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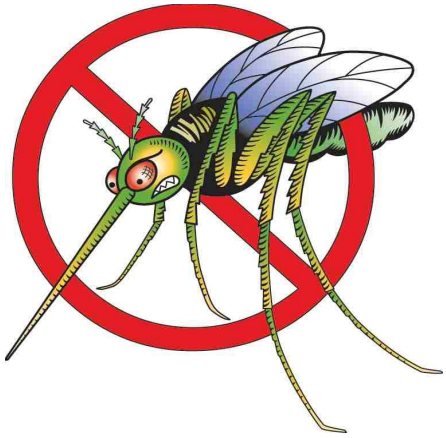

# THE IMMC CONSORTIUM

## INTEGRATED MOSQUITO AND MALARIA CONTROL

A comprehensive integrated mosquito and malaria control program to reduce the incidence of malaria, and other insect spread diseases.

## EXECUTIVE SUMMARY
## INTERNATIONAL

July 2006

DRAFT – FOR DISCUSSION ONLY

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# INTEGRATED MOSQUITO AND MALARIA CONTROL CONTEXT

***THIS DOCUMENT IS PART OF A SERIES THAT INCLUDES THE FOLLOWING:***

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# INTEGRATED MOSQUITO AND MALARIA CONTROL
# INTRODUCTION AND OVERVIEW

An estimated 500 million cases of acute malaria occur worldwide each year, mostly in Sub-Saharan Africa (SSA). There more than 1 million deaths a year from malaria, primarily among infants and young children. Every 3 minutes a child dies of malaria, or about 3,000 children a day. Malaria is not only a killer of children, but is a debilitating disease for adults.

This is not the situation that was expected when projections were being made in the 1940s, 1950s and 1960s. It was reasonably expected that malaria was going to be reduced to a disease of virtual insignificance. Malaria had been overcome as a constraint to the construction of the Panama Canal, malaria had been reduced significantly in Europe and the USA prior to WWII and then practically eliminated between 1946 and 1950, and malaria was substantially reduced almost all over the globe. Most of Africa, and some other low income countries, however, were not part of the progress through the 1960s, but it was expected that this would come in due course.

But policies changed, and the rapid progress did not continue through the 1970s, 1980s and 1990s. A large part of this was the discontinuance of DDT use as an anti-mosquito pesticide, and aggravated by limited funding for malaria by the international relief and development sector and poorly managed malaria control interventions that increased resistance in both the mosquito and the malaria parasite.

In the last few years, there have been growing efforts to address the malaria crisis again. Since 2000, fund flows have substantially increased but it is not clear that the resources are being used in the best possible ways, and a lot of places where malaria is endemic are not getting a fair share of the available resources.

The IMMC Consortium has been established to provide (1) a framework of management information that will help make malaria interventions more effective, and (2) to provide operational capacity that can be easily mobilized to implement a large scale cost effective integrated mosquito and malaria control (IMMC) program.

The IMMC Consortium is organized so that it is effective in terms of both geography and functionality. The goal is to make IMMC support available when it is needed, where it is needed and at an affordable cost.

The IMMC Consortium is made up of: (1) Tr-Ac-Net Inc. (The Transparency and Accountability Network) with a focus on management information; (2) West Coast Aerial Applicators (WCAA) specializing in aerial operations and pest control, (3) ADAPCO, pesticide experts and consultants, (4) Acroloxus, experts in wetlands management; (5) Africa Fighting Malaria, experts in mosquito and malaria control; and, (6) an IMMC team of expenenced entomologists. Together, the IMMC Consortium has expertise in operational matters, in management information and scientific analysis, which are all required together for success in mosquito and malaria control.

The following are estimated costs for an IMMC program as described with a single country operation established in Liberia.

| **Estimated Investment and Operating Costs**<br>In thousand dollars ($ 000) | | | | | | |
|---|---|---|---|---|---|---|
| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | 5 Year Total |
| IMMC coodinating unit | 100 | 100 | 100 | 100 | 100 | 500 |
| Management information unit | 400 | 400 | 400 | 400 | 400 | 2,000 |
| Regional aerial operations unit | 2,500 | 1,000 | 1,000 | 1,000 | 1,000 | 6,500 |
| Liberia TOTAL | 10,000 | 7,500 | 7,500 | 7,500 | 7,500 | 40,000 |
| Contingency | 1,000 | | | | | 1,000 |
| **TOTAL** | **14,000** | **9,000** | **9,000** | **9,000** | **9,000** | **50,000** |

In addition there is a capital cost estimated as follows for the first year:

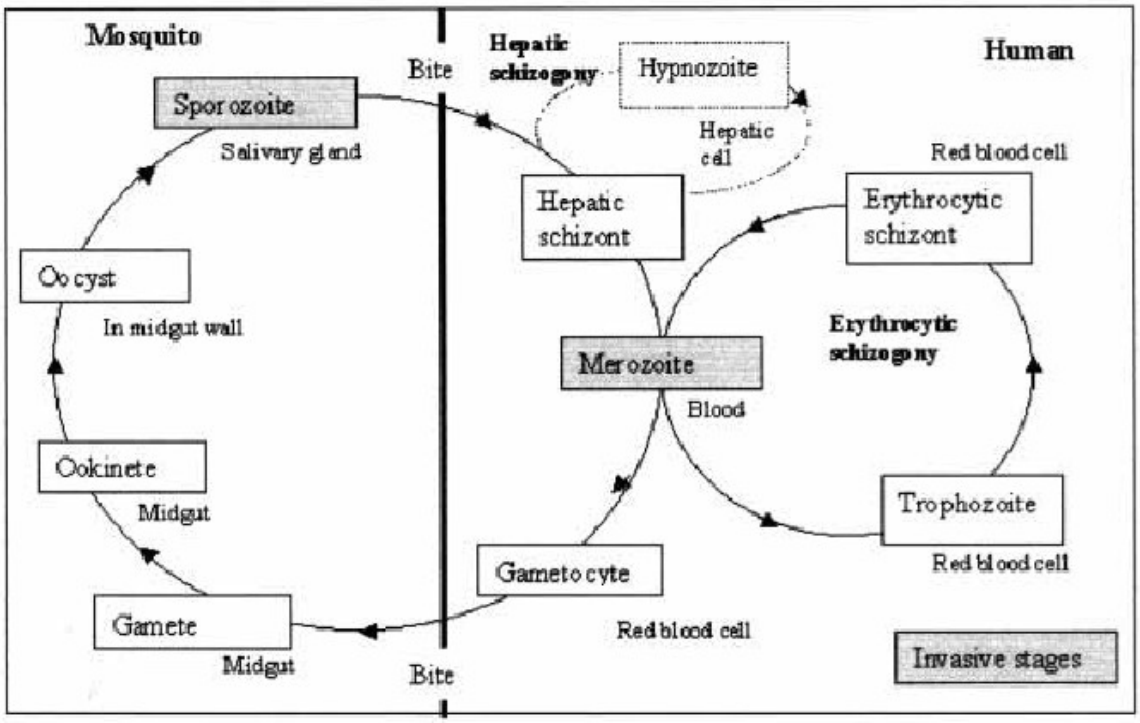
| **Year 1 Capital Costs (including working capital)**<br>In thousand dollars ($ 000) | |
|---|---|
| International (mainly ICT) | 300 |
| Aircraft, vehicles and other equipment | 2,000 |
| Buildings, vehicles in Liberia | 1,500 |
| Working captial | 700 |
| Contingency | 500 |
| **TOTAL (Year 1)** | **$4,000** |

## CAVEAT

The numbers set out above are preliminary. The detailed calculations and projections are being revised and the summary tables will be updated as soon as the projection information is available. The cost projections will change substantially depending on the scale of the work that is undertaken. Additional country progams will increment the total cost by an amount similar to the Liberia amount above (Liberia has a population of about 3 million) for each incremental 3 million people to benefit.

# THE DYNAMICS OF THE DISEASE
# MOSQUITOES, MALARIA AND IMMC INTERVENTIONS

The problem of malaria is a function of the mosquito, the malaria parasite and human physiology. The biting of a mosquito joins the three elements together.




From:

**The malaria parasite**

When a mosquito bites an infected person, it ingests microscopic malaria parasites *(Plasmodium vivax)* found in the person's blood. The malaria parasite must grow in the mosquito for a week or more before infection can be passed to another person. If, after a week, the mosquito then bites another person, the parasites go from the mosquito's mouth into the person's blood. The parasites then travel to the person's liver, enter the liver's cells, grow and multiply. During this time when the parasites are in the liver, the person has not yet felt sick. The parasites leave the liver and enter red blood cells; this may take as little as eight days or as many as several months. Once inside the red blood cells, the parasites grow and multiply. The red blood cells burst, freeing the parasites to attack other red blood cells. Toxins from the parasite are also released into the blood, making the person feel sick. If a mosquito bites this person while the parasites are in his or her blood, it will ingest the tiny parasites. After a week or more, the mosquito can infect another person.

**The mosquito life cycle**

The female *Anopheles* mosquito carries and transmits the malarial parasite during blood feeding at the adult sexual stages. The mosquito is an uninterrupted individual feeder and is predominantly a night biting insect. The *Anopheles*

mosquito lays eggs that hatch in shallow, warm, slow moving or relatively still water. Any site that holds rain water or permanent standing water for one week or more is ideally suited for breeding. The gestation period is approximately twenty to twenty-one days. In dry conditions, eggs may last up to five years, waiting for water to trigger the larval and pupal stages. One report noted that, in an area the size of a football field, over one million eggs can be found. The number of mosquitoes in relation to the number of human targets is overwhelming. Mosquito broods may peak during any season and the vector's ability to strike is continuous, chronic, and acute.

To add to the challenge, malaria can be imported into the control area. An adult mosquito riding on slight breezes can travel up to fifty miles from its point of origin. People carrying malaria can migrate into the area, bringing with them new parasites to add to the vector's source of infected hosts. The combination of many factors makes the malaria situation an epidemic by any standard, and the situation will be resolved only by all-out intervention.

