale color-infrared photo - 1 each

1:50,000 scale color-infrared photo - 1 each

1:50,000 scale panchromatic photo - 2 each

c.) Photo Indexes - Only black and white

1) Two negatives each of 1:9,000, 1:18,000 and 1:50,000 scale photo

2) Four prints each of the above

d.) Six copies each of photo line plots

e.) 1:10,000 scale map sheets, 20 copies each, 270 sheets

5.) Listed below is a tabulation of areas to be mapped, 1:10,000:

<u>Name</u>	<u>Area No.</u>	<u>Square Kilometers</u>
Aftout es Sabel	1	829
Rosso (Lac R'Kiz)	2	3,434
Podor	3	340
Bogue	4	175
Salde	5	337
Kaedi	6	525
Matam	7	411
Bakel	8	262
Karakoro	9	399
Kayes	10	262

6.) Senegal River Basin Area - Photo only at 1:50,000 scale, 24,636 square kilometers.

Summary of Survey Costs (BUDGET) for Basic Control

First Order Levelling	\$ 500,000
Precise Geodetic Traverse and Supplementary Stations	\$2,000,000
Mapping Surveys	<u>\$2,646,600</u>
TOTAL	\$5,146,600

Detail of Budget Formulation

1.) Leveling, first order, (500,000)

Assumptions: A) Full season's work for leveling crew each year.

B) Average spacing between first order benchmarks about 1km. 130 existing marked feature will probably be usable over the 790 km. stretch.

C) The estimate for second order leveling assumes monumented benchmarks to average 5 km. apart. For a 790 kms. stretch it is assumed that 26 existing features would serve as benchmarks.

Budget for Levelling First Order

<u>ITEM</u>	<u>First Order</u>	<u>Second Order</u> (for figuring cost per km.)
Reconnaissance (selection benchmark location)	\$ 6,900	\$ 6,300
Monumenting (price for concrete and labor for benchmarks @ \$75 ea.) <i>low</i>	49,500 (660 new)	9,900 (132 new)
<u>OBSERVATIONS</u>		
- (surveyors 896 Mandays x \$150/day)	134,400	67,200
- (local skilled labor 896 Mandays x \$25)	22,400	11,200
- (900 man-days unskilled at \$15/day for digging holes, mixing concrete, etc.)	13,500	6,750
<u>VEHICLE OPERATION</u>		
- 2 vehicles at 300 mi/mo x 15 mos. at .25 per mile	6,000	3,000
<u>AIR FARE FOR PERSONNEL</u>	4,400	2,200
<u>SEA FREIGHT FOR VEHICLES</u>	12,000	6,000
<u>AIR FREIGHT</u>	1,000	500
<u>MISCELLANEOUS</u>	<u>2,425</u>	<u>1,210</u>
TOTAL	\$252,525	\$114,260
+ Overhead (90%)	202,020	91,408
+ Contingency (10%)	45,455	20,567
Expected Bid	500,000	226,235
	(This column represents breakdown of \$500,000 being requested for FY76 funding for levelling)	(or about \$300 per km) (This column is calculated to show average cost per km for the later mapping survey)

Budget for Precise Traverse Estimate (80' km)

Assumptions:

- A) Average length of line is 25 km or a total of 32 lines.
- B) No more than half of the stations will require Bilby Steel towers; portable stands will suffice for the others.
- C) Ties to supplementary points will only require a single occupation.
- D) Each precise line will require about 45 man-days of effort by surveyors and technicians. This includes anticipated weather loss. Assumed also is a figure of 45 man-days of local employees.
- E) Each supplementary station will require about 20 man-days of effort by surveyors and technicians and 20 man-days of local employees.
- F) A loss of about 600 man-days each season for mobilization, sickness, etc.
- G) Average salary and per diem for surveys and technicians is \$150/day; for skilled, locally hired employees is \$25/day and for unskilled locally hired employees is \$15/day.
- H) About 35 supplementary stations, for example, across the river from the precise traverse, will be established.
- I) About 12 stations around the delta will be established with about four astronomical stations.
- J) Approximate composition of work crews:

	1	Chief
	3	Geodimeter Observers
	3	Azimuth/Angle Observers
	1	Computer Specialist
	2	Astronomical Observers & Computer Specialists
	2	Reconnaissance Engineers
	3	Tower Builders
	2	Clerical/Logistics Assistants to the Chief
TOTAL	17	Men

- K) Vehicles: Four 5-ton trucks, 4x4
Nineteen 1-ton trucks, 4x4

BUDGET:

Salaries:

Precise Traverse:

U.S. Technicians - 32 main stations x 45 man-days x \$150	216,000
Local Skilled - 32 main stations x 25 man-days x \$25	20,000
Local Unskilled - 32 main stations x 20 man-days x \$15	9,600

Supplementary Stations:

U.S. Technicians - 35 suppl stations x 20 man-days x \$150	105,000
Local Skilled - 35 suppl stations x 12 man-days x \$25	10,500
Local Unskilled - 35 suppl stations x 8 man-days x \$15	4,200

Delta Survey

U.S. Technicians - 12 stations x 20 x \$150	36,000
- 4 astron stations x 12 x \$150	7,200
Local Skilled - 12 stations x 12 x \$25	3,600
- 4 astron stations x 12 x \$25	1,200
Local Unskilled - 12 stations x 8 x \$15	1,440
Loss Time - 600 man-days x \$150	90,000
- 600 man-days x \$25	<u>15,000</u>

TOTAL SALARIES

519,740

COMMODITIES AND OTHER COSTS

(19) Vehicles (of which four are for the levelling activity)	150,000
4 5-ton Trucks	40,000
Office Rent (\$500/mo x 7 mos)	3,500
Monumenting Stations, equipment & materials	25,000

what happens to these

Fuel for generators, lamps, etc.	5,000
Office Supplies	5,000
Vehicle Operating costs (15 x 19,000 mi x .25 mi)	71,250
17 round-trip air tickets @ \$1,100	18,700
Air freight for instruments (6,000 lbs. x \$2.50 x 2)	30,000
Sea freight for vehicles, tower equipment, and camping equipment	60,000
Miscellaneous	<u>6,911</u>
<u>TOTAL COMMODITIES AND OTHER COSTS</u>	415,361

SUMMARY

Total Salaries	\$ 519,740
Total Commodities & Other Costs	415,361
Data Reduction (+ computer time @ \$25,000 + .2½ man-years @ \$20,000)	<u>75,000</u>
SUB-TOTAL	\$1,010,101
Overhead (30%)	808,081
Contingency (10%)	<u>181,818</u>
TOTAL BUDGET FOR PRECISE TRAVERSE	\$2,000,000

Mapping Control Estimate

This assumes that the same contractor will do both the basic control and the mapping control and therefore, anticipates storage costs, but no additional expenses for sea freight nor the capital loss (i.e., equipment worth less than the price of shipping it back to the U.S.).

Vertical Control: The required accuracy for the vertical picture points is 0.1 meter. This accuracy can be achieved by running fourth order levels between first, second, and third order benchmarks. This means that considerable supplementary levelling of second or third order will have to be established for the vertical picture point work.

Along with the estimate for the first order levelling (double run) is an estimate for second order (same method and equipment, but done in one direction only). The \$300 per kilometer figure is based on the budget on page 12. Third order levelling is estimated to be cheaper - about \$275 (same method and equipment but longer sights and larger closures permitted). Fourth order levelling is estimated at \$250 per kilometer. These figures include overhead and contingency.

To determine the elevations for all the vertical picture points in the mapping areas, the following amounts of levelling will have to be run:

	<u>VERTICAL CONTROL BUDGET</u>
Second Order: 988 km x \$300	\$ 296,400
Third Order: 108 km x \$275	29,700
Fourth Order: 4342 km x 250	1,085,500
 Total Expected Cost of Surveying Vertical Picture Points for Mapping	 1,411,600

Horizontal Control: The horizontal picture points can be connected to the precise traverse with much of the same equipment used for the traverse and if the members of the crews are cross-trained, by the same teams doing the vertical picture point work. As the work locating the horizontal picture points will require little, if any, monumenting and less accuracy, this work will be cheaper than the supplementary points. About 16 man-days (surveyors and technicians) per point.

