DoD
Global Emerging Infections System

Armed Forces Institute of Pathology

Military Infectious Disease Research Program

Uniformed Services University of the Health Sciences

United States Army

United States Navy

United States Air Force

Office of the Assistant Secretary of Defense (Health Affairs)

US Regional Unified Commands

DoD Overseas Laboratories

US Centers for Disease Control & Prevention

United States Department of State

Pan American Health Organization

World Health Organization

Annual Report Fiscal Year 2005

Partnering in the Fight Against Emerging Infections

DoD Global Emerging Infections System

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Table of Contents

Executive Summary 1

Central Hub Activities 5

MHS Summaries Section 8

Overseas Laboratories Summaries 36

Acronyms 46

Appendix A 52

Appendix B 54

Appendix C 55

Appendix D 57

Appendix E 58

Appendix F 59

Appendix G 61

Executive Summary

The Department of Defense Global Emerging Infections Surveillance and Response System (DoD-GEIS) activities and accomplishments for FY 2005 are detailed by DoD-GEIS supported partners throughout the remainder of this annual report. The DoD-GEIS mission is to support and coordinate DoD global surveillance, training, public health research and outbreak response capabilities for microbial threats impacting force health protection and national security. Specifically, DoD-GEIS projects support outbreak response preparation, detection, clinical investigation, microbial agent identification, and communicable disease control and prevention. The DoD-GEIS has four goals outlined in Appendix A: 1) surveillance, 2) outbreak response, 3) integration and innovation activities, and 4) capacity building and training. The surveillance priorities for DoD-GEIS are for microbial agents capable of causing serious outbreaks in military populations. These are: a) respiratory illnesses (especially influenza and pandemic influenza); b) febrile illnesses (especially malaria, dengue and viral hemorrhagic fevers); c) diarrheal illnesses; d) sexually transmitted infections, and e) agents with antimicrobial resistance. In FY 2005, DoD-GEIS partnered with hundreds of Army, Navy and Air Force medical professionals working in fourteen military medical research laboratories and medical treatment facilities on many cooperative projects in over thirty countries (Appendices B, C, and D). The most important activities of DoD-GEIS were influenza surveillance and pandemic response preparation, and the most important products in FY 2005 were timely medical information and medical expertise that were provided for the military medical leadership. DoD-GEIS built surge capacities into the planning, budgeting, and project execution of its global systems in FY 2005, and optimized flexibility and emergency response of DoD-GEIS partners in public health emergencies, such as the Indian Ocean tsunami, by promoting communication, interoperability, professional interactions including joint training, resource sharing, and standardization among partners. The examples provided in this annual report demonstrate how the DoD-GEIS system of networked military medical professionals accomplished its mission and worked together, and with CDC, WHO, and many international partners to strengthen the Military Health System and global health.

Background

DoD-GEIS is a network of medical professionals, a system of systems. It is focused on outbreak response preparation and enabled by multiple partnerships. As a Tri-service program, DoD-GEIS works through partners and programs within the military health system (MHS) and five DoD overseas medical laboratories, with coordination by the GEIS Central Hub. DoD-GEIS was created in response to the June 1996 Presidential Decision Directive (PDD) National Science and Technology Council -7 (NSTC-7) which states that emerging infections threaten national and global security. In this directive the mission of DoD was expanded to support surveillance and response to microbial threats. This was to be accomplished through central coordination, enhanced support of overseas laboratories, collaboration with host country governments and improved cooperation and collaboration nationally and internationally.

DoD has approximately 9,200,000 military medical beneficiaries, including about 2,400,000 active duty and reserve personnel, and 120,000 healthcare workers distributed across the globe. These populations are a primary focus of medical surveillance, primary sources of surveillance information, and primary consumers of medical information created by DoD-GEIS. Because surge capacities, coordination and flexibility were weaved into the planning and operations of the DoD-GEIS network, the strength and performance of the DoD-GEIS partners as a whole was designed to be far more than the simple sum of the individual partners.

Additional background concerning DoD-GEIS is available at http://www.geis.fhp.osd.mil including previous annual reports and historical documents contained in the section "About DoD-GEIS." Appendices A-G of this FY 2005 Annual Report contain supplementary information about the DoD-GEIS plan, partnering military Commands, cooperative project topics, global project locales, examples of DoD-GEIS weekly reports,

conferences, presentations and publications. The FY2004 and prior annual reports are available at http://www.geis.fhp.osd.mil and the five year plans and strategic plans and criteria and other details about DoD-GEIS funding are on the MIDRP (http://www.midrp.org).

