

**I. PROJECT IDENTIFICATION**

1. PROJECT TITLE  
 Protection of the Human Environment During Ecological change associated with rural Development and Capitol Construction in rural area

APPENDIX ATTACHED  
 YES  NO (499)

2. PROJECT NO. (M.O. 1095.2)  
 931-11-511-048

3. RECIPIENT (specify)  
 COUNTRY Panama  
 REGIONAL  INTERREGIONAL

4. LIFE OF PROJECT  
 BEGINS FY 7/74  
 ENDS FY 6/30/75

5. SUBMISSION DATE 6/13/74  
 ORIGINAL  REV. NO. DATE  
 CONTR. PASA NO. \_\_\_\_\_

**II. FUNDING (\$000) AND MAN MONTHS (MM) REQUIREMENTS**

A. FUNDING BY FISCAL YEAR	B. TOTAL \$	C. PERSONNEL		D. PARTICIPANTS		E. COMMODITIES \$	F. OTHER COSTS \$	G. PASA/CONTR.		H. LOCAL EXCHANGE CURRENCY RATE: \$ U.S. (U.S. OWNED)	
		(1) \$	(2) MM	(1) \$	(2) MM			(1) \$	(2) MM	(1) U.S. GRANT LOAN	(2) COOP COUNTRY
1. PRIOR THRU ACTUAL FY										(A) JOINT	(B) BUDGET
2. OPRN FY 74	125	75				50					
3. BUDGET FY											
4. BUDGET +1 FY											
5. BUDGET +2 FY											
6. BUDGET +3 FY											
7. ALL SUBQ. FY											
8. GRAND TOTAL											

9. OTHER DONOR CONTRIBUTIONS

(A) NAME OF DONOR	(B) KIND OF GOODS/SERVICES	(C) AMOUNT

**III. ORIGINATING OFFICE CLEARANCE**

1. DRAFTER Edgar Smith <i>Edgar Smith</i>	TITLE Health Science Administrator	DATE 6/13/74
2. CLEARANCE OFFICER Lee M. Howard M.D. <i>Lee M. Howard</i>	TITLE Director, Office of Health	DATE 6/13/74

**IV. PROJECT AUTHORIZATION**

1. CONDITIONS OF APPROVAL  
 Approval is limited only to Phase I - "Pilot project for use of Malathion Spraying against Yellow Fever" which involves the following activities: 1) to locate and chart the movement of the existing westward-moving wave of yellow fever virus; 2) Determine the best methods of ultra-low-volume malathion aerial spray as a control measure for jungle canopy insect vector, as well as checking its effect on other jungle canopy fauna; and 3) to recommend the time and place of yellow fever wave interruption. Phase II will be presented as a separate Research project in FY 1975 to cover the following: 1) the determination of other ecological factors which (continued)

2. CLEARANCES

BUR/OFF.	SIGNATURE	DATE	BUR/OFF.	SIGNATURE	DATE
TA/PM	M. Mozynski <i>MEM</i>	6-17-74	IA/DR	Maura H. Brackett <i>(draft)</i>	
TA/PM	A. Bisset <i>AB</i>	6/17/74			
TA/PM	Carl R. Fritz <i>CRF</i>	6/17/74			

3. APPROVAL AAS OR OFFIC DIRECTORS

SIGNATURE  
 Curtis Farrar *Curtis Farrar*  
 DATE  
 6/17/74  
 TITLE  
 Associate Assistant Administrator AA/TA

4. APPROVAL A/AID (See M.O. 1025.1 VI C)

SIGNATURE  
 DATE  
 ADMINISTRATOR, AGENCY FOR INTERNATIONAL DEVELOPMENT

1. Conditions of Approval (continued)

contribute to the spread of yellow fever; and 2) the determination of practical measures to reduce the environmental risk of insect borne diseases in rural forest settings.

June 17, 1974

MEMORANDUM TO: AA/TA, Mr. Curtis Farrar  
THRU: TA/PM, Carl R. Fritz *AB for*  
FROM: TA/PM, Mary E. Mozynski *Mary E. Mozynski*  
SUBJECT: PROP - Protection of the Human Environment During  
Ecological Change Associated with Rural Development  
and Capital Construction in Rural Areas.

The attached proposal was originally presented as a single 12 months project to obtain alternative methods for the protection of the human environment from biological hazards during ecologic change associated with rural development and capital construction in tropical areas. The proposed activities are as follows:

1. Phase I - to combat the serious spread of jungle yellow fever the following activities will be undertaken:
  - a. to locate and chart the movement of existing westward-moving wave of yellow fever virus;
  - b. to determine the best methods of ultra-low-volume malathion aerial spray as a control measure for jungle canopy insect vector and to check its effect on other jungle canopy fauna; and
  - c. to recommend the time and place of yellow fever wave interruption.
2. Phase II - Research proposal to:
  - a. determine other ecological factors which contribute to the spread of yellow fever; and
  - b. to determine practical measure to reduce the environmental risk of insect borne diseases in rural forest settings.

The attached PROP is limited to Phase I because of the urgency of combatting a serious spread of jungle fever. Phase II is less urgent and will be handled as a separate research project which will be submitted in fiscal year 1975 to the Research Advisory Council for approval.

This project is supported by the Government of Panama, the Gorgas Memorial Laboratory (GML), the U.S. Army and PAHO. The contributions of each are described in detail on pages 10, 11 and 12 of the attached PROP. Except for the full-time professional personnel needed for this project which will be provided by A.I.D., participants and supplies are on hand or readily available. Existing GML staff are already working within the limits of available time and material available, the PAHO consultant is in Panama, GOP-provided insecticide is in Panama City, and the U.S. Army helicopters and crews and Panamanian troops can be deployed on short notice. Approval of this Phase I will permit the full-scale program to go into operation to prevent the spread of the virus toward the Canal.

It is recommended that you indicate approval of Phase I by signing the attached PROP.

Attachment: a/s

**I. PROJECT IDENTIFICATION**

1. PROJECT TITLE  
**Protection of the Human Environment: During Ecological change associated with rural Development and Capital Construction in rural areas**

APPENDIX ATTACHED  
 YES  NO

2. PROJECT NO. (M.O. 1095.2)

3. RECIPIENT (specify)  
 COUNTRY Paraguay  
 REGIONAL  INTERREGIONAL

4. LIFE OF PROJECT  
 BEGINS FY 77  
 ENDS FY 81/82/85

5. SUBMISSION  
 ORIGINAL 6/13/74 DATE  
 REV. NO.      DATE  
 CONTR./PASA NO.     

**II. FUNDING (\$000) AND MAN MONTHS (MM) REQUIREMENTS**

A. FUNDING BY FISCAL YEAR	B. TOTAL \$	C. PERSONNEL		D. PARTICIPANTS		E. COMMODITIES \$	F. OTHER COSTS \$	G. PASA/CONTR.		H. LOCAL EXCHANGE CURRENCY RATE: \$ L5 (U.S. OWNED)		
		(1) \$	(2) MM	(1) \$	(2) MM			(1) \$	(2) MM	(1) U.S. GRANT LOAN	(2) COOP COUNTRY (A) JOINT (B) BUDGET	
1. PRIOR THRU ACTUAL FY												
2. OPRN FY <u>74</u>	<u>125</u>											
3. BUDGET FY												
4. BUDGET +1 FY												
5. BUDGET +2 FY												
6. BUDGET +3 FY												
7. ALL SUBQ. FY												
8. GRAND TOTAL												

9. OTHER DONOR CONTRIBUTIONS

(A) NAME OF DONOR	(B) KIND OF GOODS/SERVICES	(C) AMOUNT

**III. ORIGINATING OFFICE CLEARANCE**

1. DRAFTER <b>Edgar Smith</b>	TITLE <b>Health Science Administrator</b>	DATE <b>6/13/74</b>
2. CLEARANCE OFFICER <b>Leo M. Howard M.D.</b>	TITLE <b>Director, Office of Health</b>	DATE <b>6/13/74</b>

**IV. PROJECT AUTHORIZATION**

1. CONDITIONS OF APPROVAL

**2. CLEARANCES**

BUR/OFF.	SIGNATURE	DATE	BUR/OFF.	SIGNATURE	DATE
<u>IA/PM</u>	<b>H. Mesynski</b>		<u>IA/DR</u>	<b>Maure H. Braskett</b>	
<u>IA/PM</u>	<b>A. Blaset</b>				

3. APPROVAL AAS OR OFFICE DIRECTORS		4. APPROVAL A/AID (See M.O. 1025.1 VI C)	
SIGNATURE <b>Curtis Farrar</b>	DATE	SIGNATURE	DATE
TITLE <b>Associate Assistant Administrator AA/TA</b>		ADMINISTRATOR, AGENCY FOR INTERNATIONAL DEVELOPMENT	

May 22, 1974

PROJECT PROPOSAL

Protection of the Human Environment during Ecologic  
Change Associated with Rural Development and Capital  
Construction in Tropical Areas

The Generic Problem

Current legislation emphasizes rural development, human resource development, and improvement in the lives of the poorest segments of the population. Simultaneously, the legislation supports agricultural production, transportation, and power development. In contrast to the physical environment in the temperate climates, the tropical environment presents biological hazards which pose special risks to labor during the construction of dams, roads, irrigation systems, to rural farmers who must develop land from virgin forest, and to the increasing human migration facilitated by transportation development.