HORIZONTAL CONTROL BUDGET

Salaries:

U.S. Technicians - 16 man-days		
x 95 points x \$150	\$	228,000
 Skilled Local - 10 man-days		
x 95 points x \$25		23,750

Unskilled Local - 7 man-days x x 95 points x \$15	9,975
Loss Time	
- U.S. Employees: 500 man-days x \$150	75,000
- Skilled Local: 500 man-days x \$25	<u>12,500</u>
TOTAL SALARIES	349,225
<u>Commodities & Other Costs:</u>	
Vehicle Operating Costs: 19 x 16,000 mi x .25/mi	75,000
Office Rent (20 mos x \$500)	10,000
Storage of Equipment during wet season (18 mos, x \$800)	14,400
Fuel for Generators, lamps, etc.	15,000
Round-trip Air Tickets	40,000
Office Supplies	15,000
Air Freight for Instruments (6 trips x 6000 lbs x \$2.50)	90,000
Miscellaneous	<u>15,112</u>
TOTAL COMMODITIES & OTHER COSTS	274,512
Total Salaries, Commodities & Other Costs	623,737
Overhead (80%)	498,990
Contingency (10%)	112,273
TOTAL HORIZONTAL PICTURE POINTS	\$1,235,000
TOTAL VERTICAL PICTURE POINTS	\$1,411,600
GRAND TOTAL FOR MAPPING SURVEYS	\$2,646,600

AERIAL MAPPING PHOTOGRAPHY

Specify Dates

First Season - 90 days - plane on site.

Mobilization (Manager & labmen arrive 3 wks before plane)

Crew Prep.	\$ 200
Pilot, copilot, cameraman, mechanic, 2 lab men	
Ship Plane	\$ 10,000
Ship Supplies 2500k x \$3	\$ 7,500
Manager 3 weeks at \$25,000/year	\$ 1,500
Lab men (2) 3 weeks at \$18,000/year	\$ 1,038
TDY 3 men x \$100 x 21 days	\$ 6,300
Fare 6 men x \$1100 + \$2200 round trip for manager	\$ 8,800
Car \$30/day x 21 days	\$ 630
	\$ 35,968
	<u>\$ 79,130</u>

Demob. (Lab men stay behind 3 wks)

2 Lab men 3 wks at \$18,000/year	\$ 1,038
Fare 6 people x \$1100/year	\$ 6,600
TDY (2 lab men) \$80 x 21 days x 2 men	\$ 3,360
Car \$30/day x 21 days	\$ 630
Ship plane	\$ 10,000
Ship Supplies 200k x \$3 2000k	\$ 6,000
Office	\$ 500
Local help	\$ 400
	\$ 28,528
	<u>\$ 62,751</u>

Standby

Pilot \$25,000 \$70/day x 90 days	\$ 6,300
Copilot \$20,000 \$55/day x 90 days	\$ 4,950
Mechanic \$13,000 \$50/day x 90 days	\$ 4,500
2 Lab men \$13,000 \$50/day x 90 days x 2 men	\$ 9,000
Cameraman \$13,000 \$50/day x 90 days	\$ 4,500
Office & Lab \$500 /month x 3 months	\$ 1,500
Per diem 6 men x \$80 x 90 days	\$ 43,200
Car rental \$30 per day x 90 days	\$ 2,700
Translator/driver \$300/mo. x 3 mo.	\$ 900
Janitor \$200/mo. x 3 mo.	\$ 600

Misc.

Aircraft \$125/day x 90 days	\$ 11,250
	<u>\$ 91,400</u>
	<u>\$201,080</u>

Flying Cost	
\$100/hr x 155 hrs	\$ 15,500
	<u>34,100</u>

Materials	
10602 photos inc. 20% rej. rate	
10602 x .50¢ each	5,301
212 rolls pan film at \$125 each	26,500
(100 pics/roll 1:9000, 1:18000)	
Chemicals	2,000
18 rolls False color at \$545 per roll	9,810
False color developed in States	
18 rolls x 100 pics .50¢ / foot	900
	<u>44,511</u>
	<u>\$ 97,924</u>

First Season Photo . 3 months

Mobilization	\$ 79,130
Standby	\$201,080
Flying time	\$ 34,100
Materials	\$ 97,924
Demobilization	\$ 62,761
	<u>\$474,995</u>

Mobilization

Crew prep.	\$ 200
Pilot, copilot, cameraman, mechanic, lab man (3 wks before plane)	
Ship Plane	\$10,000
Ship Supplies 2000k x \$3	6,000
Labman 3 weeks at \$18,000/year	519
TDY Labman 3 wks x \$80/day	1,680
Fare 5 men x \$1100	5,500
Car \$30/day x 21 days	630
Office & Lab	500
Local help	500
	<u>25,529</u>
	<u>\$56,164</u>

Demob. (Labman stays behind 3 wks)

Lab man 3 wks at \$18,000/year	519
Lab man TDY \$80 x 21 days	1,680
Car \$30/day x 21 days	630
Fare 5 men x \$1100	5,500
Ship Plane	10,000
Ship Supplies 1500 k x \$3	4,500
Office	500
Local Help	400
	<u>23,729</u>
	<u>52,204</u>

Standby

1st Season \$201,080 ÷ 2 (half of 1st season)	\$100,540
---	-----------

Flying Cost

\$100/hr x 50 hrs	\$ 5,000
	<u>11,000</u>

Materials

Prints - 1200 x .50¢ each	\$ 600
10 rolls pan at \$128 each	1,280
10 rolls color - infrared at \$545 each	5,450
Chemicals	200
100 pics - color .50¢/ft. (develop)	500
	<u>8,030</u>
	<u>17,666</u>

Second Season

Mob.	\$ 56,164
Standby	100,540
Flying time	11,000
Materials	17,666
Demob.	52,204
	<u>237,574</u>

Photo Indexes - Number of photographs and scale

7069	1:9000	
1766	1:18000	
815	1:50000	
<u>9650</u>	prints at .50¢ each =	4,825

70 indexes		
1 day each x 70 days x 8 hrs. x \$7/hr =		3,920
Material for negative		
\$5 x 70		<u>350</u>
		9,095
		<u>20,009</u>

Control Plan

1766 Photos x 2 each x .50¢ each	1,766
38 Photo Indexes 4 sets at \$8	1,216
Two men - three months	
92 days x 2 x 8 hrs x \$7/hr.	<u>10,304</u>
	13,286
	<u>29,229</u>

Triangulation - Photogrammetry (aerotriangulation)

1766 photos x \$100 each =	<u>176,600</u>
----------------------------	----------------

Compilation - Contours, spot heights

7069 photos x 3 hrs ea. x \$7/hr =	395,864
7069 Estars x \$1.50 =	<u>10,603</u>
	406,467
	<u>894,227</u>

Orthophotomaps

1. 9 photos/sheet	9
2. 9 plates	20
3. C-8 9 models 8 days x 8 hrs x \$7	448
4. GZ-1 9 negatives	18
9 prints	18
4 models/day x 2 days x 8 hrs x \$7	112
5. Preparation & Completion	100
6. Mosaics 8 hrs x \$7	56
7. Annotation names, spot heights, contours	150
8. Photo Process	100
9. Repro	100
	<u>1,131</u>
	2,488

270 sheets	
75% by ortho - 202 x 2488 =	\$502,616
	<u><u> </u></u>

Cost of Photomaps

1. 9 photos	9
2. Rectify 9 photos 4 photos/hr x \$7	28
3. 9 Estars 9 x \$1.75	16
4. Prep. & Completion	100
5. Mosaic 3 hours x \$7	56
6. Annotation names, spot heights, contours	150
7. Photo Process	100
8. Repro	100
	<u>559</u>
	\$1,230

25% of 270 sheets	
68 sheets x \$1230	\$83,640
	<u><u> </u></u>

Materials Furnished to OMVS

1. Prints	4 each	
1:9000	7100 x 4 x \$1	\$ 28,400
1:18000	1770 Pan x 4 x \$1	7,080
1:18000	1770 F.C. x 4 x \$5	35,400
1:50000	815 Pan x 4 x \$1	3,260
1:50000	815 F.C. x 4 x \$5	<u>16,300</u>
		90,440

2. One set of original rolls of film at scales listed in Item 1.
This includes 2 sets of 1:9000 scale film rolls exposed simultaneously,
therefore, not listed in Item 3.