Budget Allocations and Project Support Overview

DoD-GEIS financial resources in FY 2005 were used to support a global multi-disciplinary professional network of military expertise and capabilities as described in the five year plan (Appendix A). Although DoD-GEIS did not have command and control of this network, DoD-GEIS Central Hub direction and oversight of the funding, under the supervision of Army Executive Agency, created a standardized global approach and coordination that supported capabilities in the three military services. Goals included surveillance, response, research/integration, and training/capacity building; products include timely medical data and information and services such as consultation and analysis. Upon request, DoD-GEIS funded military experts to conduct epidemiological investigations or provided expertise such as participating in policy development and training.

DoD-GEIS surveillance projects in FY 2005 were designed to facilitate tri-service readiness, relevance, and responsiveness to the medical challenges emerging in the MHS and operational medicine settings, and to facilitate professional interactions within DoD medical organizations so that these would be strengthened and better prepared for serious medical emergencies such as pandemic influenza. They were designed to be optimized to detect outbreaks. Response projects typically concentrated on outbreak investigations, communicating information, alerts and situational analyses.

Approximately 12% of the FY 2005 budget was allocated to surge capacity and emergency use. Sizable percentages of the budget were allocated for OCONUS (Outside the Continental United States) projects, and specifically influenza. Projects were negotiated between the DoD-GEIS Central Hub and the principal investigators so that projects were expected to have at least "dual use" of public health / clinical benefit plus military beneficiary and operational benefit. Information and reports were shared regularly with the partners, service specific and tri-service epidemiology experts, and with COCOM Surgeons. DoD-GEIS tried to learn and improve with each natural outbreak that affects DoD.

Funding has been consistent from year to year, while capabilities have continued to improve. Influenza remains the number one priority. Connectivity and interoperability projects with WHO and CDC continued to be priorities and were funded by DoD-GEIS in FY 2005. DoD-GEIS supported a balanced tri-service surveillance and response capability and facilitated identification of additional funding opportunities for DoD-GEIS partners from the research community or from outside agencies such as CDC or USAID to promote interoperability and widest possible public health benefit for DoD-GEIS supported projects.

Surveillance Overview

DoD-GEIS provided important information to the nation and for global public health. Most funding went to five overseas, or “outside of CONUS” (OCONUS) military medical research laboratories. These five OCONUS labs are the Armed Forces Research Institute of Medical Sciences (AFRIMS), US Army Medical Research Unit, Kenya (USAMRU-K), US Navy Medical Research Unit 3 (NAMRU3), US Navy Medical Research Unit 3 (NAMRU2), and Naval Medical Research Center Detachment (NMRCD). Three of these laboratories are WHO Collaborating Centers. DoD-GEIS projects were designed to help surveillance information and expertise from the OCONUS labs become relevant to military healthcare workers in the MHS and operational settings. Each of these laboratories conducted projects relevant to the priority infectious diseases and syndromes listed in Appendix A, and each lab held in reserve about twelve percent of its DoD-GEIS FY 2005 annual funding budget for surge capacity in case of unexpected emergencies. Laboratories filed reports with the DoD-GEIS Central hub staff twice monthly and responded to specific requests for information when international outbreaks appeared to threaten the MHS. These broad-based capabilities and activities produced timely information about important emerging infections in the countries and regions where the laboratories are located, and surge capacities that could be transformed in the event of medical and public health emergencies.

