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PN-ABZ-837

## FEASIBILITY STUDY OF RECOVERING THREE SUNKEN SHIPS IN THE PORT OF BISSAU

WIKTOR KAPUSCINSKI  
IN COOPERATION  
WITH VLAD M. KACZYNSKI

JUNE 1995  
GUINEA-BISSAU

TIPS REPORT NO. 51E

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March 28, 1996

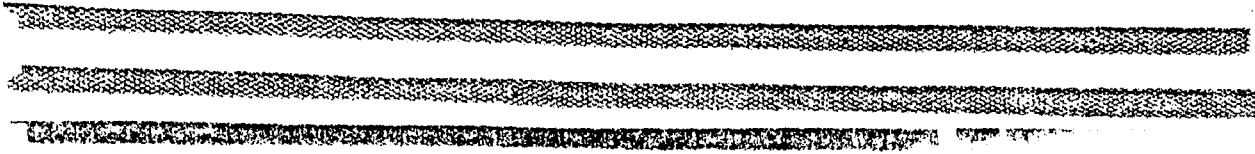
Submitted to USAID  
April 11, 1996

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## Introduction

The port of Bissau is the largest fishing, merchant and passenger traffic center in Guinea-Bissau. More than 90% of all cargo country's movement is concentrated in this port. Shiprepair, vessel support, storage and naval facilities are also located in the same area. The port is conveniently located in the estuary of the River Geba that provides an easy access to important fishing grounds and Bijagos Archipelago in the coastal zone and to provinces in the interior of the country.

The Port of Bissau is composed of three major parts:

- a) Fishing port (Cais) the oldest and initially the main part of the port facility,
- b) Merchant port - built in the end of 1980's with funding of the World Bank,
- c) Passenger, navy and support fleet pier (Pingiguiti).

The fishing and passenger/navy/support fleet facilities can not be used in their full capacity because of a number of wrecks and incapacitated vessels occupying substantial part of the piers. The vessels that are sunken in the port constitute serious navigational danger for all other ships. The estimated length of piers blocked by these abandoned vessels is equal to about 250 meters. This is about 35% of the total length of available mooring capability of the Cais and Pingiguiti ports. All sunken ships constitute substantial obstacle and retain large masses of mud transported by the river. Each wreck contributes to continuing sedimentation and retention of sand in the pier area rendering it unusable by medium-size fishing and merchant ships. The World Bank built merchant port due to intensive sedimentation brought by the tide and river currents during last 3 years lost in average 3 meters of depth. This reduces port's capability to accept national and foreign fishing and larger cargo vessels and - inevitably - forces port authorities to limit traffic and run substantial costs of dragging. In Guinean conditions this task could be done by hiring foreign specialized companies and running very high hard currency expenses that could reach US\$ 1.5 - 2.0 million.

The Government of Guinea-Bissau is highly interested to open the port of Bissau as a safe, cost-effective and efficient international trade, fishing, passenger traffic and marine surveillance base - a key factor determining continued development of the national economy. Removal of sunken ships is, therefore, the most important condition to attain these objectives.

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## I. Project Objectives and Its Socio-Economic Implications

The principal objective of this Project is to remove several sunken ships from the port of Bissau, Republic of Guinea-Bissau thus allowing a safe, efficient and inexpensive use of facilities that are crucial for the present and future development of the country.

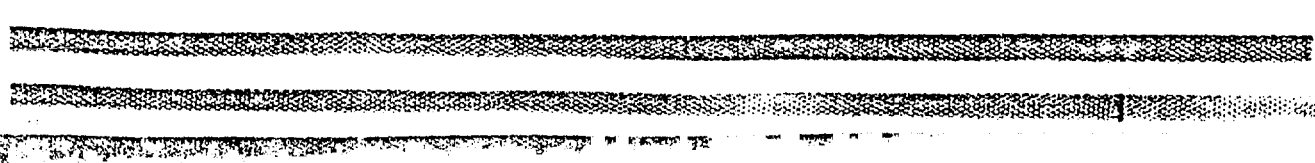
Because of growing number of wrecks in this port, the cargo handling, passenger traffic and fishing operations are severely constrained. The available moorage space is reduced, thus contributing to higher port fees and increasing number of collisions that are also caused by port overcrowding and lower safety standards. Foreign investors, in particular fishing, processing, shiprepair and cargo handling companies are discouraged to bring their capital, technology and know-how. The Government has serious difficulties to secure full protection of its 200 mile Exclusive Economic Zone as the navy/surveillance ships can not be safely operated from the port presently working at 50% of its designed capacity.