3. Duplicate Film		
1:18000	18 rolls pan x 100' x \$2	3,600
1:50000	10 rolls pan x 100' x \$2	<u>2,000</u>
		5,600

False color 1:18000 x 1:50000
original film can be shared by
participating countries.

4. Photo Indexes - Black & White - False color
will be in the same sequence because of
simultaneous operations. (70 indexes)

2 neg. ea of 1:9000, 1:18000 and 1:50000	
6 x 70 negs. x \$15	6,300
4 prints each 70 x 12 x \$12	<u>10,080</u>
	16,380

Pan = Panchromatic - Black & White
F.C. = False color = color-infrared

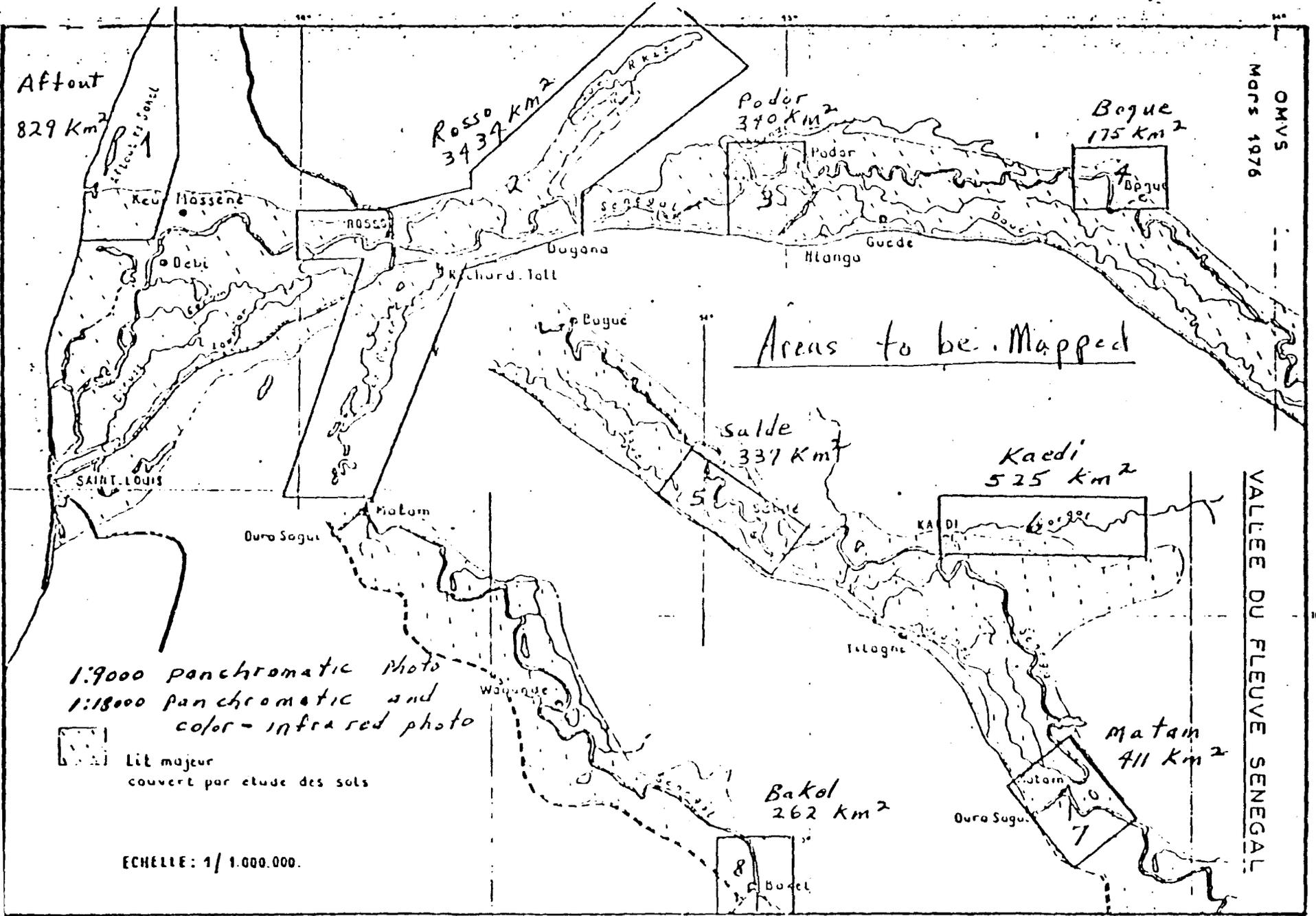
5. Photo Line Plot - Three	3,000
5 copies each	

6. 1:10000 Scale sheets	
20 copies each	64,800
20 x 270 sheets x \$12	
	<u>\$182,220</u>

Cartographic Costs

Item	Cost \$	Cost CFA at: 230
Aerial Photography	712,569	163,890,870
Photo Indexes	20,009	4,602,070
Control Plan	29,229	6,722,670
Triangulation	176,600	40,618,000
Compilation - Vertical Only	894,227	205,672,210
Orthophotomaps	502,616	115,601,600
Photomaps	83,640	19,237,200
Materials to OMVS	<u>182,220</u>	<u>41,910,600</u>
	<u>2,601,110</u>	<u>598,255,300</u>

OMVS
MARS 1976



Affout
829 km²

Rosso
3439 km²

Podor
370 km²

Bogue
175 km²

Salde
337 km²

Kaedi
525 km²

Matam
411 km²

Bakol
262 km²

Areas to be Mapped

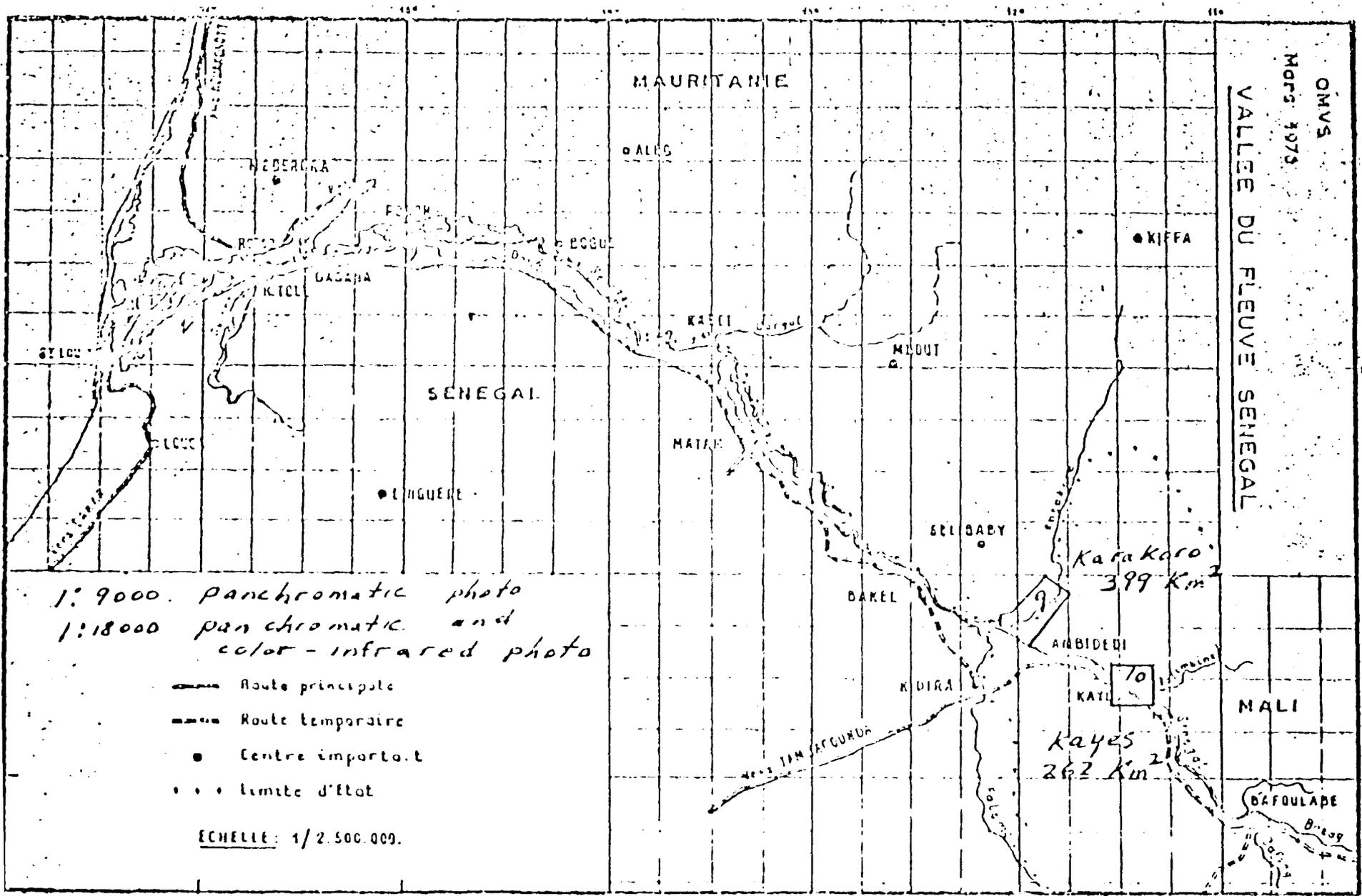
1:9000 panchromatic photo
1:18000 panchromatic and
color-infrared photo