Among the 69 AID-assisted countries in FY 1973, 52 (75%) lie within the tropics and 15 within the subtropics. These countries, lying within the parallels 30N and 30S, are characterized by extreme temperatures and rainfall patterns where, by definition, the mean temperature in the coldest month of the year is never less than 68°F. This broad globe-encircling band is characterized by the combination of heat and rainfall, without the seasonal variation of temperate climates. Perennial rather than seasonal breeding is characteristic of insects, snails, and other disease vectors. Under conditions of high reproductive rates, insect transmitters of disease, in the presence of animal or human disease reservoirs, pose serious hazards to agricultural labor, and to all labor involved in capital construction in forested or rural areas.

Examples of vector borne hazards commonly associated with capital construction and rural development:

<u>Disease</u>	<u>Vector</u>	<u>Estimated No. infected</u>	<u>Location</u>
Schistosomiasis	snail	200,000,000	Africa, Asia, Latin America
Onchocerciasis	black fly	40,000,000	Africa, Central America
Malaria	mosquito	100,000,000	Africa, Asia, Latin America
Filariasis	mosquito	190,000,000	Africa, Latin America
Yellow Fever	mosquito	Not Known (epidemic outbreak annually)	Africa, Latin America Virus-related outbreaks of dengue in the Caribbean, and hemorrhagic fever in Korea and Philippines.

In the actual tropical environment, biological hazards rarely occur as single phenomena. The risks are almost always multiple, even though one biological problem may predominate. Except in special situations, the cost of single disease control becomes less cost-efficient than seeking methods which can control multiple hazards. As an approach to environmental protection of the rural poor, the farmer, the laborer, the issue is to determine low cost methods for the reduction of biological hazards which, depending on the environment, will be multiple in number.

#### The Specific Problem

A specific example of the adverse environmental impact of development occurred in January 1974 with the outbreak of yellow fever in Panama secondary to the development of a hydroelectric dam project on the Bayano River in eastern Panama. Prior to the outbreak over 1,000 laborers were imported by the Government to clear the land and build the dam. Families resident in the reservoir area were displaced further into the inland towards the notoriously disease-laden jungles of the Darien Gap.

Following the discovery of yellow fever, laborers were vaccinated, but many rural agricultural families remained exposed. For the rural poor, beyond access the health services, and beyond the services available in more accessible urban settings, the problem is to determine methodology which will prevent the risk of mutiple insect borne disease problems by methods which may not be disease specific. In short, what technology can be applied that can protect the human environment?

The Panama outbreak permits a unique opportunity to examine the problem of environmental protection of interregional significance since several unique conditions prevail:

- 1) A highly fatal disease (yellow fever) outbreak resulting from ecological change secondary to hydroelectric dam construction.
- 2) The potential for interrupting the jungle yellow fever with ULV Malathion in Panama and thereby prevent human risk and control costs in other Central American countries.
- 3) A geographic locality characteristic in climate and disease potential to much of tropical Africa and Asia.
- 4) A country which is dependent on hydroelectric energy and therefore planning to build additional dam sites for increasing energy requirements.
- 5) The presence in Panama of an internationally famous tropical disease laboratory, the Gorgas Memorial Laboratory, with strong on-board Panamanian and U.S. scientific staff capability in tropical environment and ecological investigation.

Background on Yellow Fever in Panama

The natural reservoir of the virus is believed to be in wild monkeys living within the forest of the Amazon Basin. Infected monkeys are normally not found in the territory of Panama but periodic cycles of the disease enter Panama from the east. According to current information, the jungle disease cycle occurs among wild monkeys. Infection is transmitted from animal to animal by bite of a forest canopy mosquito called Hemogogus. When the forest is cleared for purposes of dam construction, farms, or new residential sites, humans are accidentally exposed to the bite of infected mosquitoes and thereby contract the disease. The danger does not stop here. The infected human poses a threat in any urban setting where the domesticated yellow fever mosquito, Aedes aegypti, provides the potential for transmitting the virus in explosive epidemics among humans. Therefore, the situation can be seen in perspective as a continuing potential threat from the jungles and forests into which the population is moving for settlement and capital development construction, e.g., dams and roads.

The Government of Panama, recognizing the threat, immediately undertook known measures such as urban yellow fever mosquito control and vaccination of exposed populations. The GOP input into the mosquito campaign for calendar year 1974 is \$327,451. The <sup>cost</sup> of the vaccination campaign has been <sup>in additional</sup> \$120,000, <sup>with PAHO providing the vaccine, valued at \$225,000</sup>. It is estimated that for the next four years the Government of Panama will require \$250,000 annually to maintain the control of the yellow fever mosquito. In short, the appearance of yellow fever in Panama has put the Government of Panama to the expense

of approximately \$450,000 for the current calendar year.

Although these efforts have reduced the immediate threat of yellow fever for the urban population of Panama, the vaccination and mosquito programs are not certain guarantees against exposure to this highly fatal disease because coverage is seldom complete and human migration is difficult to control. Of equal importance is the genuine threat of the continuation of the jungle yellow fever wave westwards to Central America and potentially to the Caribbean. If, as a consequence of this exposure, each government is required to take emergency measures for the control of yellow fever as Panama has done, the expenditures could well exceed several million dollars this calendar year, excluding the costs of sickness and loss of life.

Prior epidemics in 1959 and 1965 faced a situation less receptive to major transmission in Central America as a result of a Pan American Health Organization Campaign with the United States (HEW) support, for the hemispheric eradication of the yellow fever mosquito. Around 1967 the United States (HEW) discontinued its initial commitment to reduce the presence of this mosquito in the southern United States. It is inconclusive as to whether the yellow fever mosquito has been reintroduced into Central America from the United States, or whether it recurred from incomplete hemispheric campaigns. It is a fact, nevertheless, that the presence of the mosquito has increased to densities capable of transmitting urban yellow fever, particularly in San Salvador, Honduras and southern Mexico.

A. Goals

1. Goal Statement

Protection of the human environment from biological hazards during ecological change associated with rural development and capital construction in tropical areas.

2. Measurement of Goal Achievement

(a) Reduction of prevailing insect borne diseases from rural farmers, migrants, and laborers.

(b) Development of methods which effectively interrupt the primary vector borne disease patterns in the environment of man.

3. Means of Verification

The primary methods are epidemiological and laboratory methods which identify the presence of viruses, parasites within insect and animal life. Means of verification also includes those used by the entomologists and species identification.

4. Assumptions for Achieving Goal Achievement

(a) Awareness of the potential biological hazards of environmental change associated with rural development and capital development programs will lead to application of proven low cost methods for insect borne disease prevention.

## B. Project Purpose

### 1. Statement of Purpose

(a) To determine the practical alternatives to protect human populations exposed to risk of multiple insect borne diseases which emerge as a consequence of environmental change.

(b) To determine the practical alternatives for interrupting the westward spread of jungle yellow fever in Panama.

(c) To determine alternate transmission cycles for jungle yellow fever.

### 2. Conditions Expected at the End of the Project

(a) Confirmation of alternative methods to protect rural populations and laborers from insect borne diseases.

(b) The effect of ultra low volume malathion and other environmental procedures will be documented.

(c) Jungle canopy fauna in the area of Northern Panama will be tested for the potential of yellow fever transmission.

### 3. Means of Verification

In Panama, the virological and entomological facilities of the Gorgas Memorial Laboratory will be used for confirmation of vector species and the presence of viruses in insects and animals. Entomological procedures will also be undertaken to determine the effect of ULV malathion on canopy mosquitos.

### 4. Assumptions for Achieving Purpose

(a) The Gorgas Memorial Laboratory has the professional competence to identify the wave and determine alternative methods of interrupting yellow fever.

(b) Failure to stop the northward movement of the yellow fever virus wave in the Panamanian jungles poses a serious threat to rural and urban populations in Central America.

(c) Project findings will be of value throughout the tropical world where ever development projects are encroaching upon and disturbing the ecological balance of the natural forest.