The socio-political implications of the long-term wreckage pollution of the only important port of the country are also severe: the local population and foreign interests see the port crisis as a reflection of inefficiency and inability of local authorities to secure vital conditions for expansion of tourism, international trade, private investment in the marine sector and implementation of economic development strategy announced by the newly elected, democratic Government .

## II. Analysis of Present Situation: The Port Authorities' Perspective

This portion of the study is based on studies made previously by the National Directorate of Ports and Marinas lead by Mr. Mario Mendonca, who in close cooperation with authors of this Proposal addressed several important areas of concern for Guinean authorities.

From the point of view of the Bissau Port Authority the recovery of three sunken vessels:



"Djagobel"  
"Lembrance d'Afrique" and  
"Captain Cook"

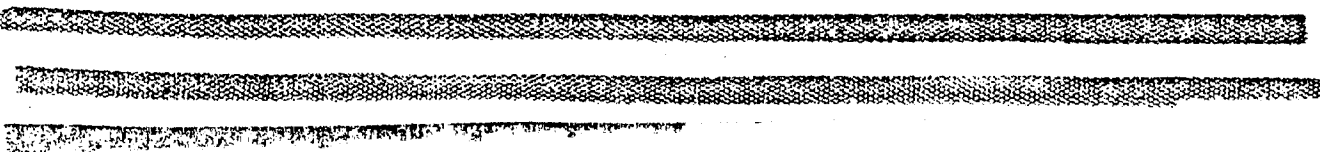
150 GRT fishing vessel,  
750 GRT passenger ferry,  
350 GRT stern trawler

is considered as the most immediate priority. There are many other sunken or half-sunken wrecks that must be removed as soon as possible but the Government has no funds to hire large salvage company stationed in Dakar, Las Palmas or in Europe. The only way to do this job would be using less expensive techniques that could be partially based on equipment and machinery available in Bissau.

According to the Port Authority these and other sunken vessels contribute to the following negative consequences:

- Less space available for moorage,
- High danger of collisions and navigational hazards,
- Obstruction of port traffic,
- Accelerated sedimentation and port shallowing,
- Difficulties in unloading the fish for local consumption,
- Lower interest of foreign investors to bring their capital and technology to Guinea-Bissau,
- Negative socio-political impacts.

On the basis of calculations made by the Port Authority the above mentioned vessels by blocking available commercial space at the Caish and Pingiguiti piers reduce potential port revenues. According to the following Table 1 these revenues, as for June 1995, would be equal to approximately US\$ 850,000:



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Table 1. Port Call and Moorage Fees Lost by the Port Authority  
(as a result of pier occupancy by sunken ships)

Vessel's name	Days sunken	Moorage Fee US\$/foot	Port call Fee US\$/day	TOTAL US\$
Captain Cook	2.625	261.45	40.14	593.830
Lemrance d'Afrique	880	243	23.94	176.180
Djagobel	810	117	7.45	75.735
TOTAL COST:				845.676

Source: Bissau Port Authority, June, 1995

Additional negative implication of the presence of sunken ships in the Port of Bissau is high rate of sedimentation and resulting cost of its removal through dredging. Table 2 indicates that this cost will be equal to approximately US\$ 620.000.

Table 2. Dredging Cost of the Port of Bissau  
( caused by sunken ships)

Area of sedimentation	45.000 sq.m.
Average depth lost by sedimentation	0.55 m
Volume of sand	

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mud deposited in the port	24.750 cu. m.
Dredging fee per 1 cu.m. to be charged by foreign Contractor	US\$ 25.-
<hr/>	
TOTAL DREDGING COST	US\$ 618,750

Source: Bissau Port Authority, June 1995

Increased unloading difficulties, refusal of foreign fishing vessel owners to bring fish to the port of Bissau (as a part of payment for license fees) and abstention of overseas investment capital to finance land processing facilities and support of fishing fleets from Bissau are other, significant losses that national economy must absorb by lack of adequate possibilities to use the port as their transloading and vessel servicing base. Expressed in US\$ value this loss could be at the level of US\$ 5 - 10 mln.