Lit majeur
couvert par étude des sols

ECHELLE: 1/1.000.000.

VALLÉE DU FLEUVE SENEGAL



OMVS
Mars 1973
VALLEE DU FLEUVE SENEGAL

1:9000 panchromatic photo
1:18000 pan chromatic and
color - infrared photo

- Route principale
- - - - - Route temporaire
- Centre important
- • • limite d'Etat

ECHELLE: 1/2.500.000.

Karakoro
399 Km²

9

AMBIDEJI

KAYES
262 Km²

10

SCHEDULE FOR SURVEYING, PHOTOGRAPHY, & MAPPING OF SENEGAL BASIN

(calendar year)	'77	'78	'79	'80	'81	'82	'83
LEVELING	\$250K	\$250K					
MAIN TRAVERSE	\$875K	\$510K					
DELTA TRAVERSE		\$520K					
COMPUTATIONS & ADJUSTMENTS	\$100K	\$15K					
AERIAL PHOTOGRAPHY		\$475K	\$250K				
PHOTO INDEXES		\$15K	\$5K				
CONTROL PLAN		\$420K	\$14K				
MAPPING SURVEYS			\$1323K	\$1323K			
AEROTRIANGULATION			\$88K	\$88K			
COMPIATION				\$441K	\$447K		
MAP PRODUCTION					\$293K	\$293K	
CONTRACT INSPECTION	\$55K	\$100K	\$55K	\$55K	\$16K	\$16K	\$10K
COMMODITIES, PRINTS, FILM FOR PHOTO INDEXES, FLIGHT LINE PLOTS, MAP SHEETS, ETC			\$20K	\$60K	\$37K	\$55K	\$30K
Summation	\$1200K	\$1965K	\$1694K	\$1973.6K	\$837K	\$344K	\$40K

The CWR DAP Overview (page 101) states, "... it is appropriate that the U.S. should be involved in (river basin development) as part of a continuing interest in the (Sahel) Region," and notes that "water resource development and irrigated farming are major areas of U.S. expertise; not only do we have the technology and the experience, but also we have some awareness of the range of problems involved in the transformation toward modern water use."

The purpose of the general program is to initiate the surveying and mapping of critical portions of the Senegal River Basin in order to assist the Senegal River Basin Development Authority (OMVS) with the coordinated development of the Basin. The program consists of two phases, the first of which will provide the OMVS with the precise horizontal and vertical networks required to put all mapping in the area on a common system. The second phase will consist of the large-scale mapping of selected sites. The entire survey and mapping project, as proposed by the U.S. Defense Mapping Agency, would cost about \$8 million. Of this amount, \$1.2 million is being proposed here for funding from the \$5 million provided especially by the Congress for the African Development Program. AFR/SFWA is proposing to fund the remaining \$6.8 million from regular program funds or the Sahel Development Program if approved, via the PID-PP process. The additional activities have already been reviewed and approved at the PID stage for the next stage of design work.

The project's first phase will establish precise horizontal control by means of a precise geodetic traverse connected to the so-called 12th parallel survey at Kayes, Mali, passing through the Senegal River Valley to the vicinity of Rosso, Mauritania before turning south and rejoining the 12th parallel survey near Thies (which lies about 40 kilometers east of Dakar). At the same time vertical control will be established by carrying out basic first order levelling. This establishment of proper horizontal and vertical control is necessary because the currently existing horizontal and vertical networks do not meet the required standards and are not based on a common datum. The only existing horizontal control - in the area is the net established by the French National Geographic Institute (IGN) over 20 years ago from astronomical observations. This net was an expedient just adequate for 1:200,000 scale maps but is not reliable for large-scale mapping. Horizontal distance is important for linking two originally separate sites as for example in designing an irrigation canal linking a reservoir with crop production sites. Precise vertical control is required to establish relative vertical position of all points which is essential to project planning, some of which will include gravity irrigation.

These first phase activities will support the second phase activity which includes the aerial photography and preparation of the maps. The photography will include the Senegal River Flood Plain including the Faleme, Bafing and Bakoye tributaries at a scale of 1:50,000 in order to provide basin development planners with information on such topics as navigation, forestry, positioning of levees and dams, identification of types of

crops, diseased or dead vegetation, areas subject to flooding, and other relevant studies. Beginning after the photography is completed will be the surveys for mapping control which tie the photographs into the vertical and horizontal control.

The aerial photography will also provide for the mapping at a scale of 1:10,000 of the following ten sites within the Basin: (1) Aftout es Sahel, (2) Rosso (Lac R'Kiz) (3) Podor, (4) Bogue, (5) Salde, (6) Kaedi, (7) Matam, (8) Bakel, (9) Karakoro, (10) Kayes.

Because of the high priority placed by the OMVS on establishing horizontal and vertical networks, we are requesting \$1.2 million in this memorandum to fund a portion of the first phase. Because of the nature of ground control work, the project's first phase, based on the availability of funding, can be logically divided into complete packages. Therefore we are proposing that the \$1.2 million be used to establish a series of benchmarks (vertical control points) across the valley floor from Kayes to St. Louis, Senegal and a series of triangulation stations (horizontal control points) from Kayes to the vicinity of Kaedi, Mauritania. This network can be drawn upon immediately for application to the development projects now being considered by the OMVS in conjunction with the United States and other donors. The data generated will have measurable impact and could stand by itself even if no additional funds were forthcoming. Technical and physical resources for this portion will include equipment and commodities as well as such personnel as surveyors and related technicians and laborers required for identifying and marking natural benchmarks, constructing new ones, and making observations.

A budget based on the Defense Mapping Report is as follows (\$000):

1. Vertical Control		<u>381</u>
Expatriate Personnel	150	
Commodities	92	
Other Costs (local labor and construction material and operating costs)	139	
2. Horizontal Control		<u>764</u>
Expatriate Personnel	339	
Commodities	241	
Other Costs (local labor and construction material and operating costs)	184	
3. Contract Inspection		<u>55</u>
	Total	<u><u>1,200</u></u>

The funds will be obligated by a grant agreement with the OMVS. Thereafter, arrangements will be concluded to implement the project with the help of the U.S. Defense Mapping Agency or the Bureau of Reclamation of the U.S. Department of the Interior. It is currently planned to conduct most of the program with private U.S. contractors; therefore these agencies will assist AID and the OMVS with the writing of contract specifications and the evaluation and selection of contractors as well as the monitoring and evaluation of contractor performance.

It will be pointed out to the contractors that Landsat imagery of the Senegal River Basin is available from the EROS Data Center in the United States and at the OMVS Documentation Center in St. Louis, Senegal. While Landsat imagery does not have the resolution nor contain the topographic data needed for large scale irrigation project mapping, it still has several potential uses in a project such as this. The contractors will be informed that they should consider the application of Landsat imagery to cartography and resource inventories.