### C. Project Outputs

1. Identification of the yellow fever wave location and speed of travel. Such identification will be achieved by measurement and mapping of the virus in wild and sentinel monkeys. Laboratory tests will be confirmed in the Gorgas Memorial Laboratory.
2. Demonstration of the effectiveness of ULV malathion on canopy Hemagogus mosquitos and other potential transmitters. Measurement of pre and post treatment to insect populations in test and control areas will be carried out by the Gorgas Memorial Laboratory staff. Entomological verification of kill will be determined.
3. Determination of ecological factors contributing to yellow fever transmission. Viral tests will be carried out on canopy insects and animals to see if there are alternative transmission cycles.
4. Recommendation will be made to the Government of Panama on the optimal time and place of yellow fever wave interruption in Panama.
5. Recommendations will be made on practical measures to reduce environmental risks from insect borne diseases in the rural forest setting. The form of this output will be a report of findings and observations which can be circulated to agencies carrying out capital development projects in similar tropical areas in other parts of the world.

#### 6. Assumptions for Achieving Outputs

The use of ultra low volume spraying is not a new concept. It has been used extensively for insect control and crop protection in many parts of the world. The specific test required in Panama is the determination of the effect of malathion on canopy insects. This is not known. Unless the determination can be made as to the degree and length of effect on canopy mosquitos, it would be difficult to determine the potential for malathion to interrupt the northward spread of yellow fever. It is an assumption of this project that jungle yellow fever can be confined to the mountain ranges in northern Panama by ULV malathion and thereby prevent it from proceeding either to urban populations in Central America or to rural populations throughout the Isthmus. It is further assumed that the virus studies by the Gorgas Memorial Laboratory on the basic ecology of the Bayano River Basin will give the Gorgas scientists an advantage in understanding ways in which to interrupt biological hazards to settlers in the rural areas of the tropics.

## 6. Assumptions for Achieving Outputs

The use of ultra low volume spraying is not a new concept. It has been used extensively for insect control and crop protection in many parts of the world. The specific test required in Panama is the determination of the effect of malathion on canopy insects. This is not known. Unless the determination can be made as to the degree and length of effect on canopy mosquitos, it would be difficult to determine the potential for malathion to interrupt the northward spread of yellow fever. It is an assumption of this project that jungle yellow fever can be confined to the mountain ranges in northern Panama by ULV malathion and thereby prevent it from proceeding either to urban populations in Central America or to rural populations throughout the Isthmus. It is further assumed that the virus studies by the Gorgas Memorial Laboratory on the basic ecology of the Bayano River Basin will give the Gorgas scientists an advantage in understanding ways in which to interrupt biological hazards to settlers in the rural areas of the tropics.

D. Project Inputs

1. The Gorgas Memorial Laboratory

The Laboratory provides the basic scientific facility to undertake the requisite studies. The Laboratory equipment and staff of personnel will be assigned to the project. In addition to the part-time participation of the current Director, Dr. Pedro Galindo, and Associate Director, Dr. K. Karl Johnson, the Laboratory will provide three full-time professional personnel: an epidemiologist, a vertebrate ecologist and an entomologist. These individuals will be supported by field technicians, laboratory technicians, animal caretakers and camp personnel. The attached budget for the period of the project does not include contributions which GML has already made in view of its participation on an emergency basis since the outbreak of an epidemic in January 1974. Because of the emergency period, salaries of professional and technical personnel, indirect laboratory support of administration, and use of capital equipment within the laboratory. The total value of the use of these facilities by the laboratory between February and March 1974 is estimated to be approximately \$15,500. The budget from April to December 1974 were estimated to be approximately \$242,000. Although the laboratory obtains much of its funding through separate contracts and grants from HEW and DOD, the basic Congressional appropriation of \$500,000 a year permits the utilization of laboratory staff in the study of tropical diseases. The contribution of the GML during the April - December 1974 period is therefore not an excessive estimate in view of the emergency deployment of staff and personnel to the yellow fever outbreak.

2. The Government of Panama

During the project period the Government of Panama will provide 500 gallons of malathion with value of \$5,000. In addition the National Guard will provide 200 men for 8,000 man-hours of labor as insect and animal collectors. These contributions to the reduction of the risk of jungle yellow fever are over and above the major input made by the Government at the time of the initial yellow fever outbreak. In order to reduce the immediate risk of urban yellow fever, the Government of Panama undertook a \$357,000 anti-yellow fever mosquito campaign which will require approximately \$250,000 annually for upkeep. In addition, the Government of Panama provided \$120,000 worth of yellow fever vaccination for urban populations.

3. Pan American Health Organization

PAHO has provided a consultant on the control of yellow fever. The salary of the consultant, approximately \$20,000, is a direct input in the sense that the consultant is one of the world's outstanding experts on yellow fever.

4. U.S. Army (Canal Zone)

The U. S. Army has agreed to provide helicopters with equipment for dispensing ultra low volume sprays of malathion for test purposes in the jungle terrain of northern Panama. In the event that these tests are successful, the utilization of U.S. helicopters for interruption of the yellow fever wave would be subject to a mutual agreement between the Government of Panama and the U.S. Government.

5. A.I.D.

Budget support is provided in detail in Annex No. 1. The total support for salaries, equipment, supplies, consultant travel and overhead is estimated at \$14,200. The immediate needs to carry out the identification

of the yellow fever wave, the development of the test sites from malathion spraying and the determination of the effectiveness of spraying could be accomplished between the months of June 1 and November 30 at a cost of \$124,808. The balance of the project from November 1974 to June 1975 would permit GML scientists to determine alternate mechanisms for the transmission of yellow fever in the forest in order to assure that disease transmission is not continuing through cycles other than that of the monkey and the haemagogus mosquito.

6. Assumptions for Providing Inputs

Annex 3 and Annex 6 provide the endorsement of the Ministry of Health of the Republic of Panama and the Ambassador of Panama to the United States. The project period of one year will be continued on the basis that project efforts will have the continued full support of the Government of Panama, the Pan American Health Organization and the U.S. Army.

E. Rationale

Given the Agency policy of emphasizing assistance to the lower income and rural populations of the LDC's, an increasing number of development projects are being carried out in tropical forest areas where man's encroachment has been minimal in the past. Such projects as hydro-electric dams, farm-to-market roads land reform and homesteading, irrigation etc., while designed for the long-term improvement of the lives and standards of living of the target populations, tend to create temporary ecological imbalances and expose workers, local populations, and immigrants to biologically adverse environments. The spread of jungle yellow fever in Panama, and the increase in populations exposed to it as a result of major development projects, are prime examples.

At the same time, a combination of factors makes this an ideal proving ground for methods of minimizing such environmental health risks. These factors, not likely to occur again at the same time and place, include:

1. The presence of Gorgas Memorial Laboratory, one of the best equipped and most knowledgeable organizations in the Americas for arbor-virus (including yellow fever) research.
2. The discovery of the presence and movement of the jungle yellow fever wave by GML.
3. The geography of the Isthmus of Panama which provides a series of natural bottlenecks where the disease may be attacked with some hope of success.
4. The history of suffering and economic loss in Panama resulting from yellow fever epidemics and the GOP's consequent awareness of its damage potential which necessitated that the government take expensive independent action in its urban and rural centers to prevent the risk of yellow fever.
5. The willingness of the U.S. Army (Canal Zone) to provide helicopters for insecticide tests and transportation for project technicians to remote jungle areas.

F. Course of Action (See Annex 2)

1. Implementation Plan: The proposal consists of three separate activities:
  - a. Pinpointing and measuring the movement of the virus wave.  
Already roughly located by appearance of human and monkey infections and deaths, the wave front is to be precisely mapped and its movement plotted by means of virus recovery from wild mosquitoes and monkeys and from sentinel monkeys caged at canopy level. A precise map of the current front should be available by August or September, 1974, and movement plotted continually from that point through the life of the project.

b. Testing efficacy of ULV malathion aerial spraying as a means of controlling canopy vectors. It is known from previous tests that such applications will control ground-level Anopheles mosquitoes beneath the jungle canopy, but there is no existing knowledge of their effect upon canopy-inhabiting vectors. Tests would involve a series of applications to a 1 x 2 km. plot with effect measured by comparison of vector population densities, before and after application, with those of a comparable unsprayed control plot. Careful rainfall measurement will permit study of relationship of rain and mosquito populations. If the insecticide causes marked reduction in population of test plot, mosquitoes from area around this plot will be dye-tagged to permit study of extent and rate of vector migration into treated area. This part of the project has high priority, since the knowledge gained will be required if the movement of the virus forces emergency interdiction measures, and should be completed by September 1974.

c. Determination of other potential vectors or reservoirs. While Haemogogus spp mosquitoes are known to be vectors of jungle fever, and various species of monkeys are known to be reservoirs knowledge is sparse as to the potentiality of other arthropods and vertebrates in these virus to determine whether any of these should also be considered within a control plan. This program would begin immediately and continue throughout the 12 month life of the project in order to allow for seasonal differences.