**Impact on human beings**

Malaria can easily kill children who have not yet developed any sort of immunity against the malaria parasite. Also pregnant women with low levels of immunity have a higher incidence of contracting the disease, and many die. Placental parasitemia causes not only lower birth weights, but entire lives of increased susceptibility to illness. Exposure to malaria during childhood seems to provide some immunity to the disease in adults. Some scientists express concern that successful programs to control malaria during childhood will reduce adult resistance to the disease with seriously adverse consequences unless there are perpetual control programs for mosquitoes and malaria.

**Control of mosquitoes and malaria**

Without mosquito bites, malaria does not get transmitted. Without malaria in the human host, a mosquito does not pick up malaria, and if the mosquito does not have malaria, then a mosquito bite does not transmit malaria. The control of mosquitoes and malaria is therefore best done in coordination. A simulation model suggests that an integrated comprehensive coordinated mosquito and malaria control program can be substantially more efficient and cost effective than any single intervention on its own.

The IMMC Consortium is organizing to get results. The first step is to have access to world class expertise that can focus totally on helping to get the best possible results. Several organizations are making available their skills and experience so that the IMMC Consortium can deliver on its aims.

An IMMC program is going to be successful when data, decisions and IMMC activities are coordinated in the most efficient manner. A simulation and planning model has demonstrated that the various possible IMMC interventions require significantly different scale and organizational structure to optimize costs and deliver best results. The simulation, as well as expertise, also shows that timing is critical to optimizing results and getting the most value from money spent.

The IMMC Consortium has two primary areas of focus: (1) a management information dimension; and (2) support for practical IMMC interventions.

# THE IMMC CONSORTIUM
# MANAGEMENT INFORMATION

The management information dimension integrates the scientific and operational data with costs and results information to form an integrated whole. The management information dimension of development has the potential to make a very substantial improvement in performance because decisions can be more fully based on relevant information, and results can be reported in a timely way to all the stakeholders. The IMMC Consortium combines a respect for old fashioned accounting and ethics with respect also for the enormous potential of modern information and communications technology (ICT) and its capacity to process data, do analysis and provide timely reporting anywhere with ICT access. The critical questions to be answered are: (1) what did the intervention cost; (2) what results were achieved; and, (3) is there a way of getting better results at less cost.

The management information system can be used in support of any practical control intervention, whether or not the intervention is operated by the IMMC Consortium. The aim is to develop and have good management information that is easily accessible so that results can be optimised. The management information used by the IMMC Consortium will change as the programs mature, and provide the best possible information to continue to improve performance, to get the best results for the least possible cost. Some characteristics of good management information include (1) timeliness; (2) clarity; (3) consistency; (4) relevance; and, (5) materiality. If results improve and seem to be the best possible, then, arguably the management information is serving its purpose.

**What data already exists**

The starting point for the IMMC Consortium work is to collect and organize existing data so that it is easier to understand and to have a baseline and starting point. A lot of data are already available, and these data should be supplemented and updated as needed. There are several sets of data that are needed: (1) entomological data concerning the mosquito population and its breeding locations; (2) geographical or spatial information about the community ... population, buildings, water, etc; (3) medical information about malaria in the community and how cases are being treated (if at all); (4) the actual IMMC interventions that have taken place and where; and, (5) updates of all the information so that results can be compared to activities.

The data that has been collected in the past is difficult to use. It is not easily accessible and there is little common principles in the way the data are compiled. Much of it is inaccessible because it is in non-public systems. The data are often merely survey sets designed for a single stand-alone analysis and not part of a broader information program. To the extent that initiatives like the MARA program have compiled data, the IMMC Consortium will seek to make best use of the data rather than setting up to replicate existing work.

**Collecting new data**

The collection of new data and its organization so that it is easily available for

analysis and planning can be done now using a combination of low cost local data collectors and the low cost and power of modern information and communications technology (ICT). The IMMC program pulls together a lot of data that have been collected in the past, as well as current data to provide a starting point for planning. The IMMC process then continues data collection, analysis and planning to ensure that IMMC interventions are as effective as they can be and low cost.

The information that is critical to measuring IMMC performance is founded on data that are collected “on the ground”. Timely information about the mosquito population and the environment are needed. The success of IMMC is determined in large part by the entomological data that is collected and the analysis of this data to design effective interventions. This is where the data originate ... in the field:

The value of the data is maximised by using it in ways that help planning for the best possible IMMC interventions, and using the data to understand what is working and what is not. The data has a lot of value if it can be used in a timely manner, and in a mosquito / malaria system that changes significantly from day to day, daily data can be very valuable.

Powerful management information is obtained when the data collected from the field is matched to the cost and timing of IMMC interventions. At one level this is very basic accounting, but it is also the raw input for the IMMC simulation models that make optimization possible.. Note that the cost data from accounts must not under any excuse be delayed, and if necessary cost accounts can be run independent of the financial accounts to get timely information.

**Spatial information.**

Modern information tools can be used, especially modern GPS for spatial information and development of simple useful geographic information. It is very clear that major improvement in performance can be achieved by getting IMMC focus on situations where mosquitoes and malaria are the worst, and the need for intervention greatest. Research work has been done for more than 20 years on various aspects of remote sensing and the development of sophisticated

geographic information systems (GIS). Some of this work might be very valuable in a practical implementation if it can be used to help focus interventions on very specific areas of need.