Influenza Surveillance

In FY05, world attention focused on the potential threat of an influenza pandemic because of continued global spread of an epizootic of highly pathogenic avian influenza A (H5N1) and documentation of over 100 human infections in South East Asia. Because influenza always poses a threat to the US military, DoD-GEIS has from its inception supported coordinated tri-service influenza surveillance. The GEIS global professional network in FY 2005 cooperatively isolated influenza viruses from at least 1800 individuals from at least 20 countries; these influenza isolates were available to CDC and world public health officials for molecular analysis and for consideration in the formulation of vaccination preparations. The cornerstone of DoD-GEIS-supported DoD influenza surveillance activities was AFIOH. AFIOH, based at Brooks City Base, TX was named as the DoD Executive Agent for Influenza Surveillance in 1996. The AFIOH DoD Influenza Surveillance laboratory and Air Force epidemiology hub provided 990 of DoD's 1800 influenza isolates from mostly DoD personnel through cooperative projects in at least eleven countries. AFIOH also provided influenza data analyses, surveillance information, and influenza isolates for WHO, DoD, and CDC through cooperative relationships that included sharing weekly surveillance reports through CDC's Epi-X epidemic information exchange system. NEHC and the NEPMU's also provided support for global influenza surveillance by providing direct assistance to CENTCOM and PACOM for the development of pandemic influenza emergency response plans while the various NEPMU's provided surveillance for incidence of influenza among military populations. NEPMU personnel were also able to provide training and education sessions for healthcare workers that would aid in rapid detection and management of influenza illnesses. Influenza surveillance and avian influenza capabilities were also provided by NMRCD in Peru as well as by USAMRU-K personnel in Kenya, and both were involved in influenza outbreak investigations in their respective countries. USACHPPM-West provided public health surveillance efforts including influenza, in the Honduras, El Salvador, and Guatemala in partnership with AFIOH. In FY05, NAMRU3 provided cooperative influenza surveillance activities in seven countries in the Middle East and in the Central Asian Republics, notably providing laboratory and epidemiological support in the identification of the avian influenza A (H5N1) virus from wildfowl specimens in Kazakhstan. During FY05 influenza and avian influenza surveillance by NAMRU2 in Indonesia provided important and timely information through cooperative projects with the government of Indonesia, with WHO and CDC including providing diagnostic support for avian influenza (H5N1). The NHRC closely monitored influenza and other respiratory diseases at military training centers and provided critical information on the effectiveness of the annual influenza immunization. The AFMEO at the AFIP, with NHRC assistance, monitored all deaths in active duty personnel and investigated those possibly due to infectious disease.

In addition, GEIS Central Hub personnel provided support for pandemic influenza surveillance by the evaluation of 29 emergency response plans from the local state governments, federal agencies, and international organizations and foreign governments. An Army Reserve Officer worked with the DoD-GEIS Central Hub staff on a pandemic preparedness and policy development project for the Army MEDCOM and Army Surgeon General's staff; this involved assessing the current capabilities and preparedness of most of the tri-service DoD-GEIS partners, and visits to the US CENTCOM surgeon in Qatar and to NAMRU3 and AFRIMS. The GEIS Central Hub administrative staff provided logistical and administrative support for the entire DoD-GEIS system, arranging for meetings, travel orders, performance evaluations, awards, budget documents, surveillance project documentation, cooperative agreements, diplomatic and military clearances. Information about these evaluation and support activities were presented at the 2005 annual meeting of the Society of Research Administrators International as a unique form of policy-analysis support for medical surveillance and healthcare.

Response Overview

On December 26, 2004, a tsunami catastrophe occurred in the eastern Indian Ocean. Military medical professionals globally, and especially in the USPACOM region were mobilized to respond. The Assistant Secretary of Defense (Health Affairs), the Honorable William Winkenwerder, said at a

Pentagon Press Conference on January 4, 2005, "DOD [already has]…assessment teams in all three countries [i.e. Thailand, Indonesia, Sri Lanka] …preparing for...waterborne diarrheal illnesses... *E. coli* [agents of]…traveler's diarrhea, cholera, …hepatitis A; …Respiratory diseases: [including] viruses and bacteria. [Febrile illnesses including]: measles …dengue and [multidrug-resistant] malaria. The Navy has deployed a preventive medicine team [i.e. NAMRU2] that is normally based in Jakarta, Indonesia, and certainly the fact that they were right there close at hand made it quite easy for them to go out into the field to begin to look at the possibility of these problems." http://www.defenselink.mil/transcripts/2005/tr20050104-1925.html This massive response to the tsunami involved many DoD-GEIS partners including AFRIMS, NAMRU2, NEPMU6, officials from the USPACOM Surgeon staff, the military medical liaisons to WHO and CDC, the GEIS Central Hub and many others. Dr. Winkenwerder's remarks speak to the utility of having multidisciplinary medical experts in infectious diseases pre-positioned overseas so that these can be trained, equipped, and ready to respond to a complex medical emergency in a meaningful way. DoD-GEIS had money budgeted for surge capacity and diverted other GEIS resources to this emergency.