It is likely that there will be a requirement for local procurement of services as well as for an increase of the per transaction limit on shelf items in order to most effectively conduct the study. However, we believe that any request to you for an authorization regarding these requirements should wait until we have the details provided by the selected contractor.

With regard to the contractors we believe that we would attract the best-qualified contractors if these contractors knew about AID's entire \$8 million survey and mapping program. We also believe that the submission of proposals for the entire program would significantly strengthen the results by ensuring that the main components of such a program - ground control, aerial photography, and map preparation - were conducted as an integrated effort rather than by three disparate companies possibly producing results which did not dovetail properly with the various components. Therefore we propose to inform possible contractors that we are considering a major survey and mapping program in the Senegal River Basin and that we would like integrated proposals for the whole program, based on the report prepared for AID by the Defense Mapping Agency in consultation with the OMVS. We would make it clear to the contractors that only a certain portion - that for which we are requesting the \$1.2 million here - is going to be let immediately, but that the possibility of subsequent funding exists. It would be made clear that any additional contracting would be dependent on AID programming decisions, the approval of the project design, and the availability of funds from the U.S. Congress.

Recommendation: That you approve the use of \$1.2 million to fund the first portion of the OMVS Basin Survey and Mapping Program as described above and that you approve our proposal to seek integrated proposals for the whole \$8 million program as described above,

Approve *Paul Steward*

Disapprove _____

Date 8/30/76

EP
Drafter: AFR/SFWA: HGray:8/19/76:baa

- Clearances: AFR/SFWA: IRosenthal *(draft)* *IF*
- AFR/SFWA: DBaker *sk*
- AFR/DR: JKelly *EP* *FM*
- AFR/DP: EDonoghue *ED*
- GC/AFR: STisa *Set*
- SER/ENGR: LMastrofini *(draft)* *IF*
-
- TA/OST: MConitz *(draft)* *IF*
-
- AA/PPC: AShakow *(draft)* *IF*

Subject: Africa

RM

Murphy (folder)
Parker (logs)

File Mapping

AUG 30 1975

INFORMATION MEMORANDUM FOR THE DEPUTY ADMINISTRATOR

THRU: ES

FROM: AA/AERY *Stanley Scott*

SUBJECT: The OMVS Basin Survey and Mapping Program

This is to advise you that I intend to approve the use of \$1.2 million from the \$5 million provided especially by the Congress for the African Development Program, Section 494 B of the Foreign Assistance Act, to fund the first portion of the Basin Survey and Mapping Program being implemented with the Senegal River Basin Development Authority (OMVS), as described in the attached memorandum. The entire survey and mapping project, as proposed by the U.S. Defense Mapping Agency, would cost about \$8 million, with the remaining \$6.8 million proposed to come from regular program funds, or the Sahel Development Program if approved, via the PJD-PP process.

Because of the nature of the ground control work being proposed in the project, this work, based on the availability of funding, can be logically divided into complete packages. For instance the first portion, being financed with the \$1.2 million, will provide a network of control points establishing, between given geographical points, exact horizontal distance, as well as their difference in altitude. The horizontal distance is important for linking two originally separate sites as for example in designing an irrigation canal linking a reservoir with crop production sites. Vertical differences are important for determining potential gravity-flow irrigation sites. Completion of this surveying will result in sizable economies in later works and would have the major advantage of providing all construction sites with systems which have general applicability. This network can be drawn upon immediately for application to the development projects now being considered by the OMVS in conjunction with the United States and other donors. The data generated will have measurable impact and could stand by itself even if no additional funds were forthcoming. Included within the additional \$6.8 million component of the proposed program is the extension of the ground control work to additional areas of the basin. The additional funding also includes the photography and map-making. It is therefore with the full \$8 million program that development of the Senegal River Basin will achieve maximum benefit from this activity.

Because the components - ground control, aerial photography, and map preparation - are seen as integral parts of a general surveying and mapping program, and in order to attract the best-qualified contractors, we propose to inform possible contractors of the entire survey and mapping program. We also believe that the submission of proposals for the entire program would significantly strengthen the results by ensuring that the main components of such a program were conducted as an integrated effort rather than by three disparate companies possibly producing results which did not dovetail properly with the various components. Therefore we propose to inform possible contractors that we are considering a major survey and mapping program in the Senegal River Basin and that we would like integrated proposals for the whole program, based on the report prepared for AID by the Defense Mapping Agency in consultation with the OMVS. We would make it clear to the contractors that only a certain portion - that for which I intend to approve \$1.2 million - is going to be let immediately, but that the possibility of subsequent funding exists. It will be made clear that any additional contracting would be dependent on the approval of the project design, AID programming decisions, and the availability of funds from the U.S. Congress.

Clearances: AFR/SFWA, DShear MS
AFR/DR, JKelly JK
AFR/DP, CWard CW
GC/AFR, STisa ST
ENGR/OPNS, LMastrofina (Draft) LS
AA/PPC:ASHakow (draft) AS
TA/OST, MConitz (Draft) MC

HP
Drafter: HGray:AFR/SFWA:8/17/76:baa

AGENCY FOR INTERNATIONAL DEVELOPMENT PROJECT IDENTIFICATION DOCUMENT FACESHEET <i>To Be Completed By Originating Office</i>				1. TRANSACTION CODE A Add C Change D Delete <input checked="" type="checkbox"/> A		PID 2 DOCUMENT CODE 1																						
3. COUNTRY, ENTITY OMVS - Senegal River Basin				4. DOCUMENT REVISION NUMBER <input type="checkbox"/>																								
5. PROJECT NUMBER (7 digits) <input type="checkbox"/> 628-0504 <input type="checkbox"/>		6. BUREAU/OFFICE A. Symbol AFR B. Code <input type="checkbox"/> 1 <input type="checkbox"/>		7. PROJECT TITLE (maximum 40 characters) <input type="checkbox"/> OMVS Basin Survey and Mapping Program <input type="checkbox"/>																								
8. PROPOSED NEXT DOCUMENT A. <input type="checkbox"/> 3 2 = PRP 3 = PP B. DATE MM YY <input type="checkbox"/> 05 <input type="checkbox"/> 77				10. ESTIMATED COSTS (\$000 or equivalent, \$1 = 220 CFA)																								
9. ESTIMATED FY OF AUTHORIZATION/OBLIGATION a. INITIAL FY <input type="checkbox"/> 78 <input type="checkbox"/> b. FINAL FY <input type="checkbox"/> 80 <input type="checkbox"/>				<table border="1"> <thead> <tr> <th colspan="2">FUNDING SOURCE</th> <th>Life of Project</th> </tr> </thead> <tbody> <tr> <td>a. AID-Appropriated</td> <td></td> <td>6,500</td> </tr> <tr> <td>b. OTHER</td> <td>1</td> <td></td> </tr> <tr> <td>U.S.</td> <td>2</td> <td></td> </tr> <tr> <td>c. Host Country</td> <td></td> <td>200</td> </tr> <tr> <td>d. Other Donor(s)</td> <td></td> <td></td> </tr> <tr> <td colspan="2">TOTAL</td> <td>6,700</td> </tr> </tbody> </table>				FUNDING SOURCE		Life of Project	a. AID-Appropriated		6,500	b. OTHER	1		U.S.	2		c. Host Country		200	d. Other Donor(s)			TOTAL		6,700
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c. Host Country		200																										
d. Other Donor(s)																												
TOTAL		6,700																										
II. PROPOSED BUDGET AID APPROPRIATED FUNDS (\$000)																												
A. APPROPRIATION	B. PRIMARY PURPOSE CODE	PRIMARY TECH CODE		E. FIRST FY 1978		LIFE OF PROJECT																						
		C. Grant	D. Loan	F. Grant	G. Loan	H. Grant	I. Loan																					
(1) FN	B 183	051		3,920		6,500																						
(2)																												
(3)																												
(4)																												
TOTAL				3,920		6,500																						
12. SECONDARY TECHNICAL CODES (maximum six codes of three positions each)																												
876		190																										
13. SPECIAL CONCERNS CODES (maximum six codes of four positions each)						14. SECONDARY PURPOSE CODE																						
BR		BS																										
15. PROJECT GOAL (maximum 240 characters) <input type="checkbox"/> To achieve increased agricultural production and a higher, more secure standard of living for the inhabitants of the Senegal River Basin, while protecting the Basin from further environmental deterioration. <input type="checkbox"/>																												
16. PROJECT PURPOSE (maximum 480 characters) <input type="checkbox"/> To complete the surveying and mapping of critical portions of the Senegal River Basin in order to assist the OMVS with the coordinated development of the Basin. <input type="checkbox"/>																												
17. PLANNING RESOURCE REQUIREMENTS (staff/funds) Due to the information-gathering nature of this activity, planning should move to the PP stage, which would require several mapping experts from DMA or BuRec and an AID project design officer, all for one month in Washington at a cost of \$15,000.																												
18. ORIGINATING OFFICE CLEARANCE						19. Date Document Received in AID/W, or for AIO/W Documents, Date of Distribution																						
Signature <i>Henry J. [unclear]</i>																												
Title OMVS Coordinator				Date Signed MM DD YY <input type="checkbox"/> 06 <input type="checkbox"/> 23 <input type="checkbox"/> 76		MM DD YY <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>																						