We know that spatial information is useful in a general way. For example, the following are satellite images of Monrovia, Liberia. One image shows all of Monrovia, and the location of a tidal marsh running through the center or the city. The other is a section of the city at higher resolution that shows individual houses.



On the all Monrovia image, the area within the yellow line is 50,000 acres, and the dark brown area is about 15,000 acres of tidal marsh right in the middle of the city where mosquitoes breed prolifically. The higher resolution image shows individual houses and it is possible to relate specific IMMC interventions to very specific areas of the city, and measure results.

**Basic cost information, results and value adding**

The IMMC management information system is built on concepts that have a proven track record for totally reliable accounting systems. There are daily transactions that show either status or activity, and an analysis system that links the two and produces timely analysis reports. The analysis reports can be used locally for practical decision needed for local purposes, or can be summarized for broad overview analysis or for comparative purposes.

The single metric that needs the most focus is the relationship between cost and the results achieved ... with result being, more than anything else the reduction in the prevalence of malaria in the area population.

Getting cost information, and knowing what the money is being used for is very basic cost accounting, but it is vital, and must be done in a rigorous manner following sound accounting principles and done in a timely manner. The decision makers should know all the time how much each of the IMMC interventions are costing and what results are being achieved, both in terms of the mosquito population, the larva population and malaria prevalence in the human population.

A number of cost analysis techniques should be used including the standard costing technique that measures the actual costs incurred and compares these costs with the costs that are expected from the interventions implemented and the time and scale of the interventions. The same technique can be applied to results being achieved.

Another technique for analysis that will be used is to compare results being

achieved and their costs with the cost and results of a simulation model that is being used by decision makers. The aim of this simulation model is to help make good timely decisions about intervention actiivity so that optimized results can be achieved.

**Using an easily accessible relational database**

In order to make access to information as easy as possible, a relational database is being established that will be web accessible for all IMMC analysts. The goal of the database is to make it possible to track performance both as a time series and across different locations, and using different sets of interventions.

The same data are needed for detailed analysis at the community level and to assess performance on a global basis and to provide cross country and time series information. However, the data needs to be accessed in different ways so that specific activity optimization can be done at the community level, and at the macro level there can be decision support for the mix of interventions that is optimum and how resources should best be analyzed.

**Simulation models**

Sumulation or planning models are being developed so that critical variables that affect the dynamic of the mosquito and malaria can be studied with easy to understand “what if?” simulations. The model attempts to relate cost with result, on top of calculations that reflect the underlying science. The model includes costs, scale of interventions and results and helps decision making about what might work, how much it is likely to cost and what results should be expected. The model is in an early version, and has not yet been tested against a lot of field information, but initial indications are that a combination of interventions is very much more cost effective than any single intervention carried out on its own.

**Training, oversight and organization for information management**

The best information is always information that is USED. A lot of detailed operating information will be collected because it is needed to make decisions. It is needed on a timely basis, and it needs to be right so that good decisions can be made. Local people need to be engaged to collect information, and local organizations should have oversight responsibility for the quality of the data, and accordingly, also some considerable responsibility for the success of the program.

Local telecenters can also be involved in the data collection process and the communication of these data into the database and management information system.

Data from different locations can be compared and lessons drawn from the relationships between costs and results.

The “business” relationship between all the various organizations that need to be engaged will evolve. The underlying principle is that local people should be involved to the largest extent possible, and remunerated on a basis that is reasonable and related to their capabilities and the value of work.

# IMMC CONSORTIUM INTERVENTIONS
# OPERATIONAL SUPPORT FOR IMMC INTERVENTIONS

The practical IMMC interventions include: (1) community awareness, education and training; (2) neighborhood cleanup to reduce mosquito breeding places; (3) interior residual spraying (IRS); (4) ultra low volume (ULV) external adulticide spraying to kill flying mosquitoes; (5) mosquito larva control to kill larvae and stop mosquito recruitment into the population; (6) personal use of insecticide treated bednets (ITN); and, (7) malaria treatment.

**Community awareness, education and training.**

The community is where success is best measured, and it is community people that will benefit the most from success. Everyone from an early age needs to be made aware of malaria, and how it can be controlled. A lot of what is needed to have success depends on the community. There are many ways that local organizations, schools, churches, health centers, etc can be engaged in the IMMC program.

The community is the key to success because people live in communities, and progress can be best measured at the community level. However, the challenge of involving the community should not be underestimated. People have a lot to do just to survive, and while malaria may be critical health issue, it may not be recognised as a health issue that is in any way in the local community's control.

**Neighborhood clean up**

Community level efforts to reduce mosquito breeding places is valuable. These can be organized through schools, churches, women's groups either as independent efforts or as part of a comprehensive set of activities. Reducing mosquito breeding places is a simple way to start getting control of the mosquito population. If the community is organized to help with clean up, and to remove places where mosquitoes can breed, they also learn about other aspects of the malaria problem.

The involvement of local people in clean-up can be on any basis that suits the local situation. It can be a government sponsored program with remuneration, or a “Food for Work” program with resources from the World Food Program (WFP), a program funded by Faith Based Organizations or a totally volunteer program. The key is involvement that helps people help themselves and understand the way in which the whole program is aiming to help the community.