### III. TECHNICAL ASSESSMENT OF THE RECOVERY OPERATION AND ENGINEERING ASPECTS OF THE PROJECT

#### a) *Equipment Transported for the 1st Mission to Bissau - May 21 - June 11, 1995*

To better evaluate the scope of work and equipment necessary to salvage above mentioned wrecks one exploratory mission (1st Mission) was carried out from May 21st to June 11th, 1995. For this mission the following equipment was transported from Seattle, WA by the diving/salvage expert, Mr. Wiktor Kapuscinski:

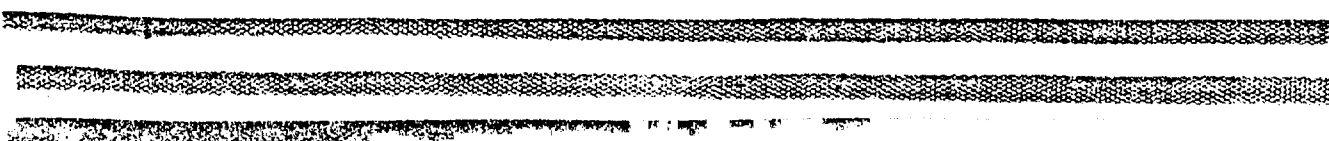


Table 3. Equipment Brought for the 1st (Survey) Mission

Item	Quantity
1 Air Compressor	1
2 Diving suit	1
3 Dry suit hood	2
4 Diving Helmet	1
5 Air hoses ( 180 feet)	180 ft
6 Underwater camera	1
7 Walkie-Talkies(Radio Shack ) Divers' gloves	3 6 pairs
8 Material:	
Hose	6
clamps	
Air filter	2
Yellow	4
tapes	
Teflon	3
tapes	
Octane boost	1
Compressor oil (regular)	1
Compressor oil (synthetic)	1 gal.
Films (Kodak) 35 8 rolls mm	8
Filter	1
carbon	
Tapes, screws, soldering material	(purchase in Bissau)
Other minor inventory items (purch.Bissau)	
Insect repellents	
Packing material (crate, bands, screws, paint, etc.	
Underwat. lamps	2
Batteries	2 kg
9 Pressure regulator	2
10 Coupler (type KI)	1



11	First Aid Kit	1
12	Tool box (wrenches, screwdrivers, etc.)	1
13	Gas tank 1 gallon	1
14	Ballast belt - 35 kg	1

The above listed equipment was used for the survey/appraisal phase of the mission and is presently stored in Bissau for its future use - during recovery operation as planned for II nd and IIIrd Mission.

**b) In-Situ Technical Survey of Three Wrecks (1st Mission)**

According to surface and underwater surveys made recently by our salvage expert Mr. Wiktor Kapuscinski, to prepare removal of three sunken ships ("Djagobel", "Lembrance d'Afrique" and "Captain Cook") from the port of Bissau the following information on the technical and engineering aspects of the Project is presently available:

**1. "DJAGOBEL"**

This vessel must be cut in pieces using chain saws (for wooden hull) that are to be brought from the US, and by oxygen/acetylene torches (for metallic structures) - that in part could be obtained in Bissau by the Port Authorities.

We agreed with the Port Authorities that they will provide with various items, equipment and materials that are specified in the Cost Study (Governmental Contribution) presented to you earlier. Local manpower will be used and it will be trained on the job to secure efficiency and safety of work. Supervision of this work, however, will be ours.



"Diagobel" is resting close to the Customs quay. The vessel is burned-out wreck to be cut and evacuated in pieces.