## 2. Narrative Statement

This project will attempt to provide information necessary to stop the existing wave of jungle yellow fever now moving through Panama from the Colombian border toward the canal. If unchecked, the virus could spread

through the urban and rural populations in Central America, Mexico, and possibly, the southern U.S. On this basis, project implementation may be considered to be of an emergency nature.

Of longer term importance is the fact that similar environmental hazards occur as a result of ecological imbalances created by development construction projects designed to improve the way of life of the lower income rural populations in many tropical countries. Information gained through this project will be applicable to similar situations involving AID-supported rural development elsewhere in the tropical zones of the world.

Location and tracking of the virus wave-front is to be accomplished by capture of jungle canopy mosquitoes and monkeys and by setting out caged sentinal monkeys in the jungle canopy. This work will be done from a jungle base camp, by GML workers and specially-trained Panamanian soldiers assigned to the project. All captures will be checked for yellow fever virus by utilizing GML equipment and personnel.

Testing of ULV malathion is planned as a joint GML-US Army-GOP-PAHO operation under technical supervision of GML scientists and PAHO consultants. The U.S. Army will provide helicopters, spray-rigs and experienced crews. The GOP will supply insecticide and the services of Guardia Nacional troops as mosquito-collectors.

Surveying the jungle canopy fauna for yellow fever vectors and reservoirs will be carried out by these same personnel with the U.S. Army providing helicopter transport to remote jungle areas. All virus testing will be done by the GML.

Except for full-time professional personnel needed for this project, participants and requirements are on hand or readily available. Existing GML staff are already working within the limits of available time and material available, the PAHO consultant is in Panama, GOP-provided insecticide is in Panama City, and U.S. Army helicopters and crews and Panamanian troops can be deployed on short notice. At this point, the only factor missing is the funding required for additional professional and sub-professional personnel and the purchase of special supplies and equipment, for use in this project. Prompt obligation of the first fund increment (\$124,760) is needed in order to begin a full-scale program before the virus can spread further toward the Canal. Strong assurance of the availability of the second increment (\$189,370) is also required if high-calibre professionals are to be recruited.

Gorgas Memorial InstituteProposed Budget Summary

	<u>Immediate Needs</u> (FY 74) (June-Nov)	<u>Continuing Needs</u> (FY 75) (Nov. 74-June 75)	<u>TOTAL</u> (June 74-June 75)
Direct Salaries and Wages	\$48.650	\$109.950	\$158,600
Fringe Benefits:	5.838	13.194	19,032
Equipment:	29.800	-	29,800
Supplies:	19.600	15.600	35,200
Consultant and Travel:	<u>-</u>	<u>3.370</u>	<u>3,370</u>
Total direct costs:	103.888	142.114	246,002
GMI overhead (43% S & W)	<u>20.920</u>	<u>47.278</u>	<u>68,198</u>
Subtotal:	\$124.808	\$189.392	\$314.200

## B U D G E T

### Personnel (new):

Epidemiologist - July 1, 1974 - July 1, 1975	\$ 25,000
Post doctoral scientist - vertebrate ecologist beginning July 1974	10,000
Post doctoral scientist - entomologist beginning July 1974	10,000
Field technicians (2) camp leaders at 3,600	7,200
Laboratory technician - virology	5,000
Laboratory technician - entomology	4,000
Supply technician	3,000
Animal caretaker	3,000
Camp cooks (3) at 2,100	6,300
Field workers - animal (6) at 1,800	10,800
Mosquito collectors 8,000 man days at 4.00 (These are members of Guardia Nacional. Money is for food, special clothing, transport. Salries paid by R.P. Government).	32,000
Overtime - field and laboratory technicians Aver. 15 hours weekly at aver. \$7/hr.	5,400
Miscellaneous temporary hire guides, field- workers, etc.	3,000
	<hr/>
New personnel	124,700

### Personnel (Monthly salaries of GMI personnel not otherwise supported beyond 1974):

#### Full time:

Dr. Pauline Peralta	1,700
Teresa Díaz	800
Eduardo Miranda	700
Alonso Espinosa	700
Mañuel Correa	650

#### Half time:

Paula Fábrega	400
Fred Valencia	333
Walter Smith	360
	<hr/>
	5,643

Subtotal - Direct salary & wages  
\$5,643 x 6 mos.

. . 33,900

### TOTAL

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\$ 158,600

Fringe benefits at 12%

19,032

## Equipment

1	4 wheel drive vehicle, long wheel base, winch, self cleaning mud tires	\$ 6,000
8	Liquid N <sub>2</sub> containers, assorted sizes	2,000
40	CDC light traps, 6 volt, with 24 spare motors, bulbs	2,500
2	Generators 1.5 kv 120 v. A.C. 60 cycle	700
2	Portable kerosene refrigerators	500
6	Kerosene pressure stoves	250
9	Kerosene pressure lanterns	270
30	Hunting head lamps	150
2	Refrigerated chill tables for sorting mosquitoes	1,100
18	Monkey cages, stainless steel with racks	4,500
500	Mouse cages, laboratory at 8.00	4,000
200	Portable animal traps, assorted sizes	3,000
24	Mist nets	300
3	Shotguns	300
50	Boxes shotgun shells, 20,16,12,410 gauge	200
2	Small field centrifuges, with heads and Shields at 315	630
1	Outboard motor 20 h.p.	400
	Field radio equipment	1,000
1	Stereoscopic microscope	2,000
		<u>2,000</u>
		<u>\$ 29,800</u>

Supplies and Animals:

2000 liter liq. N <sub>2</sub> (as back-up in case of failure GMI plant)	\$ 2,000
Animal food and bedding	4,500
Cell culture media and serum	2,000
Microtitration equipment, serological tests	1,500
Disposable plastic trays, tubes, pipette tips	3,800
Batteries dry cell 6 volt and flashlight	1,000
Gasoline, oil (+ 5,000 gals, and 100 qts. oil)	3,000
Syringes, needles, vacuumtainers, vials for serum	4,200
60 rhesus monkeys-sentinel & experimental at \$100	6,000
100 wild animals various species aver. at \$20	2,000
Miscellaneous	4,000
Misc. - Rental of house in Chepo as supply base	1,200
<b>T O T A L</b>	<hr/> 35,200

ANNEX 2

GORGAS MEMORIAL INSTITUTE OF TROPICAL AND PREVENTIVE MEDICINE, INCORPORATED

TELEPHONES:  
CANAL ZONE 52-5064  
PANAMA 25-6550

GORGAS MEMORIAL LABORATORY  
P. O. BOX 2016  
BALBOA HEIGHTS, CANAL ZONE

CABLE: GOMELA  
PANAMA, R. DE P.

21 March 1974

Director  
Agency for International  
Development  
Panama, Republic of Panama

Dear Sir:

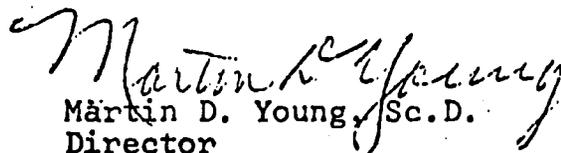
Enclosed is a proposal which we kindly present for your approval and submission to the Washington headquarters of the Agency for International Development. This project is for the experimental development of a method for the interception of a wave of jungle yellow fever as it moves westward from the Bayano River area toward the Panama Canal and the populated areas located along this canal.

We are requesting fiscal support for this project.

Also enclosed are copies of a letter from Panama Minister of Health Saied giving the approval of the Panama government for this project.

It is kindly requested that you notify Dr. Lee Howard, Medical Director, AID of the receipt of this proposal.

Sincerely,

  
Martin D. Young, Sc.D.  
Director

MDY/ifs

Encl.

L. S. Davis  
1/10/74

## SYLVAN YELLOW FEVER

### Project Proposal for Emergency Action in Panama

Gorgas Memorial Institute

#### History

It is well established that sylvan yellow fever is not detectably enzootic on the Isthmus of Central America. Rather, the yellow fever virus (YF) is introduced periodically into eastern Panama from the south at intervals of roughly 7-10 years. From thence it proceeds to the west along the slopes of the low mountains of Darien; the presumed basic enzootic cycle being arboreal primates and several species of Anemagogus mosquitoes. The wave may travel up to 9 km. per week in rainy season, dead howling monkeys (Alouatta) serving as the conspicuous evidence of virus activity. During dry season the virus appears to pause - possibly maintained at low activity by the long-lived arboreal mosquito Sabethes chloropterus. Depending on environmental conditions and other poorly understood factors, the history of such epizootics varies widely. A wave reached the east bank of the Panama Canal at the beginning of the dry season (January-April) in 1949, and subsequently crossed this barrier in January of 1950. Thereafter sylvan yellow fever took hundreds of human lives, particularly among the economically active age group of agriculturists, as it progressed up the Isthmus into Guatemala in the course of about 6 years. Another wave reached the vicinity of the Canal in 1956-57, causing a few human deaths - and petered out there. A third, detected in 1965, never advanced out of Darien Province in eastern Panama.