PROJECT IDENTIFICATION DOCUMENT: (PID)
OMVS BASIN SURVEY AND MAPPING PROGRAM

I. The Problem and the Proposed Response

A. The Problem

In order to meet the Congressional mandate "to develop a long term comprehensive development program for the Sahel", priority attention must be given to the need for basic resource data in the various river basins. The planning of irrigation, drainage and flood control projects, which will be a very important part of long term Sahelian area development, can only be done on a sound basis attractive to donors and investors when adequate information exists on topography, suitability of land for farming, water supply, susceptibility to flooding, other physical resources and human and economic resources. This comprehensive planning is specifically required for AID projects both by logic and by Section 101 of our appropriations legislation. Therefore, basin-wide and regional master plans identifying potential projects need to be prepared. Experience has shown that contour maps to a scale of 1:10,000 or 1:20,000 are generally needed to identify irrigable lands and to make feasibility designs and estimates for alternative projects. Lacking such maps, individual projects might be built which would later prove incompatible with effective development of the river basin.

In order to achieve such development planning for the Senegal River Basin, new surveying and mapping are required. Existing maps of the area are small scale (1:50,000 and smaller), lacking in detail, and incomplete in their coverage of the areas where, according to the Indicative Basin Plan, major developments will occur. Existing surveys in the basin are not, in many cases, related to a common horizontal or vertical reference point. This lack of adequate topographic information, if not corrected, will lead to more costly and less satisfactory projects within the basin. In fact, in the absence of better topographic information, some potentially feasible gravity irrigation projects may not be identified, and some development may occur which is incompatible with optimum resource use.

The CWR DAP Overview (page 101) states, "... it is appropriate that the U.S. should be involved in (river basin development) as part of a continuing interest in the (Sahel) Region," and notes that "water resource development and irrigated farming are major areas of U.S. expertise; not only do we have the technology and the experience, but also we have some awareness of the range of problems involved in the transformation toward modern water use."

B. Proposed Response

1. Project Purpose

The purpose of this project is to complete the surveying and mapping of critical portions of the Senegal River Basin in order to assist the OMVS with the coordinated development of the Basin. This project consists of two phases, the first of which will provide the OMVS with the precise horizontal and vertical

networks required to put all mapping in the area on a common system. The second phase will consist of the large-scale mapping of selected sites and 1:50,000 scale photography of the entire basin area including Faleme, Bafing and Bakoye/tributaries. The project activities being presented in this PID are expected to be the continuation of activities which have been proposed for funding under separate funds provided especially for the Sahel by the Congress.

2. Project Details

a. Projects Outputs

The Project's first phase will establish precise horizontal control by means of a precise geodetic traverse connected to the 12th parallel at Kayes, Mali, passing through the Senegal River Valley to the vicinity of Rosso, Mauritania before turning south and rejoining the 12th parallel near Thies (which lies about 40 kilometers east of Dakar). At the same time vertical control will be established by carrying out basic first order levelling. This establishment of proper horizontal and vertical control is necessary because the currently existing horizontal and vertical networks do not meet the required standards and are not based on a common datum. The only existing horizontal control in the area is the net of astronomical stations established by the French National Geographic Institute (IGN) over 20 years ago for 1:200,000 scale maps. This net was an expedient just adequate for that scale but is not reliable for large-scale mapping. Precise vertical control is required because gravity-powered irrigation is planned for several regions in the Basin.

These first phase activities will support the second phase activity which includes the aerial photography and preparation of the maps. The photography will include the entire Basin from the Delta to Kayes at a scale of 1:50,000 in order to provide basin development planners with information on such topics as navigation, forestry, positioning of levees and dams, identification of types of crops, diseased or dead vegetation areas subject to flooding, and other relevant studies. Beginning after the photography is completed will be the surveys for mapping control which tie the photographs into the vertical and horizontal control.

The aerial photography will also provide for the mapping at a scale of 1:10,000 of the following ten sites within the Basin: (1) Aftout es Sahel, (2) Rosso (Lac R'Kiz), (3) Podor, (4) Bogue, (5) Salde, (6) Kaedi, (7) Matam, (8) Bakel, (9) Karakoro, (10) Kayes. (See attached Maps for details).

b. Technical and Physical Resources for the first phase horizontal and vertical control networks will include equipment and commodities as well as such personnel as surveyors and related technicians and laborers required for identifying and marking natural benchmarks, constructing new ones, and making

.../...

observations. These same resources will conduct the mapping control surveys to be conducted once the second phase aerial photography is completed. The second phase aerial photography and map preparation will include film, airplanes, pilots and support personnel and also the personnel and support services required to make the maps.

c. Disbursements during the early phases of the project will bunch up each year as a result of the seven month working period between rainy seasons. Once map preparation gets underway, disbursements are expected to occur on a more regular basis.

3. Major Assumptions

It is assumed that weather conditions will remain "normal" and will not adversely affect the implementation or results of the program.

4. Host Country and Other Donor Activities

There is no host country surveying and mapping of the Senegal River Basin in the scale required for proper development. Individual activity sites and surrounding areas, such as the Diama and Manantali Dam sites, will be mapped by the Other Donors conducting the pertinent engineering studies on those projects, and for that reason these sites have not been included for the detailed mapping indicated on the attached maps.

5. Project Alternatives

There is no sensible alternative to conducting a survey and mapping program. However the implementation of such a program could be done solely with U.S. support, as proposed in this PID, or could be done in conjunction with one or more Other Donors. Perhaps this alternative should be explored before the PP stage.

6. Project Beneficiaries

Project beneficiaries will ultimately be the Senegal River Basins approximately 1.6 million inhabitants who will share in the results of basin development activities which have been better planned and coordinated as a result of this proposed activity.

7. Spread Effect

The proposed activity is designed for Basin-wide impact, with all Senegal River Basin inhabitants in mind. However, as a result of the activity, other River and lake basins not yet possessing such a data base may be more interested in doing so.

II. Financial Requirements and Plans

A. The entire project as proposed in draft by the U.S. Defense Mapping Agency Topographic Command would cost about \$7.7 million. A.I.D. is proposing to fund \$1.2 million of the project's initial costs with funds appropriated especially by the U.S. Congress for the Sahel. This will allow project activities

to begin in FY 1977. The details are presented elsewhere. The remaining \$6.5 million being proposed here will cover seven years (1978-1984) and is broken down as follows (\$000):

1. Vertical control (funded within the \$1,200)

2. Horizontal control (partially funded within the (\$1,200)

Technical Assistance	\$550
Commodities	400
Other Costs	320
	<u>\$1,270</u>

3. Mapping Control

Technical Assistance	\$1,300
Other Costs	1,350
	<u>\$2,650</u>

4. Aerial Photography and Map preparation

Technical Assistance	\$ 100
Commodities	2,030
Other Costs	450
	<u>\$2,580</u>

TOTAL	<u>\$6,500</u>
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B. A.I.D. provision of the \$6.5 million is expected to be entirely in the form of a Technical Assistance Grant.