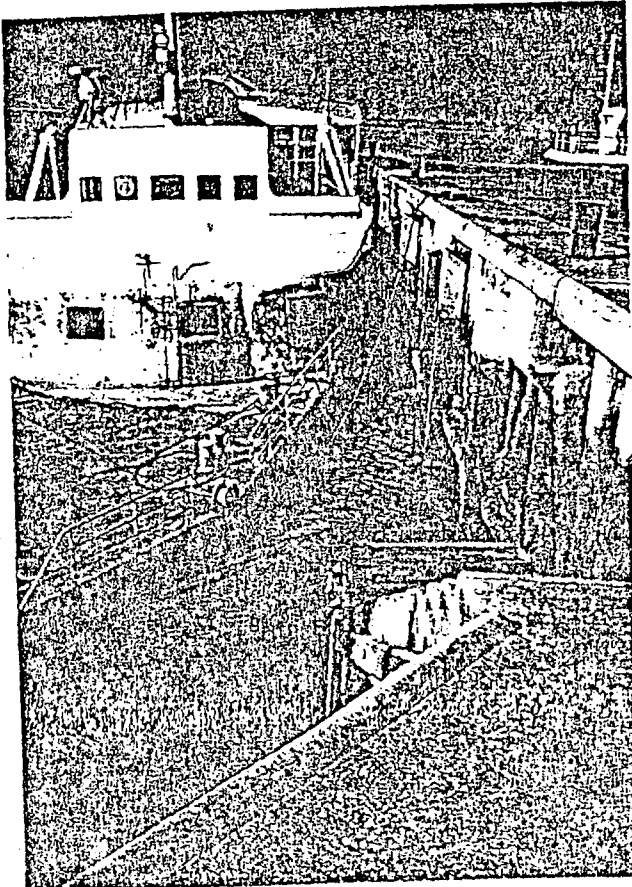
The ship during its cutting process will be part by part removed by the land tractor. All parts will be than evacuated by the Port Authority's trucks to selected place outside of the port or they will be towed on the pontoon and again sunken in an appropriate site.

Cutting process could be finished within 2 weeks, provided the Port Authorities will deliver the equipment and manpower as agreed with them earlier and reconfirmed in the above mentioned Cost Study. We are to write special letter to the Port requesting prior examination and maintenance of all their equipment so it is ready for use during my II and III mission. Cutting and removing "Djagobel" is to be concluded during the II<sup>nd</sup> mission (July - August, 1995).

## 2. "LEMBRANCE D'AFRIQUE"

This vessel can be removed by eliminating all existing openings in the hull below and above of the waterline and evacuation (full or partial) of the sand, mud and water from inside of the ship.

During our diving inspections we found number of ports (for cars), and illuminators opened. Additional holes were found on the bow part of the vessel. Because of complete lack of visibility in the water and heavy sedimentation around the hull, this project is difficult, but not impossible to execute at the very modest cost.



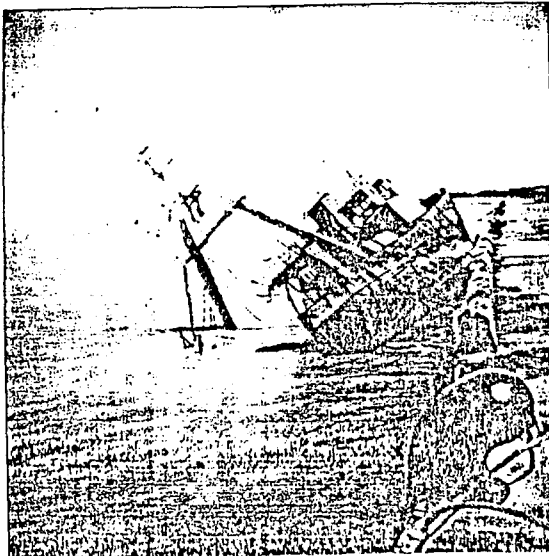
"Lembrance d'Afrique" sunk pulled by "Djagobel" that was tied-up to "Lembrance". "Djagobel" caught fire and went to the bottom of the port about 800 days ago.

"Lembrance d'Afrique" can be removed during our II-nd mission (July - August , 1995) using equipment brought from the United States and heavy machinery to be delivered by the Port Authority - Bissau.