**Interior residual spraying (IRS)**

The use of interior residual spraying (IRS) has been successful in many different settings, from South America to South Asia, in the Mediterranean region and in South Africa. IRS requires workers to enter houses and do the spraying according to a protocol that is safe for residents and the spray teams.

IRS works through three mechanisms: (1) there is a repellent action that keeps mosquitoes out of the house; (2) there is an irritant action that makes a mosquito leave a house quickly after entering; and, (3) a toxic action that kills the mosquito if it chooses to rest in the house. Broadly speaking, the size of the mosquito population is not affected by an IRS intervention, but behavior is modified so that there is less human blood meal taking by the mosquitoes. In an area where there is a substantial IRS intervention, the mosquito population moves outside, where it can be effectively subject to adulticide control.

IRS is most effective when DDT is used is the pesticide, but DDT use is resisted by some national authorities. Other pesticides can be used but they cost more and are less effective. Nevertheless, according to some peer reviewed reports, IRS is more than 3 times more cost effective that ITN is reducing the number of malaria cases in a community.

IRS requires a well trained team of sprayers in order to get good coverage. The training takes time, and the salary costs are substantial.

**Ultra low volume (ULV) adulticide spraying.**

Adulticide treatment is commonly used where public health authorities are concerned about the possibility of insect borne disease. In the USA, large areas where sprayed in the aftermath of Hurricane Katrina, and similar interventions have been used after other devastating hurricanes in the USA. Spraying is widely used when West Nile Virus is detected in US communities. Spraying has a role in getting control of mosquito vectors in malaria endemic areas.

The purpose of adulticide spraying is to kill adult mosquitoes. The ULV approach kills mosquitoes mainly when they are flying. The droplets, which are about 50 micron in diameter, attach to the mosquitoes legs. The concentrations of pesticides used are very low, for example: about ¾ oz of Dibrom pesticide is used per acre.

Adulticiding can be done from the air, using vehicle mounted equipment or using hand held equipment. The aircraft used for ULV spraying are very maneuverable, and suited to flying with very precise positioning and they are also equipped with spray equipment that enables them to generate very small spray droplets just microns in size.

Spraying by air is the lowest cost per acre when large areas have to be treated. Spraying by air also makes it possible to have a quick impact over a very large area. The results of the IMMC operation simulation show the importance of timeliness and speed, and argues for rapild aerial treatment as a key component of an integrated coordinated program. Vehicles can also be quite cost effective where there is good road access. Hand adulticiding is very costly for large programs.

All pesticide use must be done under controlled conditions with strong safety protocols in place. Used in the manner intended, the pesticides and biological agents used are highly toxic to mosquitoes, but safe for humans, animals and the environment. Compared to many of the chemicals used in treatment of malaria and other human diseases, the pesticides have low human toxicity. ULV adulticiding is a safe way of reducing the mosquito population and is used regularly around the world under protocols that ensure safety for people, animals and the environment.

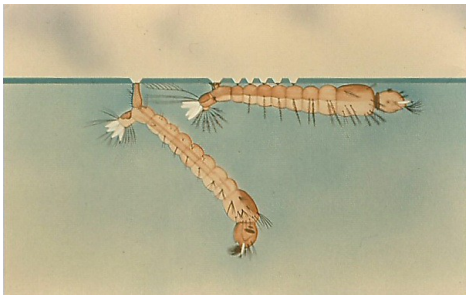
**Larviciding and environmental control**

Mosquito population control is best when mosquitoes are never recruited into the flying adult population. Mosquitoes lay eggs in stagnant water, and in a matter of days eggs become larvae, become pupae and then adult flying mosquitoes. The picture below shows what larvae look like, and how they attach themselves to the surface of the water.

There is a high natural mortality in the stages between egg and adult mosquito, and natural mortality can be supplemented by larvicide control measures to stop all the recruitment from the water body. For larviciding to be effective, there needs to be accurate and timely knowledge about the water bodies and the status of the mosquito larvae ... and interventions to control the larvae need to be scientifically suitable and timely. The use of well organized local data collection in combination with modern ICT, and easy access to the required intervention helps to have IMMC success.

The images below show mosquito larvae. The examples hanging vertically are

probably Culex larvae. The Anopheles larvae attaches itself horizontally to the surface of the water as shown in the right hand image.



The success of larviciding has been demonstrated over and over again, but it requires a lot of organization. Precise data are needed, timely intervention and well trained staff. Some bodies of water are difficult to access, and larviciding can be done by air. In some places helicopters are used for very precise delivery of treatment.

The environment makes a big difference to the recruitment of mosquitoes into the population. The data seem to suggest that man-made construction has a big role in creating the sort of environment that encourages mosquito breeding. Natural water is often associated with natural vegetation that seems to inhibit mosquito breeding. While the mechanism is not known, the idea that mosquito breeding varies spatially argues for precise information about the spatial entomological situation, and the precise interventions for each place.

**Bednets and insecticide treated textiles**

Bednets, insecticide treated nets (ITN), are another intervention that should be part of a comprehensive anti-malaria campaign. The model being used for IMMC planning has not been able to demonstrate that bednets on their own are as cost effective as other IMMC interventions, but they do have a favorable impact for the people who choose to use bednets.

The model suggests that bednets in fact have a potential value to help reduce the transmission of malaria from infected humans to others, and could be used to

facilitate a form of quarantine for infected patients.