C. The OMVS is expected to provide the equivalent of \$200,000 of local cost expenditures and in-kind services. This is obviously not expected to total 25 percent of total project costs but this does not pose any legislative problems since the assistance is being provided through the OMVS, a regional organization.

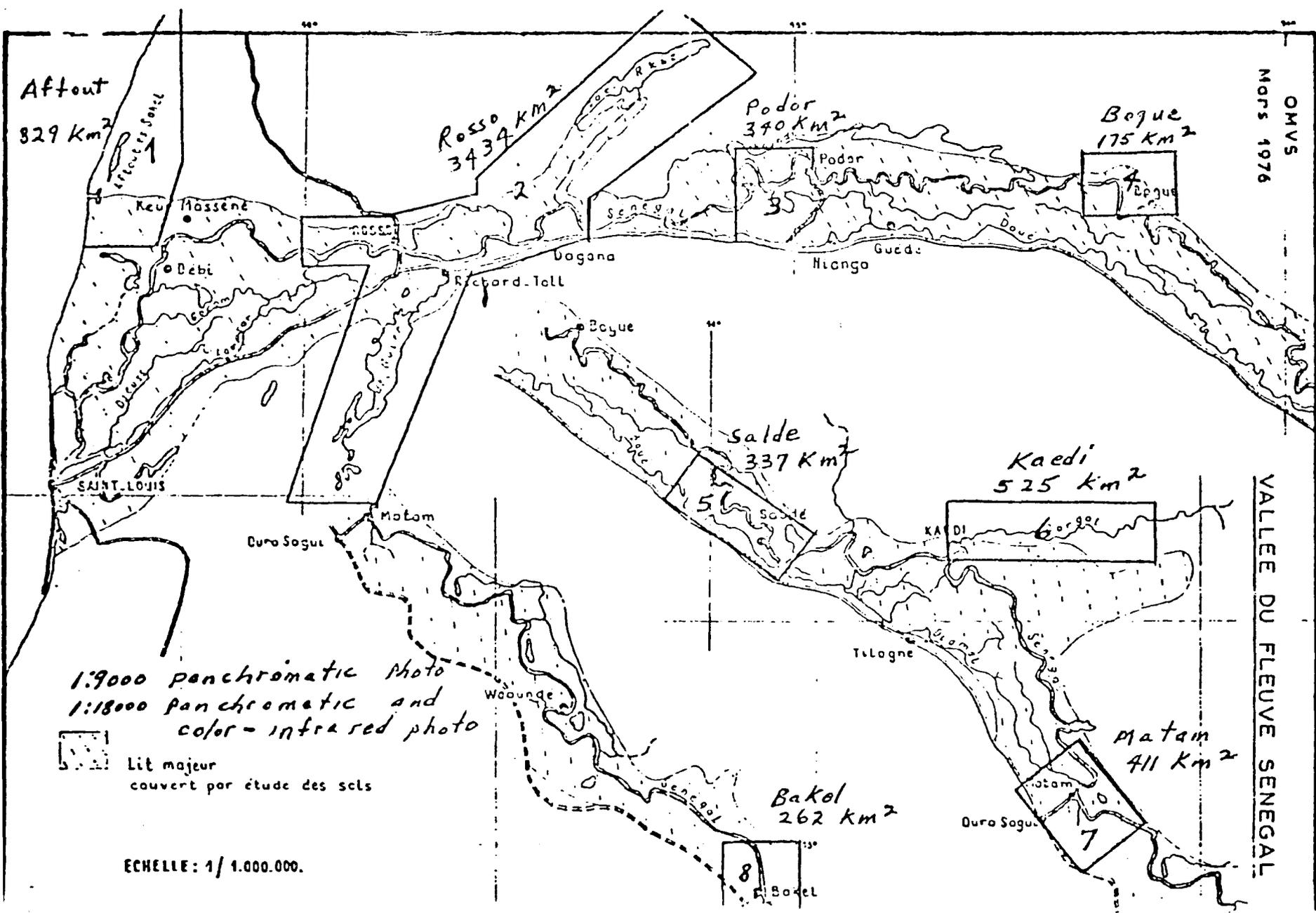
III. Project Development

Since this is basically a project to gather information rather than to build an institution or train local people, it is suggested that project development move to the PP stage. PP preparation may be accomplished best after the initial results are available from the activities funded by the special Congressional funds for the Sahel. The PP therefore could probably be ready by May 1977 and require a design team of several mapping experts and a Project Design Officer/Team Leader all of whom could probably do their work in Washington with a month's effort.

IV. Issues

A. Project obligations are expected to run from FY 1978 through FY 1984. These seven years exceed A.I.D.'s 5-year policy but since this is a project to gather information rather than to build an institution or train local people, it seems reasonable to seek a waiver of the 5-year limitation. Alternatively, this project does have separate activities and could therefore be tranced, but it still makes more sense to go for the full seven-year approval.

B. Should the United States conduct this project alone or should we seek Other-Donor participation? This question could be especially important if the Senegal-based French National Geographic Institute (IGN) were the most logical candidate to implement much of the project, yet we might not want to use U.S. dollars to fund their participation. In this case, we might want to seek French or Other-Donor participation.



1:9000 panchromatic photo
1:18000 panchromatic and color-infrared photo

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APPROVED BY AFR/SFWA: OSHEAR

AFR/DR: JHEARD

AFR/DP: EDONOGHUE

PPC/DPRE: HSHARLACH

SER/ENGR: LMASTROFINI

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AMEMBASSY NOUAKCHOTT

AMEMBASSY ABIDJAN

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AIDAC, DAKAR FOR OMVS COORD.

E.O. 11652: N/A

TAGS:

SUBJECT: PID REVIEW RESULTS: OMVS BASIN GEODETIC SURVEY AND MAPPING

SUBJECT PID WAS REVIEWED BY PROJECT COMMITTEE ON JULY 15, 1976 AND DURING ABS REVIEW ON JULY 23, 1976, AND WAS APPROVED FOR DEVELOPMENT OF FINAL PROJECT DESIGN (PP). PROJECT PURPOSE IS TO COMPLETE SURVEYING AND MAPPING OF CRITICAL PORTIONS OF SENEGAL RIVER BASIN IN ORDER TO ASSIST OMVS WITH COORDINATED DEVELOPMENT OF BASIN. DISCUSSION INCLUDED FOLLOWING POINTS:

(A) PROJECT DESIGN SHOULD INCLUDE ANALYSIS POSSIBLE USAGE

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OF SATELLITE IMAGERY.

(B) MANNER OF IMPLEMENTATION NEEDS CLEAR DEFINITION.

(C) COO MAURITANIA REQUESTS THAT AERIAL PHOTOGRAPHY OF SELIBABY AREA BE INCLUDED IN SUBJECT PROJECT.

(D) EVALUATIONS OF SIMILAR AID CADASTRAL STUDIES SHOULD BE EXAMINED DURING PROJECT DESIGN.

(E) PROJECT MEETS PROPOSED CRITERIA FOR SAHEL DEVELOPMENT PROGRAM (SDP) FUNDING.

(F) IT WAS SUGGESTED THIS ACTIVITY BE INTEGRATED WITH TWO ABS-PROPOSED WATER DATA COLLECTION ACTIVITIES INTO ONE PROJECT. ROBINSON

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EXCERPT

AFR/SFWA: HAROLD GRAY:BAA
08/17/76: EXT. 27016
AA/AFR: SSCOTT

AFR/SFWA: DBAKER
AFR/SFWA: DSHEAR
AFR/DR: SKLEIN
GC/AFR: STISA {INFO}

AFR/SFWA: IROSENTHAL
AFR/DRP CUARD
DAA/AFR: WHNORTH
PPC/DPRE: RBOBEL

DAKAR, BAMAKO, NOUAKCHOTT, ABIDJAN

AIDAC, DAKAR FOR RDO AND OMVS COORD.