Once the vessel is raised, it will be towed away to the bank of the river in order for the Port to remove propulsion engines and other engine equipment that - after full cleaning and maintenance could - possibly - be used on other ships. The vessel itself could be sold by the Port Authorities as a scrap metal or sunken in site indicated by the Port and/or agreed with environmental organization.

### 3. "CAPTAIN COOK"

This vessel - before its removal - must be put straight on its keel and any holes in the hull that is presently sunken in the mud - should be tapped. Putting the vessel on its keel will require special ejector (some parts from the US but Heavy duty compressor from the local shipyard) to remove sand and mud from underneath of the vessel's bottom. It will be also necessary to use the tug (promised by the Port Authority). Once the vessel is straight we will try to make it watertight (underwater soldering and cement work) and raise using tidal water level differences and high yield water/mud pump to be brought by me from the U.S. Since this vessel is sunken at least 6 years in the pier of Pingiguiti port, it is quite rusted over the water line but its underwater part of the hull could be repaired using simple and not expensive methods. We are planning to finish recovery of this ship during the IIIrd mission (August - September 1995 or several weeks later).



After her arrest for fishing violation that caused very high penalty, the French ship "Captain Cook" was sunk - as people say - by the crew that opened kingston valves and water entered into the hull.

**b) Necessary Equipment for the IInd and III Mission  
and Additional Diver/Salvage Specialist**

**1. Equipment and Materials of Foreign Origin**

To secure successful and low cost salvage operation in Bissau it is necessary to use equipment and materials brought from overseas and this available in Guinea-Bissau. Only the most vital and unavailable locally equipment is to be transported from the US. It is composed of:

Table 4. Overseas Salvage Equipment

High yield water pump and hoses	1 set
Underwater ejector and hoses	1 set
Diver's telephones	2
Underwater welding handle	1
Underwater welding electrodes	60
Motor saws (2 pieces)	2
Walkie-Talkie (large range)	6 sets
Skin diving compressor	1
Other skin diving equipment and couplings	1 set
Miscellaneous equipment and materials	35 kg

All sunken ships in Bissau have fuel, oil, freon and ammonia and other pollutants (decomposed matter) plus they are loaded with a mud brought by the river and tidal currents. This makes any underwater work (inspection, repair, manipulation with vessel's parts) very difficult and requires high skills to avoid any health risk. To reduce this risk the diving expert must use reliable and well known for him diving equipment especially chosen for the Bissau's environment.

We already invested quite a lot of time making research on technical data and other particulars of each ship using documents of various classification societies (Lloyd's Register of Shipping, German Lloyd, etc.) that can help in obtaining info on construction of each vessel and location of all vital components (holds, bottom valves, ship ports, piping, etc.) that now are under water or covered with the mud.

## 2) Contribution of the Port Authority to the Project

During conversations held in May 1995 with Mr. Mario Mendonca - National Director of Ports and Marinas and with the Captain of the Port of Bissau, Mr. Carlos Silva, Port Authorities declared their readiness to provide with the heavy equipment and some materials to facilitate the operation and support it with local manpower. The following is the equipment and other inputs the Port Authority is to deliver in the moment of salvage during our planned II and III missions:

Table 4. CONTRIBUTION OF THE GUINEAN GOVERNMENT  
(PORT AUTHORITIES) TO THE SHIP RECOVERY  
PROJECT

1. RENTAL OF THE HEAVY EQUIPMENT:		Days available for the Project
Equipment or	Materials	
Heavy duty air compressor		60
High Power Welding Machine		60
500 Ampers)		
Utility boat		40
Storage and security		60
Self propelled crane 5t		40
Pontoon		
Tug		22
Land truck		30
Heavy duty tractor		30
2. MATERIALS		
	Sheet metal	
	Steel Ropes	
	(100 m)	
	Torches	
	Hoses	
	Oxygen	
	Acetylen	
	Fittings	

Fittings  
TOTAL

3. MANPOWER (Five workers) 60

Source: Conversation with Mr. Mario Mendonca May 28th, 1995.

This equipment must be checked and re-confirmed soon before the start of the II and III mission in order to avoid any delays caused by its possible malfunction or unavailability. Workers that are to be used for cutting "Djagobel" will be trained in use of the equipment from overseas. We will write a letter to the Port indicating what should be done to secure smooth recovery work.