#### Present Epizootic

Yellow fever virus entered Panama during the rainy season of 1970 as evidenced by reduction in numbers of howling monkeys and a high fraction of antibodies in spider monkeys (Ateles) shot during dry season of 1971 near the eastern border of the country. A similar pattern was noted in 1972 dry season collections from the same general area. Reports of monkey mortality in the upper Chucunaque Basin (Darien) late in 1972 prompted a dry season survey at Aguas Claras (Bayano Basin) early in 1973. Howling monkeys were present, however, and only one serum had yellow fever antibodies. Nevertheless, sentinel rhesus monkeys (highly susceptible clinically to yellow fever) were exposed and mosquitoes were captured for more than 3 months well into the rainy season before work was abandoned as negative. At that time it was suspected that the long and severe dry season of 1973 had aborted the epizootic. For details see 1973 annual report, Gorgas Memorial Institute.

In late January 1974, three Chocó Indians were hospitalized in Panama City with "hepatitis". One died (no histopathology), one was biopsied and bled in early convalescence, and the third recovered but went completely unstudied. The biopsy showed rapidly regenerating liver parenchyma and the serum had high titers of complement-fixing (CF) antibodies to both YF and St. Louis encephalitis (SLE) viruses. These Indians were from Ipetí, not far from Aguas Claras, but on the opposite side of the Bayano Basin in the Majé mountains.

On February 9, 1974, E.B., an 18 year old farmer from the Majé mountains, was admitted to the Psychiatric Hospital in Panama (the patient was an epileptic who had been cared for there previously) with a 9 day history of fever, myalgia, headache, black vomitus and jaundice. We owe the diagnosis of this case to the alert mind of Dr. Luis A. Paz, resident in psychiatry at the hospital. A liver biopsy showed mid-zonal regeneration. Serum taken February 12 had 1:64 CF titer for YF and less than 1:4 for SLE. Subsequent sera showed a rising titer to YF and cross-reactions at lower levels to SLE. (See Table 1 for details.)

On February 16, Z.J., a 36 year old farmer from Las Piraguas, a village adjacent to Aguas Claras, was admitted to Santo Tomás hospital with a 6 day history of fever, headache, myalgia and black vomiting. He was delirious, mildly febrile, had diffuse abdominal tenderness, but was not clinically jaundiced. Liver enzymes were elevated, as was bilirubin, and he had mild leukopenia. This patient died on February 19. Autopsy showed hemorrhagic gastritis, hemorrhagic lymph nodes, a soft friable liver and peritoneal effusion. The liver had classical mid-zonal necrosis with Councilman bodies. Serum obtained February 17 had no CF antibodies for YF or SLE. However, sera taken 17th and 18th February have yielded YF virus. A co-worker of Z.J. clearing forest for planting, sickened on 9 February with similar symptoms and died on February 14 without medical attention.

Thus, sylvan yellow fever is active in the middle Bayano Basin. We know nothing at the moment of possible activity on the Atlantic slope of the San Blas Cordillera which forms the northern rim of the Bayano drainage. Aedes aegypti is known to be present in Panama City. Vaccination campaigns have begun in the capital and in the Bayano area; but previous experience suggests that vaccine will not reach all of the people now dispersed over this forested region.

#### Proposed Action - Basic Goals

- A. To attempt to interdict the crossing of Panama Canal by yellow fever virus.
- B. To locate and follow the crest of the sylvan wave.
- C. To document the dry season arthropod vector(s) of sylvan yellow fever in Panama, and to determine relative vector competence of several known and possible sylvatic vectors. To elucidate potential role of vertebrates other than primates in transmission of sylvan yellow fever.
- D. To prevent the occurrence of urban yellow fever in Panama.
- E. To do investigations on Viral Diagnosis, Epidemiology and Clinical Aspects of Yellow Fever.

## Specific Action:

### 1. To prevent a YF Canal crossing:

Three possible vehicles are known: monkey, man and mosquito. Monkeys are unlikely to swim the Canal. Humans must be vaccinated on both sides of the Canal and control of human traffic coming from the east of Tocumen airport on the Pacific slope and of traffic in both directions at Gatun Locks on the Atlantic should be established and maintained until the threat is past. Windblown infected Haemagogus and Sabethes mosquitoes probably represent the major danger. See Appendix A for detailed proposal.

### 2. To locate and follow the crest of the sylvan wave.

#### 1. Las Piraguas - Aguas Claras

We will concentrate on the latter area about 5 km west of Piraguas where human cases occurred. A camp will be established week of March.

Mosquito collections: 20 men will collect mosquitoes in tree platforms from 0900 to 1500 daily. Six sentinel rhesus monkeys will be exposed in canopy to detect presence of virus activity. If virus is found some men will be moved west and more sentinel monkeys deployed. We will continue and expand collections to other potential vectors (nocturnal human biting, light trap) and to non-primate vertebrates in this area until virus disappears in order to learn: 1) How long sylvan activity can persist in a given small area. 2) Which are the important dry season vectors. 3) Whether other vertebrates become infected.

#### 2. Transisthmian road El Llano-Cartí.

A highway is under construction across the San Blas Cordillera about 30 km west of Las Piraguas. Highway camp exists near divide 15 km north of Interamerican Highway. This camp will be used as advanced field headquarters. Helipad present another 10-14 km further in on Atlantic slope to make area accessible during height of rainy season.

1) Monkey collection on each side of divide will be carried out to establish by serological tests that virus has not reached this point. About 3 weeks needed to complete collections and another week to get final antibody data.

2) Sentinel rhesus monkeys. Eight monkeys will be exposed, four on each slope of the divide.

3. Cerro Azul. Located further west, but continuous with San Blas Cordillera. This is the place where virus was detected twice, first in 1948 and again in 1956.

1) Sentinel rhesus monkeys. Four will be exposed in areas known to have been theater of YF activity in the 1948 and 1956 waves.

## Experimental Virological Work

### 1. Arboreal and terrestrial vertebrates

This is urgent to establish whether any vertebrates besides monkeys can develop viremia sufficient to infect mosquitoes. It is also possible that prior infection of monkeys with other group B arboviruses, particularly JE, modifies clinical and virological response to YF helping to slow progress of the wave prior to 1973. Thus almost no such antibodies were found in monkeys in eastern Darien, whereas they were very common in our 1973 Bayano collection. Sequential inoculation of group B agents with

measurements of subsequent viremias is a must in vertebrates other than monkeys.

2. Mosquito vectors:

Also urgent but cannot be done as quickly since colonies of several species needed. We must determine relative vector competence and relative virus maintenance potential of at least the known vectors. Present data suggest Haemagogus more efficient than S. chloropterus, but latter longer-lived, more resistant to dry-season conditions. Sensitivity to infection with non-modified YF virus by intrathoracic versus oral routes very important. This information highly germane to question: when is the danger past?

D. To prevent urban yellow fever in Panama:

Interdiction of sylvan wave is of major importance. But vaccination, control of persons coming to urban areas where Aedes aegypti are present, and intensification of A. aegypti control efforts are mandatory. GMI will aid by vaccinating all persons contacted in forested areas in course of sylvan operations.

E. Viral diagnosis, epidemiology and clinical investigation

GMI will continue to provide specific isolation and serologic technology for detection YF infection. Mice, cell cultures, CF, hemagglutination-inhibition (HI), neutralization and fluorescent antibody systems all available. We will have to expand present resources quantitatively. Dr. William Dietz, epidemiologist-virologist presently working on problem will leave 30 June. Funds and competent person are urgently required to replace him. Clinical investigation is matter only of stimulating and coordinating energies of medical groups in Panama City and Canal Zone. This is going very well. We could use consultation by Col. Philip Russell re antigen-antibody complexing parameters in human cases. Experimental rhesus monkey work can be started within six weeks.

Duration of Project - Other considerations

We still do not understand the temporal behavior of sylvan YF in Central America. Even if no further evidence of the virus is obtained (unlikely in our judgement) we believe that continual searching for its presence must continue through the dry season of 1975. Thus, this proposal is initially for one year with certain key exceptions in scientific personnel, with the understanding that natural or human events may require further extension.

Logistics will require much effort. We expect excellent cooperation from the Bayano Project-Ministry of Planning, from the Ministry of Health and from the Air Force of Panama. We must also secure cooperation from the Southern Command, the Panama Canal Company, the U.S. government, Departments

of State, Defense and HEW. Basic to all field operations is the establishment of a forward base at Chepo, the gateway town to the Bayano Basin.