Integration And Innovation Overview

The DoD-GEIS Central Hub staff supported an informative public website at http://www.geis.fhp.osd.mil/ and a secure website at https://geis.fhp.osd.mil/ for official use only. New information was posted to these sites almost daily for use of partners, military medical healthcare professionals and the medical leadership. Weekly DoD-GEIS articles and information were published in the USACHPPM HIO Weekly Updates at http://chppm-www.apgea.army.mil/Hioupdate/ . DoD-GEIS Central Hub staff hosted tri-service "epidemiology chiefs" teleconferences every two weeks to discuss epidemics and related topics with leading DoD epidemiologists. These "Epi-Chiefs" teleconference minutes were transcribed and shared with the military medical leadership. Other special investigations and queries were worked through the network upon request from the medical leadership (e.g., the Surgeons Generals, the combatant command surgeons, and ASD(HA) officials). After reading about reports about information provided by DoD-GEIS partners in other geographical regions, the USEUCOM surgeon requested information from DoD-GEIS about a Marburg virus outbreak in Angola, and arranged for a NAMRU3 investigator to provide cooperative military medical assistance to that country. The military liaison officer to WHO also provided important consultation and expertise in Angola, and the CDC liaison officers helped to coordinate and share information between CDC, WHO and DoD public health officials.

Capacity Building And Training Overview

Sixteen DoD medical research laboratories or military treatment facilities (MTF)'s classified by TRICARE as Medical Centers are recognized by CDC as Laboratory Response Network (LRN) collaborating laboratories. These are important partners in the response to national public health emergencies; thirteen of these sixteen DoD LRN laboratories have cooperative projects with the DoD-GEIS network. DoD-GEIS shares epidemiological information on a regular basis within the MHS. DoD-GEIS facilitated the training of more than 100 DoD medical healthcare workers around the world in use of Epi-X, CDC's secure internet epidemic information exchange to share information about outbreaks with CDC, Homeland Security, and the 50 State Health Departments. Every week, CDC posts electronic links to DoD surveillance information to DoD influenza data from around the globe derived from AFIOH and NHRC.

Summary

GEIS has supported the development of robust global emerging infections surveillance and response system of expertise, logistical resources, and ability to integrate with security forces. The DoD-GEIS network is large, and the impact of the many public health activities and professional interactions of the DoD-GEIS partners and the other 120,000 military medical professionals around the globe is great. The DoD-GEIS Central Hub staff greatly appreciates the work of the many dedicated partners that are specifically mentioned in this report and recognizes that there are many others, both civilian and military, who have not been specifically mentioned, but nonetheless have continued to work to control emerging infections and promote global health.

Central Hub Activities

The DoD-GEIS Central Hub provided professional guidance and support to all of the global DoD-GEIS partners and coordination of over one hundred projects in FY05 according to the plan and supplementary information outlined in Appendices A, B, C, and D. These global activities assisted the Military Health System, the Military Services and operational elements within DoD and enhanced collaboration with other agencies, especially CDC and the World Health Organization (WHO). The DoD-GEIS Central Hub staff kept in regular contact with DoD-GEIS partners, typically at least every two weeks, and gathered information about their activities, results of sponsored projects, and their capabilities. Weekly reports related to DoD-GEIS partners' activities and of other timely information were published electronically in the US Army Center for Health Promotion and Preventive Medicine (USACHPPM) Health Information Operations available at URL: http://chppm-www.apgea.army.mil/ with topic titles presented in Appendix E.

Respiratory Disease

Febrile respiratory diseases are top priorities for DoD-GEIS syndromic surveillance; influenza virus is the microbial pathogen of highest priority for DoD-GEIS surveillance. Activities that promote pandemic influenza preparedness and response are the most important that DoD-GEIS supports. The U.S. Air Force Institute for Operational Health (AFIOH) is DoD's center for global influenza surveillance in military populations. The Naval Health Research Center (NHRC) supplements these influenza surveillance activities through projects that monitor febrile respiratory diseases of military trainees. In FY05, the DoD-GEIS Central Hub staff provided professional assistance to several DoD-GEIS partnering organizations to complete an epidemiological investigation of a cluster of febrile, acute respiratory disease among soldiers. DoD-GEIS Central Hub staff also assisted to complete a study of the clinical utility of ethanol-fixed specimens in surveillance for influenza and adenoviruses, as a potentially more efficient method of detecting viruses in certain situations compared to standard methods. The DoD-GEIS Central Hub staff worked with investigators from the US Army Center for Health Promotion and Preventive Medicine (USACHPPM), Aberdeen Proving Ground, MD, to evaluate selected non-vaccine interventions to prevent acute respiratory disease through a medical literature review and analysis. DoD-GEIS Central Hub staff assisted in the evaluation of the effectiveness of annual influenza immunizations in consultation with NHRC in their study of US military basic trainees. Working with the Center for Disaster and Humanitarian Assistance Medicine (CDHAM), Uniformed Services University of the Health Sciences (USUHS), Bethesda, MD, DoD-GEIS Central Hub staff collaborated with the Pan American Health Organization (PAHO), Washington, DC, and Mexican health authorities to conduct a US-Mexico one-day influenza workshop that preceded the United States-Mexico Border Health Association (USMBHA) Meeting in Laredo, TX, in June. The DoD-GEIS Central Hub staff also explored the possibility of a NATO - WHO 2006 influenza workshop in Saint Petersburg, Russia, on civil-military influenza preparedness, as follow up to a similar meeting held in 2003.