### **3) Additional Diver/Salvage Specialist**

During the recovery operations (Mission I and II) it is necessary that two divers/salvage experts are involved at the same time in diving and salvage work in order to secure safety of the human life, more effective submarine work (welding, cementing, inspection of closed areas inside of the vessels, supervision of the air compressors, communications and other related activities). We will sub-contract one certified diver with equipment so he will be able to come to Bissau with Mr. Kapuscinski.

### **4) Timing of the Salvage Operations**

Since the second diver/salvage specialist can come for the II<sup>nd</sup> mission only between the July 1 until July 23 (he has many other commitments including one month in the US Navy) our preference is to organize the recovery work as follows:

- 1) II Mission - July 1st - July 30, 1995
- 2) III Mission - end of August - part of September 1995.

For safety and underwater work efficiency reasons recovery operation must be done by at least two diving specialists using various diving equipment (underwater ejector operation, soldering, work inside of the vessel's hull, etc.).

If the II and III mission are to be made as suggested, it seems necessary to have decisions related to the Project financing as soon as possible. It is necessary to send additional salvaging equipment to Bissau with sufficient lead time to avoid delays in air transportation.

#### IV. SCOPE OF WORK FOR TWO DIVERS/SALVAGE EXPERTS

##### 1. The General Objective:

The long-term objective of the mission is to open the fishing port of Bissau for vessels unloading seafood for local population, for land processing by local and joint venture companies and receiving support for their fishing operations with Bissau as a base port. The project is to enhance private sector opportunities in the fishery sector development of Guinea-Bissau and to encourage foreign fishing companies to establish their operation in Bissau.

##### 2. Objectives of the Ist, II and III Mission:

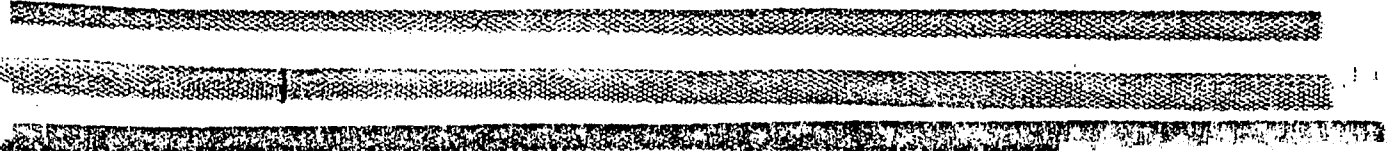
The short-term goal of the Ist Mission was to assess the technical and economic feasibility of recovering three sunken ships from the fishing port of Bissau. The salvaging expert inspected all three vessels, determined their present technical condition, indicated the ways they could be recovered and the total cost of this operation. All these findings are to be presented in this document - "Feasibility Study of Recovering Three Sunken Ships in the Port of Bissau".

During the II Mission "Lembrance d'Afrique" and "Djagobel" are to be salvaged and removed from the port.

The III Mission will be entirely devoted to the salvage of "Captain Cook".

##### 3.. Coordination and Supervision

During all the Mission time both consultants will stay in close and continuing contact with the National Director of the TIPS and USAID Director in Bissau.. The Consultants will also work in cooperation with Dr. Vlad Kaczynski, the fishery consultant of the TIPS Project.



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#### 4. Specific Tasks:

During the 1st Mission the Consultant will spent three weeks in Bissau (May 22nd - June 11th, 1995) in order to

a) Meet Port Authorities of the port of Bissau and obtain full information on the time, causes and circumstances leading to the sinking of each of the following ships:

- 1) "Lembrace d'Afrique",
- 2) "Djagobel", and
- 3) "Capitaine Cook".

b) Agree all needed steps, actions and procedures with Port Authorities that should be requested to issue all required permits and authorizations to carry out inspections and salvage operations of these ships by the Consultant.

c) Secure one or more homologues from the Port Authorities that will facilitate all the work of the Consultant and help in carrying out the work plan that should earlier be agreed with these Authorities,

