

# Senior Design Group Works to Eliminate Malaria in Sudan

All seniors in the H. Milton Stewart School of Industrial and Systems Engineering culminate their undergraduate educational experience with a capstone course called Senior Design. It provides students with firsthand experience at solving real-world problems in a team environment. Student teams select a major design project from a company or nonprofit organization and exploit all available resources in order to develop a solution for the client.

During fall semester 2007, twenty student groups participated in Senior Design, three of which were selected as finalists to present their projects to faculty, students, and industry sponsors. The winning team worked on a project sponsored by the Centers for Disease Control and Prevention (CDC) to develop an effective production and distribution method to reduce the malaria-transmitting mosquito populations in Sudan, Africa. Student members of the CDC group included Allan Garcia, Jason Hoff, Mary Beth LaHatte, Alejandro Leyva, John Shea, and Ashley Thompson, with Professor Craig Tovey serving as faculty advisor.

## Background

The International Atomic Energy Agency, the Sudan national government, and the CDC are collaborating to build a mosquito production facility in the northern part of Sudan. The facility will aid in testing the feasibility of using the Sterile Insect Technique (SIT) to eliminate the existing malaria-transmitting mosquito population located in the vicinity of Merowe, Sudan. Malaria is one of the most



Left to right: Mary Beth LaHatte, Alejandro Leyva, Ashley Thompson, Allan Garcia, John Shea, and Jason Hoff show the predicted mosquito population decrease using the Sterile Insect Technique.

severe public health problems worldwide. As a vector-borne infectious disease, it is a leading cause of death in many developing countries, with young children and pregnant women being the groups most affected.

Senior Design team members worked with entomologist Dr. Mark Benedict in designing a cost-effective production and distribution system for the mass rearing and releasing of sterile male mosquitoes at release sites in Merowe. Using the SIT, the goal is to eliminate the existing mosquito population within one year of implementation. Because female mosquitoes only mate once, the SIT works by releasing sterile males into the population. When females mate with the sterile males, they do not produce offspring. If enough sterile males are released, the entire mosquito population is eliminated.

## Project Objective

The purpose of this project was to establish and provide a set of guidelines and recommendations that will aid in the implementation of the SIT for mosquitoes in Sudan. Student team members completed several tasks to achieve their project goal. First, they developed a model to estimate population densities of adult mosquitoes at the designated release sites in Merowe. Next, they determined how many sterile male mosquitoes must be produced in order to eradicate the entire population when released. Third, team members determined the most cost effective process to produce the required number of sterile males. Finally, the students determined the best locations to release the

sterile male mosquitoes as well as the most cost effective means to deliver the mosquitoes to these locations.

## Findings

One of the important benefits of the SIT is that it does not negatively impact the environment. CDC group member Ashley Thompson explained, "The Sterile Insect Technique, or SIT, attacks malaria at the source of transmission: female mosquitoes. This process eliminates the need for preventative measures, such as insecticide treatments, which can have detrimental effects on the environment."

Further, the CDC student team determined the most effective way to implement the SIT program largely depends on conditions in Merowe, including the time of year and river level. As a result of this finding, the students developed a software tool that finds the best strategy based on a set of factors input by a user. Part of the benefit of the flexibility designed into the software tool is that it can be used to determine the best SIT strategy in other parts of the world where malaria is also a problem.

If your company is interested in submitting a project for consideration, visit [www.isye.gatech.edu/seniordesign](http://www.isye.gatech.edu/seniordesign) for more details.

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*Findings for this article were created within the framework of a student design project and its contents are neither sanctioned by the Georgia Institute of Technology nor the Centers for Disease Control and Prevention.*