E.O. 11652: N/A

TAGS:

SUBJECT: SUMMARY OF THE OMVS FY 1978 ABS REVIEW

REFERENCES: {A} OMVS FY 1978 ABS DATED JUNE 1976, {B} ISSUES PAPER FOR JULY 20, 1976 REVIEW, {C} INDIVIDUAL PID REVIEW CABLES

1. FOLLOWING SUMMARIZES SENEGAL RIVER BASIN DEVELOPMENT AUTHORITY {OMVS} ANNUAL BUDGET SUBMISSION {ABS} REVIEW OF JULY 20, 1976. THESE POINTS MAY BE BEST UNDERSTOOD IF READ IN CONJUNCTION WITH ISSUES PAPER {BEING POUCHED} WHICH SERVED AS AGENDA FOR REVIEW.

2. PROGRAM ISSUE RESULTS -

A. PROPOSED CHANGE IN DAP STRATEGY. AID'S OMVS PROGRAM IS PROPOSING TO CONCENTRATE IN THREE AREAS OF {1} STUDIES TO GENERATE BASIC TECHNICAL DATA ESSENTIAL FOR PROPER PROJECT PLANNING AND DESIGN; {2} INSTITUTIONAL DEVELOPMENT OF OMVS SECRETARIAT AND OTHER BASIN-RELATED ORGANIZATIONS; {3} AGRICULTURAL PRODUCTION AND SUPPORTING INFRASTRUCTURAL DEVELOPMENT. IT WAS AGREED, REGARDING ITEM 3 ABOVE, THAT U.S. SUPPORT FOR PROJECTS LIKE MANANTALI MIGHT BE OUTSIDE CONGRESSIONAL MANDATE AND THAT THEREFORE THIS WOULD BE EXPLORED IN INFORMAL DISCUSSIONS WITH THE CONGRESS IN CONTEXT OF SAHEL DEVELOPMENT PROGRAM {SDP}.

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F. BASIN GEODETIC SURVEY AND MAPPING -

{1} IT WAS NOTED THIS ACTIVITY IS CONSISTENT WITH SDP INFORMATION TRANSMITTED TO THE CONGRESS IN WHICH WE STATED NEED FOR FIVE TO TEN YEARS OF STUDIES FOR PROPER DEVELOPMENT OF SAHEL.

{2} THERE WERE NO PROBLEMS RAISED WHEN IT WAS PROPOSED TO MOVE FROM THE PID TO THE PP. THIS ACTIVITY IS BASICALLY DATA-GATHERING RATHER THAN INSTITUTION-BUILDING SO THAT THE PRP STAGE IS NOT NECESSARY.

G. HEALTH RESEARCH PROGRAM -

{1} THERE WAS SOME CONCERN THAT THIS MIGHT DUPLICATE SOME HEALTH ACTIVITIES IN OTHER PARTS OF AFRICA, BUT IT WAS AGREED THAT WE STILL NEEDED TO CONDUCT SUCH A PROGRAM SINCE IT WOULD BE DESIGNED SPECIFICALLY TO LOOK AT THE EFFECTS OF RIVER DEVELOPMENT ON THE HEALTH OF THE POPULATION OF THE SENEGAL RIVER BASIN. 44



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APPROVED BY AFR/SFWA: DSHEAR

AFR/SFWA: HPETREQUIN

AFR/SFWA: IROSENTHAL

AFR/DRI: JKELLY

SER/ENGR/OPNS: LMASTROFINI (DRAFT)

PPC/DPRE: RBOBEL

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INFO AMEMBASSY BAMAKO

AMEMBASSY NOUAKCHOTT

AMEMBASSY ABIDJAN

UNCLAS STATE 233935

AIDAC, DAKAR FOR OMVS COORDINATOR

E.O. 11652: N/A

TAGS:

SUBJECT: OMVS BASIN SURVEY AND MAPPING PROGRAM DESIGN TEAM

REFERENCES: (A) STATE 190958, (B) STATE 226471

1. SUBJECT PROJECT IS NOW BEING TREATED AS SEPARATE ACTIVITY FROM SENEGAL BASIN WATER DATA COLLECTION PROJECT, WHICH IS SUBJECT OF SEPTTEL. SEPARATION ARISES FROM SIGNIFICANT DIFFERENCES IN PROJECT IMPLEMENTATION AS WELL AS THE CONSIDERABLE FUNDING INVOLVED.

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2. ACTIONS NOW REQUIRED TO IMPLEMENT PROGRAM BEGIN WITH
RESOLUTION OF CONTROLLING LANGUAGE ISSUE. A TEAM OF
EXPERTS WILL THEN BE RECRUITED, POSSIBLY FROM THE DEFENSE
MAPPING AGENCY (DMA), TO DEVELOP THE SPECIFICATIONS, IN
COORDINATION WITH THE OMVS, FOR THE FULL SURVEY AND
MAPPING PROGRAM TO BE ADVERTIZED IN THE COMMERCE BUSINESS
DAILY. THIS TEAM WILL ALSO BE CHARGED WITH PREPARING
WHATEVER DOCUMENTATION IS STILL REQUIRED TO FULFILL PRP/PI
REQUIREMENT FOR PORTION OF PROJECT NOT COVERED IN 8/31/76
GRANT AGREEMENT. FYI: SFWA PROPOSING THAT PROJECT
COMMITTEE/ECPR REVIEW DMA REPORT OF JULY 15, 1976 IN ORDER
TO DETERMINE WHAT ADDITIONAL INFORMATION IS REQUIRED. WILL
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D. The establishment of a real-time flood-warning system.

E. The assessment of ground-water utilization and potential for irrigation development.

Some critical assumptions include the following:

A. Availability of trainees and their extended tenure on the project after receipt of training.

B. Residents will use the information generated by this project to advantageously modify their farming practices.

C. The program will continue to be operated by OMVS and the member countries after the termination of the 5-year project.

D. Water-resources development plans will be implemented using the data generated by this project.

3. A. I. D. and Other Relevant Experience

How much experience A. I. D. has had in projects that are exactly as proposed in this report is not known. It is known that A. I. D. and its cooperators, under PASA agreements, have had considerable experience in the individual facets of this project--i. e., stream-gaging programs, ground-water investigation and development programs, river basin and project planning programs, training and communications systems, and precipitation data-gathering systems. The U. S. Bureau of Reclamation has had vast experience in water-resources development projects from basic-data gathering programs, investigations, planning,

design, and construction on large and small scales in the United States and in many foreign countries. The U. S. Geological Survey is a leader in the field of surface-water and ground-water resources investigations and development programs. The Corps of Engineers and NOAA have established flood-warning systems in the United States. This project is intended to further develop and utilize existing and prior programs, improving and augmenting them to provide accurate and usable data.

From the beginning of this century, different organizations have worked to obtain a better knowledge of the behavior of the Senegal River. At first, the Union Hydroelectrique Africaine (UHEA) and, above all, the MAS (Mission d'Aménagement du Fleuve Senegal) made some experiments forecasting floods; after Independence, the National Services of River States gradually took over this task. Flood gages were installed and observed at several sites including Bakel, Kayes, Ambidedi, Mahina, etc. Both the Senegalese and Malian governments have on-going bilateral programs with the Office de Recherche Scientifiques et Techniques, Outre-Mer (Paris) (ORSTOM) to upgrade and equip selected river gaging stations in the Senegal River basin.

According to the Senegal-Consult Study, although gage-height records and stream-gaging measurements have been made at many stations, only 13 stations have adequate records that can be used as a reliable basis for hydrologic studies.

Ground-water surveys and development programs are currently underway by the Hydraulic Services Agencies of the three member countries. In addition, numerous ground-water surveys have been made and reports prepared by the Bureau de Recherches Geologiques et Minieres (BRGM) as a consulting service to agencies of the three member countries.

The Agence pour la Securite de la Navigation Aerienne-Dakar (ASECNA) performs a weather-forecasting service for aircraft, using meteorological data from the three member countries. The existing climatological network in the upper Senegal River basin consists of:

1. Eleven (11) synoptic stations.
2. Sixteen (16) climatological stations (auxilliary stations).
3. Fifty-one (51) precipitation stations.

In general, most of the synoptic stations have radio real-time reporting facilities.

An extensive Agromet-Hydromet system is being established under the auspices of the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS) throughout the Sahelian area.[†] This system includes several river gaging and precipitation stations in the Senegal River basin.

One of the objectives of the A. I. D. project is to assist OMVS in coordinating the water-resources activities of these different organizations.