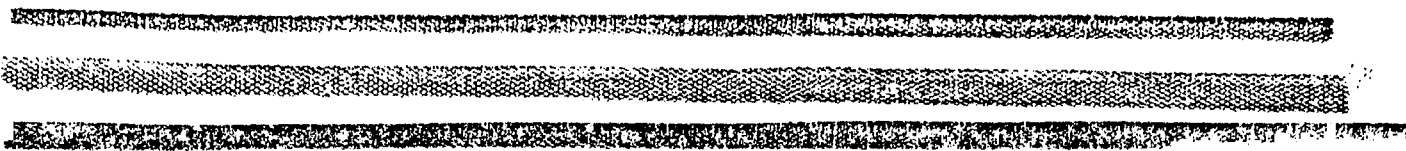
d) Carry out surface and underwater inspections of all above mentioned vessels during high and low tide and evaluate the scope of damage, present status of their hulls and superstructures, the depths, corresponding water lines and their listings in relation to the sea bottom.

e) Assess the techniques that could be applied to remove these vessels from the sea bottom considering their present status and needed prior repairs according to available engineering and logistical support in Guinea-Bissau and in the most immediate neighboring ports.

f) Determine the cost of each salvage operation and the total cost of the project considering raising, towing and disposing of these vessels in agreed (with Port Authorities) new sites,

g) Prepare the Feasibility Study including all necessary steps and preparation conducting to the final salvage operation. This Study should include timing, involved parties (Port Authorities, Shipyard, National Navy and private companies,

h) Present all findings of the inspection and technical-economic assessments during specially organized conference for the Port Authorities, Ministry of Transportation, Ministry of Fisheries and the National Navy.



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i) Deliver the "Feasibility Study of Recovering Three Sunken Ships in the Port of Bissau".including all above mentioned steps and costs involved in this operation.

j) This Feasibility Study should be delivered at the latest within 3 weeks after conclusion of the Mission.

## 5. Deliverables

a) "Feasibility Study of Recovering Three Sunken Ships in the Port of Bissau",

b) Drawings, sketches and photos of the above mentioned ships including their high and low tide positions, amount of silt and mud accumulated in their hulls and short report from meetings with Port Authorities and the above mentioned conference,

c) Written Conclusions and Recommendations of the Conference with representatives of the Port Authorities, Ministry of Transportation, Ministry of Fisheries and the National Navy.

d) Other agreed documentation and Mission Final Reports after II and III Mission.

## VI. THE BUDGET

### I. COSTS OF THE 1ST MISSION (5/20 - 6/13 1995):

1. Leasing/purchase value of the equipment and materials in the United States:		US\$
1	Air Compressor	522.61
2	Diving suit	955.00
3	Dry suit hood	51.94
4	Diving mask	872.50
5	Air hoses ( 180 feet)	435.00
6	Underwater camera	247.00
7	Walkie-Talkies(Radio Shack )	420.00

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## Materials:

	Hose clamps	125.00
	Air filter	163.81
	Yellow tapes	4.60
	Teflon tapes	6.30
	Octane boost	9.72
	Compressor oil (regular)	3.21
	Compressor oil (synthetic)	44.25
	Films (Kodak) 35 mm 8 rolls	33.87
	Filter carbon	10.80
	Tapes, screws, soldering material (purchase in Bissau)	25.00
	Other minor inventory items (purch. Bissau)	50.00
	Insect repellents	12.78
	Packing material (crate, bands, screws, paint, etc.)	75.00
	Container (10 gallons)	37.80
9	Pressure regulator	37.86
10	Coupler (type KI)	9.34
11	First Aid Kit (own)	40.00
12	Tool box (wrenches, screwdrivers, etc.) (own)	41.50
13	Gas tank 1 gallon - own)	6.00

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TOTAL DIRECT EXPENSES 4,240.89

## 2. Transportation expenses

Air Cargo Seattle-Lisbon (142 kg)	827.00
Extra luggage (suitcase - 55 kg)	203.00
Transportation Bothell - Airport Seattle	55.00

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TOTAL TRANSPORTATION COSTS 1,085.00