Long lasting insecticide treated bednets have been introduced in Africa since around 2003. These nets retain their effectiveness for about 5 years. The bednet shown below is being used in Uganda.

Data regarding the effectiveness of bednets seems to show that a bednet reduces the risk of malaria infection for the users of the bednets, but has no appreciable impact on the community as a whole that does not have bednets. This is in contrast to IRS, where the community at large seems to benefit from an IRS program, even where less than all the houses are sprayed.

Insecticide treated textiles can be used to manufacture clothes. The technology has been used already for military uniforms for soldiers being deployed in malaria endemic areas. The approach might be used in an IMMC program for uniforms for "Malaria Control Teams" as well as for the various uniformed services of countries in malaria endemic areas.

**Malaria treatment**

There are many millions of malaria cases in Africa every year. Many Africans get malaria several times a year. Only relatively few of the malaria cases in Africa get any form of professional treatment. Data that only comes from clinics is a subset of data that is not representative of the population as a whole.

With 400 million at risk, it is difficult to comprehend that each case has a human face. This child got to a clinic, but the clinic had no medicine. The child died.

Quinine was found to be a useful treatment for malaria in the 19th century and was used as part of the Panama Canal anti-malaria campaign in the early 1900s. In the post WWII years Chloroquine became the most widespread malaria treatment, both as a prophylactic and for treatment, but many malaria strains have now become resistance to Chloroquine.

Malaria can be treated with drugs. The choice of anti-malarial agent depends on the type of parasite, and the severity and stage of infection. In many parts of the world, *P. falciparum* is resistant to chloroquine, the mainstay of malaria

treatment. The following medications are used alone or in combination:

- Chloroquine
- Mefloquine (Lariam)*
- Doxycycline*
- Clindamycin*
- Malarone*
- Quinidine*
- Quinine*
- Combination of pyrimethamine and sulfadoxine (Fansidar)*
- Primaquine (for hepatic phase of *P. vivax* and *P. ovale*)
- Artemisinin*

*Commonly used to treat chloroquine-resistant strains of *P. falciparum*.

The cost of the alternatives to Chloriquine are much more expensive and this makes large scale free treatment a huge burden for the health budget.

Concern over the development of resistance and side effects from anti-malaria treatments are valid, and as long as endemic malaria in the environment prevails, there will have to be ongoing leap-frogging of medical science and resistance development. This of course, argues for an anti-malaria strategy that addresses the environment and the endemic malaria.

A malaria vaccine has not yet been developed. Malaria is not an easy disease to control with a vaccine, but it is scientifically possible. Whether there is an enabling economic environment for vaccine development and deployment is questionable, and needed political support is also problematic. For the purposes of this IMMC program a malaria vaccine is “in the future”. However, the understanding of the parasite may help in accelerating treatment so that the environment can be improved by more rapid treatment to minimize parasite prevalence.

## IMMC INTERVENTIONS RISKS

The issue of risk is important. Ineffective control of mosquitoes and malaria has created as situation where 3,000 children a day are dying from malaria in Africa. Inaction and ineffective interventions has a huge cost. How much is an African child's life worth? If it is $1,000 then the daily cost is $3 million and the annual cost more than $1 billion, and at a more reasonably $10,000, then the annual cost is more than $10 billion.

The risks of an IMMC program are small compared to the cost of doing nothing. The value of taking a DDT risk for IRS, for example, is small even compared to the trade sanctions that could perhaps be imposed by uninformed environmental activists in Europe.

# ORGANIZATION AND MANAGEMENT
# ORGANIZATION

An IMMC program is going to be successful when data, decisions and IMMC activities are coordinated in the most efficient manner. A preliminary planning model has demonstrated that the various possible IMMC interventions require significantly different scale and organizations in order to optimize the costs and the efficient deliver of results. Accordingly the Globall IMMC Organization is structured to have the following units: (1) a global international unit; (2) a series of country units; (3) one or more regional units, mainly to optimize aerial operations and logistics; (4) district units; and, (5) community activities.

**The consortium form of organization**

The consortium form of organization has been chosen because it is effective in terms of both geography and functionality. The goal is to make IMMC support available when it is needed, where it is needed and at an affordable cost. The consortium form of organization provides a framework for the independence, professionalism and cooperation of experts that is needed for success. There needs to be a geographic component, a functional component and an ability to have the various elements operate on the scale needed for efficiency. More than anything else, the consortium is a structure that makes IMMC excellence possible.

The IMMC Consortium is made up of: (1) Tr-Ac-Net Inc. (The Transparency and Accountability Network) with a focus on management information; (2) West Coast Aerial Applicators (WCAA) specializing in aerial operations and pest control, (3) ADAPCO, pesticide experts and consultants, (4) Acroloxus, experts in wetlands management; (5) Africa Fighting Malaria, experts in mosquito and malaria control; and, (6) an IMMC team of expenenced entomologists. Together, “The IMMC Consortium” has expertise in operational matters, in management information and scientific analysis, all of which are required together for success in mosquito and malaria control.