Direction of Project

Co-Principal Managers:	Pedro Galindo Karl Johnson
Laboratory Virology:	Pauline Peralta
Epidemiology:	William Dietz (to June 30)

## Appendix A

### Interdiction of Sylvan Yellow Fever Wave

Why: Sylvan yellow fever, not chronically enzootic in Central America, will move north through the forests of Central America to Mexico if it crosses the Panama Canal. This pattern was fully documented during the last such occurrence in the 1950's (Trapido and Galindo, 1956). Along the way it will kill hundreds of persons resident in forested areas, particularly among the economically active age-group of the rural population, regardless of attempts to vaccinate inhabitants of these countries will disrupt health services and tourism, and in some countries, notably Honduras and Salvador, pose a major threat of becoming urban yellow fever since Aedes aegypti is present in significant numbers in many towns of these countries.

Where: There are at least three places where a barrier to passage of the epizootic wave can be formed or reinforced:

1. Cordillera de San Blas, about 50 miles east of Panama City and perhaps 20 miles west of present virus activity. This may be achieved by the use of insecticides in a belt some 8 x 25 km in size across the sparsely populated forests which lie astride the Continental Divide. In theory this site has the added virtue of shutting off further possibility of introduction of yellow fever into urban Panama City. In practice it is not recommended because: a) Time necessary to obtain clearances for the project may not permit execution of such a barrier before the virus wave passes this point; b) Aedes aegypti are so low in Panama City that urban yellow fever seems highly unlikely, and campaign to eradicate the mosquito in the next 60 days is now in progress.
2. The Panama Canal: This natural barrier is effective against one of the three elements implicated in wave movement of yellow fever, namely monkeys. It also offers considerable protection against human transport of virus. The only bridge across the Canal in the wet forested region is at Gatun Locks near Colon. Traffic control to insure vaccination of all persons crossing at this point can be easily established. Vaccination of persons living in tiny villages along the shores of Gatun Lake is highly practical and should be based on knowledge inherent in Panama's national malaria eradication service.

Windblown infected Haemagogus or Sabethes mosquitoes thus represent the principal danger. If they can be controlled

for several months in the forest along the east bank of the Canal from near Gamboa to Gatun, the wave will be stopped when arboreal animals susceptible to viremic yellow fever infection are used up. The problem is a scientific feasibility.

3. Atlantic slopes of western Panama:

If yellow fever virus crosses the Canal, there are several places along the Atlantic coast where another attempt to stop it could be made. Such an approach is based on the fact that the virus did not cross over to the Pacific side of western Panama in the 1950's; which in turn is the consequence of a vertical limitation of the mosquito vectors to about 3,000 feet and the very sparse human population in this region. Since there is no major water barrier, however, any such attempt would require the use of herbicides in addition to insecticides. Places where less than 20 km depth from the coast reaches 3,000 feet include the rivers Caño Sucio in Veraguas Province, and Toncri, Chiriquí and Guarumo in Bocas del Toro Province. Estimated time for virus to reach these areas after a Canal crossing is one to two years. A small pilot project on herbicides could be considered carefully by an internationally competent and diverse group of scientists. Recommendations could be evaluated and contingency plans made in the event virus crosses the Canal.

When: We believe that a pilot project to measure effect of ultra low volume (ULV) malathion aerial spraying on mosquito vectors should be carried out as quickly as possible.

How: A highway is under construction across the Cordillera de San Blas about 50 miles east of Panama City. The Continental Divide can be reached with 4-wheel drive vehicles and there is an unused road camp with electric generator at this point. It can handle up to 30 people with small modification to kitchen. Thus we propose to test the effectiveness of ULV malathion in the moist forest (still undisturbed) adjacent to this camp. This location is considered superior to any located closer to the Canal because 1) access and a base camp already exist, 2) cost of mosquito collections is less than in the Canal Zone, and 3) we can maintain simultaneous surveillance for advance of sylvan virus wave there.

The specific plan is as follows:

Test Plots:

A. Size and Construction

Two each, 1 x 2 km containing 18 mosquito stations each. Separated by 1 km, oriented such that both are comparable in relation to Continental Divide and prevailing wind. One to serve as control, the other to be sprayed with malathion 20 oz/hectare at intervals of 14 days, or longer depending on results.

Plot to be laid out with line of sight compass trails to establish corners which shall be marked by long poles with flags, balloons or by spray-painting by helicopters. Three longitudinal trails 300 meters apart to be cut and tree platforms to be spaced along trails at 300 meter intervals. All trails marked with engineers' tape and each platform conspicuously numbered.

B. Operation of Test Plots

1. Eighteen mosquito collectors, to work six days weekly, 0900-1500 hours; capture all mosquitoes attempting to bite.
2. Daily collections at half the stations each plot, rotating collectors as well to randomize data.
3. Baseline. Two collections each station (4 days) with rapid assessment for comparability. One or two more collections if data appear borderline for similarity.
4. Post-spraying. Daily collections until such time as data clearly show that frequency may be reduced. Repeat spraying according to results.
5. Rain gauge at base camp to examine relation between rain falling on forest canopy and mosquito population in control plot.
6. If malathion effect is demonstrated, use of helicon powders to mark mosquitoes captured outside test plot for study of extent and rate to migration into sprayed plot.

7. Operation of 4-6 light traps, Malaise traps, and white sheet samplers in each test plot to assess effect of insecticide on non-target arthropods.
8. Use of caged mosquitoes (*Haemogogus*) to measure immediate effect of malathion. Spray test cards to document actual delivery of insecticide to test plot.

C. Duration and Observation.

If an effect is demonstrable, it is important to continue operations well into the rainy season in order to determine whether control can be maintained during periods of optimum mosquito breeding. Adjustment of spray intervals may be necessary. Possible use of Abate, a potent larvicide, together with malathion will be considered. A 5-month period from April through August is contemplated.

D. Cooperating Agencies.

In addition to various agencies of the Government of Panama, this work can only be done by enlisting help of the U. S. Southern Command, specifically the Surgeon, USARSO, and his Environmental Health Division. We must count heavily also on the Tropic Test Center, Corozal, for assistance in an inventory of canopy tree species in the test plots and for help with basic meteorological measuring equipment. For example, an anemometer is urgently needed at the main campsite to determine the optimum time of day to attempt aerial spraying.

How Much:

Basic costs of the ULV pilot project are included in the overall budget for sylvan yellow fever action. In addition, however, we have learned that about 35 gallons of malathion are required per test application. At \$10/gallon we need \$350 x 10 or \$3,500 plus cost of shipment to Panama. USARSO probably has sufficient material to do at least the first spray.

U.S. Army helicopters may be available if Southern Command is requested to provide them from Washington. If we must rent them the current cost is \$170/hour. During the next 12 months we foresee possible need for 80-100 hours divided between spraying and support of field teams engaged in monitoring virus movement along the forested Atlantic slope. Thus \$17,000 may be needed.

Table 1

Evolution of Antibodies to group B arboviruses in patient E.B.

Date	CF					HI			Neut	
	YF	SLE	GA-7	ILH	D-II	YF	SLE	D-II	YF	SLE
2-12*	64	8	<4	<4	8	40	10	<10	1024	<8
2-13						160	20	<10	2048	<8
2-14	128	<4	<4	4	8	320	80	<10		
2-15						640	160	80		
2-18	512	128	<4			>1280	640	160		
2-20	512					>1280	640	160		
2-22	256									

YF = Yellow fever; SLE = St. Louis encephalitis; GA-7 = Bussuquara;

D-II = Dengue type II

\* Estimated 12 days after onset clinical disease.

B U D G E T

Personnel (new):

Epidemiologist - July 1, 1974 - July 1, 1975	\$ 25,000
Post doctoral scientist - vertebrate ecologist beginning July 1974	10,000
Post doctoral scientist - entomologist beginning July 1974	10,000
Field technicians (2) camp leaders at 3,600	7,200
Laboratory technician - virology	5,000
Laboratory technician - entomology	4,000
Supply technician	3,000
Animal caretaker	3,000
Camp cooks (3) at 2,100	6,300
Field workers - animal (6) at 1,800	10,800
Mosquito collectors 8,000 man days at 4.00 (These are members of Guardia Nacional. Money is for food, special clothing, transport. Salaries paid by R.P. Government).	32,000
Overtime - field and laboratory technicians Aver. 15 hours weekly at aver. \$7/hr.	5,400
Miscellaneous temporary hire guides, field- workers, etc.	3,000
New personnel	<hr/> 124,700

Personnel (Monthly salaries of GMI personnel not  
otherwise supported beyond 1974):

Full time:

Dr. Pauline Peralta	1,700
Teresa Díaz	800
Eduardo Miranda	700
Alonso Espinosa	700
Manuel Correa	650

Half time:

Paula Fábrega	400
Fred Valencia	333
Walter Smith	360
	<hr/> 5,643

Subtotal - Direct salary & wages  
\$5,643 x 6 mos.