TOTAL FOR EQUIPMENT, MATERIALS AND TRANSPORT. 5,325.89

## 3. Other expenses

Medical services and medicines	265.30
Malaria pills	81.88
Visa pictures	19.58
Airport taxi	27.00

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Sub-total: 393.76

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### Time and Honoraries for divers/ship rescue experts

#### WORK TIME:

Specialist	DAYS		
	Diving	Surface work	Total
Senior diver/rescuer	15	15	30
Diving assistant/rescuer	13	17	30

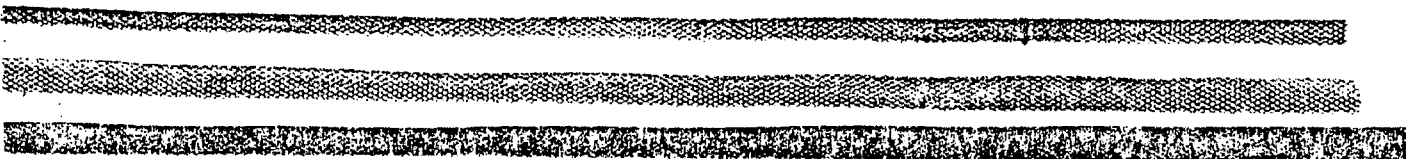
HONORARIES	Daily rate US\$		
Senior diver/rescuer	650	15 diving days	9,750
	350	15 surface days	5,250
Diving assistant/rescuer	525	13 diving days	6,825
	300	17 surface days	5,100
<b>SUB-TOTAL HONORARIES</b>			<b>26,925</b>

#### LOCAL TRANSPORTATIONS (PICK-UP)

30 days @ 35 doll/day 1,050

#### PER-DIEM (TWO SPECIALISTS)

60 DAYS @ 116 PER DAY 6,960



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Airtickets (Seattle - Bissau-Seattle - RT - business)	2 PERS.	9,000
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TOTAL PERSONAL COSTS		43,935
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Price and phisical contingencies 20%	(for II mission only)	10,000
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<b>GRAND TOTAL DIRECT COSTS FOR II MISSION</b>		<b>80,860</b>
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### III MISSION

The III mission will not entail any additional equipment costs. The only extra cost is mission expenses for two diving/ship rescue specialists and tug/towing cables to be furnished by the Bissau Port Authority.

On the basis of current assessments "Captain Cook" - sunken from 1996 is more difficult salvage case and it will be necessary to have extra time and mobilize a tug and rigs to complete this operation. This equipment will be delivered by the Port of Bissau.

#### a) Time and Honoraries for divers/ship rescue experts

##### WORK TIME:

Specialist	DAYS			Total
	Diving	Surface	work	
Senior diver/rescuer	15	15		30
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HONORARIES	Daily rate US\$		
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30 days @ 35 dol/day 1,050

PER DIEM  
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60 DAYS @ 116 PER DAY 6,960

Airtickets (Seattle - Bissau-Seattle - RT - business) 2 PERS. 9,000

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TOTAL III MISSION COST: 43,935

GRAND TOTAL FOR II AND III MISSION 124,795

**CONTRIBUTION OF THE GUINEAN GOVERNMENT  
(PORT AUTHORITIES) TO THE SHIP RECOVERY  
PROJECT**

**1. RENTAL OF THE HEAVY  
EQUIPMENT:**

Equipment	US\$/day	Days	Total US\$
Heavy duty air compressor	95	60	5,700
High Power Welding Machine 500 A - rotativo)	65	60	3,900
Utility boat	33	60	1,980
Storage and security	20	60	1,200
Self propelled crane 5t	150	40	6,000
Pontoon			
Tug	500	22	11,000
Land truck	100	50	5,000
Heavy duty tractor	350	30	10,500

**3. MATERIALS**

Sheet  
metal  
Ropes  
(100 m)  
Torches  
Hoses  
Oxygen  
Acetylene  
Fittings  
TOTAL

4,000

3. MANPOWER (Five  
workers) 70 30 2,100

**GRAND TOTAL 51,380**

52

Price contingencies	4,000
Physical contingencies	4,000

<b>TOTAL CONTRIBUTION OF THE GOVERNMENT</b>	<b>59,380</b>
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