**Communities, districts and country**

The key to success is what happens in a community, and how mosquitoes and malaria are addressed by practical interventions. Everything else is in support of this. To the maximum extent possible, therefore, it is community actiivities and community people that should drive a successful IMMC program. The data about performance, and the costs of interventions is derived from community information, and can then be used in all other organizational levels, including especially the country and the international levels.

Because a typical community may be a long way from country and international units, a district entity has a value in bringing together a number of communities in an area, all of which may have variants of the same set of conditions, and be able to benefit from interventions in common. A district team can help build bridges that include the community so that the effectiveness of IMMC interventions is understood and decisions made based on realistic information.

The country unit is absolutely critical in making it possible to get the best

performance in a country. Many interventions are organized on a country basis, and to the extent that they can be incorporated into a comprehensive IMMC program or framework for the country, it is advantageous and can result in the best possible outcomes. A community gets benefit from an IMMC intervention based on what is actually done in the community, and not in any way how the overhead organization functions and is funded. An effective IMMC country units will work closely with government and help to make it possible for government policy to be effectively translated into operational success.

**Regional air operations and logistics**

A regional unit is needed to make it possible for aerial operations to be cost effective and efficient. Insecticide application using aircraft is very cost effective when it is done on the right scale and based on good entomological data. Accordingly the air operations need to be regional because they are too large for a single country, but the best possible IMMC suite of interventions needs to include the ability to deploy air operations as and when needed. Under the planned comprehensive IMMC program, an aerial IMMC interventions should be a telephone call away, and be able to deploy exactly where it is needed within as little as 48 hours.

**International unit, management information and coordination**

The program aims for functional excellence in all areas. Management information is a key tool for performance analysis, and is used throughout the program. The program links to functional expertise internationally while being very committed to initiatives that are most appropriate and effective at the country and local level. Activities that are not funded and managed directly through this program can remain independent and still benefit from the implementation of an integrated comprehensive mosquito and malaria control program.

In any good organization, there is the need for strong coordination. This is achieved in the IMMC organization using a range of management information sets that flows throughout the organization. It is one system, with a variety of views of the information available to suit all the different functional units.

And this information also has another important value. It can be used not only within the IMMC organizational structure, but also in the public space so that information related to any community and any mosquito or malaria intervention can be incorporated in the knowledge base and lessons learned on a much broader basis than merely within the interventions being implemented in our own program.

In its first phase the IMMC Group will start building its information infrastructure and setting the stage to provide management information about IMMC and the performance of IMMC interventions. In addition there will be preparation to deploy a regional unit for aerial operations and a first country unit in Liberia. It is convenient and initially most efficient for the regional aerial operations unit to be located in Monrovia, Liberia.

# ORGANIZATION AND MANAGEMENT
# KEY STAFF AND ADVISERS

**Experienced team**

An experienced team of experts and advisers has been identified to manage the operations. This team includes personnel and consultants with management experience in medical entomology, medical science, aerial ULV spray operations, pesticide application management, and accounting, financial control and data processing. The core team includes:

**Bill Nesler,**
President of West Coast Aerial Applicators Inc., a veteran pilot and aerial operations manager with experience in US pest control and international contract flight operations in Africa.

**Peter Burgess**
CEO of Tr-Ac-Net Inc. and former CFO of Continental Seafoods Inc. a US based international fishing company and management consultant to the UN, World Bank and private organizations

**Delvin Walker**
A medical entomologist and former consultant, a former professor at Cuttington University in Liberia

**Bob Novak**
A medical entomologist, professor at University of Illinois, Champlain and consultant to international programs.

**Jeffrey Widmann**
VP of West Coast Aerial Applicators and an experienced pilot and trainer.

**Advisory Group**

The IMMC group has an advisory group that includes a number of people who are very experienced in various elements of modern mosquito and malaria control including:

**WE NEED TO GET PERMISSION TO INCLUDE SOME OF OUR FRIENDS AND COLLEAGUES IN THIS SECTION**

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# FINANCIAL COST PROJECTIONS
# FINANCING PLAN

## Financial projections

The projections of costs are derived from an operations cost model that is being development both for planning and for ongoing operations management. The numbers are still being refined and the program optimized taking advantage of all existing cost and performance information that is available to us.

**Estimated Investment and Operating Costs**
In thousand dollars ($ 000)

| | Year 1 | Year 2 | Year 3 | Year 4 | Year 5 | 5 Year Total |
|---|---|---|---|---|---|---|
| IMMC coordinating unit | 100 | 100 | 100 | 100 | 100 | 500 |
| Management information unit | 400 | 400 | 400 | 400 | 400 | 2,000 |
| Regional aerial operations unit | 2,500 | 1,000 | 1,000 | 1,000 | 1,000 | 6,500 |
| Liberia TOTAL | 10,000 | 7,500 | 7,500 | 7,500 | 7,500 | 40,000 |
| Contingency | 1,000 | | | | | 1,000 |
| **TOTAL** | **14,000** | **9,000** | **9,000** | **9,000** | **9,000** | **50,000** |

In addition there is a capital cost estimated as follows for the first year:

**Year 1 Capital Costs (including working capital)**
In thousand dollars ($ 000)

| | |
|---|---|
| International (mainly ICT) | 300 |
| Aircraft, vehicles and other equipment | 3,000 |
| Buildings, vehicles in Liberia | 1,500 |
| Working captial | 700 |
| Contingency | 500 |
| **TOTAL (Year 1)** | **$5,000** |

## CAVEAT

The numbers set out above are preliminary. The Liberia costs relate to a population of about 3 million, of which about 1.5 million are located in urban areas where public IMMC interventions are anticipated. Work is continuing on the IMMC simulation model to confirm these cost estimates in an optimized multiple intervention program.