Antimicrobial Resistance

The emergence and spread of antimicrobial resistance (AR) in pathogenic organisms remains a public health problem of global dimensions. DoD-GEIS Central Hub staff have supported a cooperative multi-disciplinary approach to AR containment and resolution, especially in military health settings. DoD-GEIS helped to document the threat of AR to DoD health care beneficiaries measured by morbidity and mortality, as well as to DoD health care delivery costs and efficiency. DoD-GEIS expanded surveillance of antimicrobial resistant bacterial infections in DoD patient populations through a partnership with Focus Bio-Inova (formerly FOCUS Technologies), The Surveillance Network (TSN®); in FY 2005, Landstuhl Regional Medical Center (LRMC) became the fourth MTF in the TSN network that allows AR surveillance data to be inexpensively monitored and compared with hundreds of other hospitals in the US and in international settings. DoD-GEIS Central Hub staff

continued to represent the DoD on the U.S. Interagency Task Force on Antimicrobial Resistance to cooperatively share information within the US Government and to mitigate the threats to health from AR. DoD-GEIS supported special epidemiological investigations and infection control activities within the MHS related to multi-drug resistant *Acinetobacter baumannii* infections, and has provided information and expertise applicable for operational medical settings in FY 2005. DoD-GEIS sponsored a second multidisciplinary AR symposium in May 2005, as a follow-up to a FY04 symposium, to define and assess the problem of multi-drug resistant *A. baumannii* infections in hospitalized DoD health care beneficiaries. This symposium facilitated discussions between military health care providers from operational military treatment facilities (MTF) in Iraq, Air Force air evacuation providers, OCONUS and CONUS receiving-MTF health care providers, clinical laboratory specialists, epidemiologists, DoD and USTRANSCOM infection control and infectious disease practitioners. It also led to discussions and creation of documents to suggest best practices to address these infections, and facilitated epidemiological investigations that assisted the military medical leadership. It also led to an ongoing dialogue between infection control practitioners, infectious disease clinicians, epidemiologists, information technology specialists and laboratory specialists that should improve abilities to identify and contain military healthcare associated infections.

Sexually Transmitted Infections

In 1997, the report from the Institute of Medicine (IOM) entitled *The Hidden Epidemic, Confronting Sexually Transmitted Diseases* concluded that "Sexually transmitted diseases (STDs) are hidden epidemics of tremendous health and economic consequence in the United States." The IOM called for increased attention to STDs and innovative approaches to diagnosis, management and prevention. Several years ago, the DoD STD Committee conducted an evaluation of STD policies and practices in the DoD. These experts concluded that while STD screening, case finding, individual diagnosis, treatment, reporting, contact tracing, and prevention were practiced, these procedures and policies were not standardized across the services, nor were they being evaluated. The proportion of STDs that were reported through public health channels, or had laboratory confirmation of clinical diagnoses was unknown. Gonococcal AR is already established as a national and international public health challenge, but its current and potential impact on military readiness is unknown. The DoD-GEIS Central Hub served as a resource in FY05 for information on STDs in Military Health System beneficiaries. Information and expertise on STD's was provided by the DoD-GEIS Central Hub staff on request to the DoD Health Affairs, the Surgeons General, the Armed Forces Epidemiological Board and other interested organizations. The DoD-GEIS Central Hub staff hosted a tri-service military professional meeting entitled "Sexually Transmitted Infections and Diseases in Military Health System Beneficiaries" at the Walter Reed Army Institute of Research, Silver Spring, MD, on May 27, 2005, and coordinated a program on *Chlamydia* screening in the DoD for the Armed Forces Epidemiological Board meeting in San Diego, CA, on December 1, 2004. DoD-GEIS Central Hub staff consulted with military installations on their STD programs and supported work by the Navy Environmental Health Center to evaluate the relationship between reported diseases and laboratory results. These activities are examples of DoD-GEIS providing opportunities within DoD to share medical information and expertise, and to promote best practices in diagnosis, management and prevention of STD's in the military.