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33,900

TOTAL

\$ 158,600

Fringe benefits at 12%

19,032

Equipment

1	4 wheel drive vehicle, long wheel base, winch, self cleaning mud tires	\$ 6,000
8	Liquid N <sub>2</sub> containers, assorted sizes	2,000
40	CDC light traps, 6 volt, with 24 spare motors, bulbs	2,500
2	Generators 1.5 kv 120 v. A.C. 60 cycle	700
2	Portable kerosene refrigerators	500
6	Kerosene pressure stoves	250
9	Kerosene pressure lanterns	270
30	Hunting head lamps	150
2	Refrigerated chill tables for sorting mosquitoes	1,100
18	Monkey cages, stainless steel with racks	4,500
500	Mouse cages, laboratory at 8.00	4,000
200	Portable animal traps, assorted sizes	3,000
24	Mist nets	300
3	Shotguns	300
50	Boxes shotgun shells, 20,16,12,410 gauge	200
2	Small field centrifuges, with heads and Shields at 315	630
1	Outboard motor 20 h.p.	400
	Field radio equipment	1,000
1	Stereoscopic microscope	2,000
		<hr/>
		\$ 29,800
		<hr/> <hr/>

Supplies and Animals:

2000 liter liq. N <sub>2</sub> (as back-up in case of failure GMI plant)	\$ 2,000
Animal food and bedding	4,500
Cell culture media and serum	2,000
Microtitration equipment, serological tests	1,500
Disposable plastic trays, tubes, pipette tips	3,800
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Syringes, needles, vacuntainers, vials for serum	4,200
60 rhesus monkeys-sentinel & experimental at \$100	6,000
100 wild animals various species aver. at \$20	2,000
Miscellaneous	4,000
Misc. - Rental of house in Chepo as supply base	1,200
	<hr/>
T O T A L	35,200

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

Direct salaries and wages	158,600
Fringe benefits at 12%	19,032
Equipment	29,800
Supplies	35,200
Consultant and Travel	3,370
	<hr/>
Total - Direct costs	246,402
Overhead - 43% s & w	68,198
	<hr/>
	<u>\$ 314,600</u>



Annex 3

## República de Panamá

Ministerio de Salud  
Despacho del Ministro  
No. 531/DM

Panamá, 20 de marzo de 1974

Señor  
Pedro Galindo  
Director Adjunto  
Laboratorio Conmemorativo Gorgas  
E. S. D.

Señor Director:

En referencia a su nota del 5 de marzo, relacionada con la necesidad de realizar intentos para detener el progreso de la onda epidemiológica de Fiebre Amarilla selvática que ha mostrado actividad en el área del Bayano.

En consideración a la posibilidad de que en la estación lluviosa de 1975, el virus cruce el canal y se dirija a Centro América, en donde existen varios países infestados de *Aedes aegypti*, hemos tomado la decisión de autorizar la ejecución del primero de los dos planes propuestos consistente en la utilización de rociados de insecticidas en volúmenes ultrabajos en la faja estrecha de la Cordillera de San Blas.

Por razones que hemos discutido ampliamente no consideramos prudente la utilización de métodos más drásticos, como la defoliación, ya que las consecuencias no son del todo predecibles y debemos en todo caso preservarla como medida de urgencia extrema.

Como quiera que el plan que debe desarrollarse, requiere fondos no presupuestados, agradeceremos se nos mantenga constantemente informado de las fuentes de financiamien-

- 2 -

20 de marzo de 1974

531/DM

to de esta operación y de sus progresos

Con toda consideración y aprecio,

  
Dr. ABRAHAM SAIED  
Ministro de Salud, a.i.

c.c. Excelentísimo Señor Ing. Demetrio B. Lakas, Presidente  
de la República.  
General Omar Torrijos Herrera, Jefe de Estado, Coman-  
dante Primer Jefe de la Guardia Nacional  
Doctor Nicolás Ardito Barletta, Ministro de Planificación  
y Política Económica  
Doctor Everardo González G., Director General de Salud



Annex 1-

Department of State

TELEGRAM

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PAGE 01 PANAMA 01609 201553Z

72

ACTION INT-08

INFO OCT-01 ARA-16 ISO-00 COA-02 AID-20 CIAE-00 INR-10

NSAE-00 PA-04 RSC-01 USIA-15 PRS-01 SPC-03 SCI-06

OMB-01 TRSE-00 DRC-01 /089 W

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024536

R 201500Z MAR 74  
FM AMEMBASSY PANAMA  
TO SECSTATE WASHDC 146

UNCLAS PANAMA 1609

E.O. 11652: N/A  
TAGS: RENV. THYD. PN, US  
SUBJECT: YELLOW FEVER CONTROL PROGRAM

REF: STATE 32267

1. ACCORDING TO OFFICIAL OF GORGAS MEMORIAL INSTITUTE-MIDDLE AMERICA RESEARCH UNIT, ULTRA-LOW VOLUME SPRAYING OF INSECTICIDES IS BEING PROPOSED AS AN EXPERIMENTAL METHOD TO CONTROL SPREAD OF OUTBREAK OF JUNGLE YELLOW FEVER FROM BAYANO RIVER AREA OF DARIEN PROVINCE TO PANAMA CITY AND CANAL ZONE AREAS. DEFOLIATION NOT REPEAT NOT PLANNED.
2. PANAMA'S MINISTER OF HEALTH IS IN CHARGE OF PREVENTION OF SPREAD OF JUNGLE YELLOW FEVER. ADDRESS IS MINISTRO DE SALUD PUBLICA, APARTADO 2048, ZONA 5, PANAMA, R.P.
3. FUNDS MAY BE REQUESTED THROUGH AID TO ASSIST WITH PROJECT, BUT AMOUNT NOT YET DETERMINED.  
DANIELS

UNCLASSIFIED

40

Annex 5

April 1974

Dr. Ernest Feigenbaum  
USAID/Panama  
U. S. Embassy  
Panama, R. P.

Dear Dr. Feigenbaum:

Regarding the proposal of Gorgas Memorial Institute to study and attempt to intercept the jungle Yellow Fever wave now moving westward toward the Panama Canal, I would like to stress the importance that such a measure would have on the health of the people of Central America, the Caribbean islands and the Southern U.S.A.

As you are well aware, if the progress of the virus is not interrupted it will invade areas surrounding International Airports and the Panama Canal from where infected mosquitoes or humans might be carried to Caribbean islands or the southern U.S.A. where there are high population densities of Aedes aegypti, thus opening the possibility of urban outbreaks of the disease.

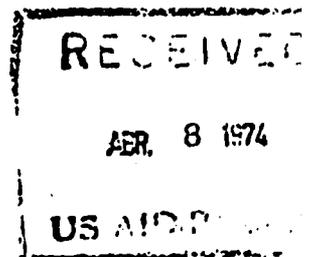
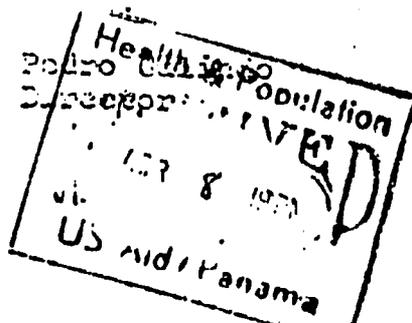
If the virus manages to cross the Panama Canal it will eventually reach some Central American countries that also have high indices of A. aegypti, like Honduras and El Salvador, endangering the lives of thousands of people. It will also place in jeopardy the lives of many country folk in Costa Rica, Nicaragua and Guatemala that live along the pathway which the wave will follow.

Panama represents the logical place to try measures to interrupt the progress of the wave because of the narrowness of the forest belt through which the virus will have to move and because of the fact that existing facilities in the area make the logistics of the project more feasible, thus lowering the costs of the operation.

Sincerely,

20/15c

cc: Director, GMI-YARU  
President, GMI



5-25-

# GORGAS MEMORIAL LABORATORY

CABLE: GOMELA

TELEFONO  
28-6850

APARTADO 699  
PANAMA S. R. DE I

April 1, 1974

Mr. Bernath Chapnick  
Program Officer  
Agency for International  
Development  
E. S. D.

Dear Mr. Chapnick:

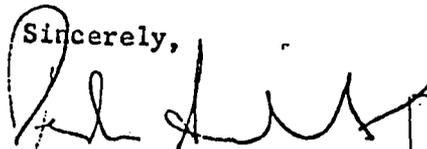
Attached please find estimates of the contribution of Gorgas Memorial Laboratory and the Middle America Research Unit of Gorgas Memorial Institute to Yellow Fever Research and Jungle Yellow Fever Surveillance Service during the present calendar year. If AID approves the proposal the direct salary costs would decrease in \$47,250 during 1975. This sum will be absorbed by the proposal.

I am also including the Panamanian Government cost for Aedes aegypti control. This figure does not include ancillary help obtained from personnel of the SNEM and from Environmental Health inspectors which is impossible to quantify.