# APPENDIX 1

## MANAGEMENT AND STAFF BIOGRAPHIES

### Biographies of Some Key Staff

The following are some of the people who are committed to the success of this initiative and will form the core of the management team – in alphabetical order.

**Peter Burgess**
**Controller and Management Information Services**
Peter Burgess is an expert in financial control and management with experience with international companies and the global relief and development sector. He is the founder and CEO of Tr-Ac-Net Inc, the Transparency and Accountability Network. He has been a pioneer in using available data to improve management informations and decision making. During his corporate career, he was CFO of Continental Seafoods, Inc, a US company that operated a successful fisheries joint venture in Liberia and around the world during the 1970s. He earned a double major in engineering and economics at Cambridge University and trained as a chartered accountant with Coopers and Lybrand in London.

**William Nesler**
**Operations Manager and Senior Pilot**
Bill Nesler is commercial aircraft pilot with over 20,000 hours of flying time, of which 15,000 hours have been in agricultural pest control operations. He has been chief pilot in charge of 8 airplanes, 9 pilots, 3 mechanics and numerous ground crews. He has been licensed and has worked in most of the agricultural states in the USA and has lived and worked in Liberia for almost 20 years. He has experience working with Liberians and an understanding and appreciation of the local traditions and customs. While living in Liberia, Mr. Nesler and his family suffered from severe attacks of malaria, giving him a personal understanding of the problem. Mr. Nesler will serve as the Program's operations manager.

**Robert J. Novak**
**Medical Entomologist**
Robert Novak will ensure that the Program follows rigorous scientific discipline and help to optimize the activities of the Program to ensure effective operation and good results. He is a professional scientist affiliated with the University of Illinois at Urbana-Champaign with vast experience with vector control both in the United States and in Africa. He earned a Masters degree at the University of Utah and PhD at University of Illinois.

**Delvin Walker**
**General Manager**
Delvin Walker will be the overall manager of the project. He was chief of the science department at Cuttington College in Liberia prior to the outbreak of the civil war. He has extensive experience in program management and is a trained entomologist. He has worked with international relief and development assistance organizations in countries around Africa for many years. He received a master's degree from California Polytechnic and has other academic training from other universities.

**Jeffrey Widmann**
**Training Manager and Senior Pilot**
Jeffrey Widmann is an experienced aerial applicator and an active and highly regarded flight instructor, with over thirty years experience, he has provided students with the specific training necessary to operate the Grumman Agcat safely. He is a retired U.S. military officer with experience in international flight operations and training and is a Federal Aviation Administration certified aircraft mechanic. Mr. Widmann will assume the position of training manager and chief pilot to train selected Liberian pilots in the field of aerial application of pesticides. Mr. Widmann has lived and worked in Monrovia and is familiar with the customs and culture of the Liberian people. He has flown commercial flight operations in Liberia and has held a Liberian commercial pilot certification and work permits.

# APPENDIX 2

## ABOUT CONSORTIUM MEMBERS

The following are some of the corporate organizations that form
The IMMC Consortium

**Tr-Ac-Net Inc.**
**The Transparency and Accountability Network**
Tr-Ac-Net started as a management consulting firm in 1978, and under the name Burgess Management Associates (BMA) carried out assignments for the World Bank, the UN and many other relief and development sector (RDS) agencies. Some of the work was related to government financial management, development planning, and aid coordination to make best use of international assistance, especially in crisis conditions brought on by natural disasters or war. BMA had a focus on accounting and financial analysis as well as organizational issues, the measurement of results and the use of information and communications technology (ICT) to create easily accessible management information. In 2000, the name was changed to ATCnet and in 2003 to Tr-Ac-Net Inc. and the focus changed from consulting assignments for the RDS institutions to providing support and management information for and about local initiatives to improve development progress at the community level and in priority areas identified by community leadership. Tr-Ac-Net works to help improve accounting as the foundation for transparency and accountability, and on management information systems and related support for value adding relief and development inititatives.

**WCAA**
**West Coast Aerial Applicators**
West Coast Aerial Applicators is a company incorporated in Liberia to engage in aerial operations, and related activities needed for mosquito control

**ADAPCO**
**Pest Control Consultants**
ADAPCO is a company incorporated in Liberia to engage in aerial operations, and related activities needed for mosquito control

**Acroloxus**
**Acroloxux Wetlands Consultancy and Coelix Inc.**
Acroloxus provides expert advice on a wide range of wetlands management issues, and also the control of mosquitoes in these habitats. They have a strong in-house team of professional ecologists and good relations with universities and colleges in the UK and Canada.

**AMF**
**Africa Malaria Foundation**
Acroloxus provides expert advice on a wide range of wetlands management issues, and also the control of mosquitoes in these habitats. They have a strong in-house team of professional ecologists and good relations with universities and colleges in the UK and Canada.