Regarding the vaccinating effort we expect that during the present calendar year Panama will spend no less than \$100,000. This sum will be considerably lower as vaccination of the entire population approaches its goal during 1975.

The Pan American Health Organization has also made contributions in vaccines and other items. These figures can be easily obtained by Dr. Lee Howard in Washington.

Sincerely,

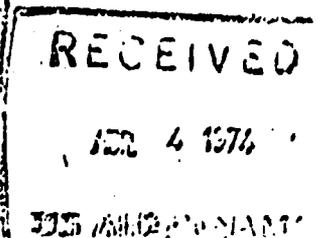
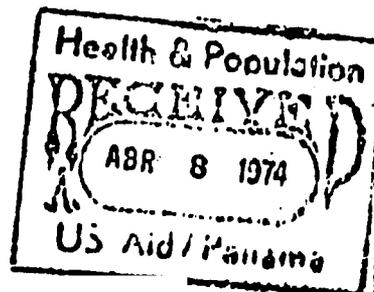


Pedro Galindo  
Director

PG/maf

cc: President GMI  
Director GMI-MARU

ACTION
<del>W. C. D. J. P.</del>
DUE 4-14-74
TAKEN



GMI DIRECT CONTRIBUTION TO YELLOW FEVER RESEARCH AND  
JUNGLE YELLOW FEVER SURVEILLANCE SERVICE.

Sum Already Spent (February and March 1974)

Personnel	\$ 6,065
Supplies	<u>9,450</u>
Total:	<u>\$ 15,515</u>

Budget April-December 1974

Personnel:

Direct salaries professional and technical \$ 72,250  
Indirect laboratory support and administration  
(Estimated 30% of total laboratory effort) 133,000

Supplies:

None. All are included in project proposal.

Equipment:

Capital equipment of laboratory valued  
at \$700,000

Depreciating this over 7 years value  
used up under project will be approxi-  
mately: 30,000

Depreciation laboratory vehicles: 7,000

Total GMI contribution: \$242,250

Republic of Panama expenditure for Yellow Fever Control

Anti-Aedes aegypti Campaign

Budget for 1974 for eradication campaign \$ 327,451

Estimated Annual  
Budget 1975 through 1979 for vigilance after eradication 250,000 (anually)

Vaccinating Campaign

Approximately cost 1974 \$ 120,000

Subj: Panama

EMBAJADA DE PANAMA  
WASHINGTON

APR 11 3 26 PM '74  
EXECUTIVE SECRETARIAT

jh Due 4/22/74 *ANNEX 6*  
ACTION: AA/LA for Parker sig.  
INFO: Parker log  
Williams log  
AA/TA

E.P. EUA-309 V

April 8, 1974

*Howard*

Mr. Daniel Parker, Administrator  
Agency for International Development  
Department of State  
Room 5942  
Washington, D.C. 20523

Dear Mr. Parker:

My Government is in receipt of a copy of the proposal submitted by the Gorgas Memorial Institute to the Agency for International Development for a project to attempt to intercept the movement westward of the yellow fever wave which is to be conducted by the Institute's research scientists in Panama.

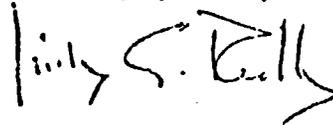
Through our Health Minister, Dr. Abraham Saied, my Government has given its approval to said proposal by letter of March 20, 1974 to the Gorgas authorities. I would like to reiterate that, in light of the danger which the advancement of the wave poses to the people of Central America, the Caribbean Islands and southern United States, my Government not only endorses fully the proposal as noted above, but also stresses hereby its importance and urgency.

The potential for an explosive epidemic of yellow fever in regions as above noted is greatly enhanced by the fact that the yellow fever mosquito, Aedes aegypti, is more prevalent in some populated areas than it has been at any time in the past ten years. As you know, it is the presence of the mosquito which creates such a large risk in the presence of a human case of yellow fever.

- 2 -

Your favorable consideration of the  
Gorgas proposal will be appreciated.

Sincerely yours,

A handwritten signature in black ink, appearing to read "Nicolás González-Revilla". The signature is stylized with a large, sweeping flourish at the end.

Nicolás González-Revilla  
Ambassador

PROJECT DESIGN SUMMARY  
LOGICAL FRAMEWORK

Life of Project: \_\_\_\_\_  
From FY 1973 to FY \_\_\_\_\_  
Total U. S. Funding \_\_\_\_\_  
Date Prepared: \_\_\_\_\_

Protection of the Human Environment During  
Project Title & Number: Ecologic Change Associated with Rural Development and Capital Construction in Tropical Areas

NARRATIVE SUMMARY	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	IMPORTANT ASSUMPTIONS																				
<p>Program or Sector Goal: The broader objective to which this project contributes: Protection of the human environment from biological hazards during ecologic change associated with rural development and capital construction in tropical areas.</p>	<p>Measures of Goal Achievement: Reduction of prevailing insect borne diseases among rural farmers, migrants and laborers.</p>	<p>Diagnosis of disease prevalence by epidemiological and laboratory methods.</p>	<p>Assumptions for achieving goal targets: Awareness of the potential biological hazards of environmental change associated with rural development and capital development programs will lead to application of proven low cost methods for insect borne disease prevention.</p>																				
<p>Project Purpose: 1. To determine practical alternatives to protect human populations exposed to risk multiple insect borne diseases as consequence of environmental change. 2. To determine practical alternatives for interrupting the westward spread of jungle yellow fever. 3. To determine alternate transmission cycles for jungle yellow fever.</p>	<p>Conditions that will indicate purpose has been achieved: End of project status. 1. Confirmation of alternative methods to protect rural populations and laborers. 2. Tests of ULV malathion and other methods will be documented. 3. All jungle canopy fauna will be tested for potential yellow fever transmission.</p>	<p>1. Virological and entomological laboratory confirmation. 2. Entomological and laboratory confirmation. 3. Viral and entomological studies.</p>	<p>Assumptions for achieving purpose: GML has professional competence to identify wave, determine alternative method of interruption. There is possibility that there are other transmission cycles in the forest canopy besides monkey-hemagogus.</p>																				
<p>Outputs: 1. Identification of yellow fever, wave location and speed of travel. 2. Demonstration of effectiveness of ULV malathion on canopy <u>Hemagogus</u> and other potential transmitters. 3. Determination of ecologic factors contributing to yellow fever transmission. 4. Recommendation on time &amp; place of yellow fever wave interruption. 5. Recommendations on practical measures to reduce environmental risk from insect borne disease in rural and forest setting.</p>	<p>Magnitude of Outputs: 1. Measurement and mapping of virus in wild and sentinel monkeys. 2. Measurement of pre and post treatment insect populations in test and control areas. 3. Viral tests on canopy insects and animals. 4. Provide report to GOP. 5. Provision of report, findings, observations and recommendations.</p>	<p>1. Laboratory viral tests field observation of animal movement. 2. Entomological verification of kill. 3. Viran, entomological, field observations. 4. Report transmitted to GOP. 5. Completed report to AID.</p>	<p>Assumptions for achieving outputs: ULV malathion known to penetrate forest but effect on canopy insects not known. Measures controlling insect transmission in Panama will be applicable in other parts of the world.</p>																				
<table border="0"> <tr> <td>Inputs:</td> <td>Budget</td> </tr> <tr> <td>1 Gorgas Memorial Laboratory</td> <td>\$242,250</td> </tr> <tr> <td>    Lab. facilities</td> <td></td> </tr> <tr> <td>    Field and Lab. Staff</td> <td></td> </tr> <tr> <td>2 Government of Panama</td> <td>15,000</td> </tr> <tr> <td>    Malathion (plus 800 mandays labor)</td> <td></td> </tr> <tr> <td>3 PAHO (Consultant to GOP)</td> <td>20,000</td> </tr> <tr> <td>4 U.S. Army (Canal Zone)</td> <td>17,000</td> </tr> <tr> <td>    Use of helicopters</td> <td></td> </tr> <tr> <td>5 AID (for GML staff, equipment and supplies support)</td> <td>314,130</td> </tr> </table>	Inputs:	Budget	1 Gorgas Memorial Laboratory	\$242,250	Lab. facilities		Field and Lab. Staff		2 Government of Panama	15,000	Malathion (plus 800 mandays labor)		3 PAHO (Consultant to GOP)	20,000	4 U.S. Army (Canal Zone)	17,000	Use of helicopters		5 AID (for GML staff, equipment and supplies support)	314,130	<p>Implementation Target (Type and Quantity) (From Square Above) 1. June 1975 2. October 1974 3. June 1975 4. At anytime during 1975 5. June 1975</p>		<p>Assumptions for providing inputs: GML will continue to have full endorsement and support of GOP, PAHO, and U.S. Army in this effort.</p>
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