Mentoring

Providing education and training in emerging infections are important DoD-GEIS activities. Resident physician and student projects have produced important medical information and career development opportunities, with DoD-GEIS sponsored projects resulting in presentations at professional meetings and publications. Many residents and students who were mentored by the DoD-GEIS Central Hub staff have made significant contributions to preventing emerging infections later in their military medical professional careers. Working with USUHS and civilian universities has provided DoD-GEIS sponsored trainees with new professional contacts and opportunities for collaborations for the DoD-GEIS Central Hub staff. The DoD-GEIS Central Hub staff provided mentoring to resident physicians, graduate students and medical students who had curriculum or projects dealing with emerging infections of military importance. As in previous years, the DoD-GEIS Overseas Training Program funded and provided professional support

enabling trainees (medical students, post-graduate medical residents and fellows) from various military commands and from three medical services to participate in approximately 30 day rotations at one of the five DoD overseas (OCONUS) medical laboratories. In FY05, the DoD-GEIS Central Hub cooperatively sponsored 18 military medical officers for international emerging infections training including medical students, Preventive Medicine and Internal Medicine residents, an Infectious Diseases fellow, and junior laboratory scientists. Training occurred at USAMRU-K (Kenya), AFRIMS (Thailand), NMRCD (Peru), NAMRU-3 (Egypt), and the NAMRU-3 Detachment (Ghana). Projects included infectious disease surveillance support for Operation Bright Star, evaluation of DoD-GEIS-supported surveillance systems, a broad-based clinical and epidemiologic training program developed by USUHS faculty, and projects focusing on malaria and other DoD-GEIS priority diseases. A review of FY00-FY04 alumni of this DoD-GEIS Overseas Lab training program revealed that of those previously trained by DoD-GEIS, 62 currently are serving on active duty in operational, research, academic, clinical, administrative, and in tri-service DoD-GEIS billets, providing a global network of military medical expertise in tropical diseases.

Professional Meetings

The DoD-GEIS Central Hub provides professional assistance and special financial support for workshops related to military emerging infections, symposia, and the publication of proceedings from these; the Central Hub also provides speakers for various professional gatherings. The Central Hub staff has the capacity to identify the need for a professional symposium concerning emerging infections, and may organize a tri-service workshop, provide consultation, or develop a lecture as appropriate. The DoD-GEIS sponsored professional meetings provide current information and invite available military medical experts, setting the stage for the development of collaborations and plans for future work and action within the DoD medical communities, both regionally and globally. These symposia are an efficient way to develop professional expertise and to disseminate best practices within the MHS. In FY05 the DoD-GEIS participated in many conferences and activities in support of DoD partners as listed in Appendix F, and also planned, supported and/or conducted four major meetings:

Acinetobacter, Methicillin Resistant *Staphylococcus aureus* and Multiple Drug-Resistant Organisms. Walter Reed Army Institute of Research, Silver Spring, MD, May 26, 2005.

Sexually Transmitted Infections and Diseases in Military Health System Beneficiaries. Walter Reed Army Institute of Research, Silver Spring, MD, May 27, 2005.

Pre-Conference Influenza Workshop, United States-Mexico Border Health Association 63rd Annual Meeting, Laredo, TX, June 21, 2005.

Epidemiologic Applications of Emerging Infectious Disease Modeling to Support US Military Readiness and National Security. Emerging Infectious Diseases, Baltimore, MD, August 3, 2005

The two May 2005 meetings updated military health care providers and public health people on the subject topics and identified future work and tasks needing to be completed. Administrative support was provided by the DoD-GEIS Central Hub staff and participants attended either in person or by telephone hook-up. The Laredo, TX meeting enhanced existing relationships and established new contacts between people working on DoD-GEIS respiratory disease programs, CDC, PAHO and Mexican Government and border state public health professionals. The program emphasis was influenza. Administrative and program management for this meeting was done in partnership by the Center for Disaster and Humanitarian Assistance Medicine, Uniformed Services University of the Health Sciences, Bethesda, MD, with DoD-GEIS support. The August 2005 meeting that was attended by NORTHCOM officials was arranged and supported by the DoD-GEIS Central Hub staff and assessed current and future epidemiologic application of emerging infectious disease modeling.

The DoD-GEIS Central Hub responded to a request from the President of the Armed Forces Epidemiological Board (AFEB) to provide a program on screening for *Chlamydia trachomatis* in the US military at the AFEB meeting in San Diego, CA, on December 1, 2004. The DoD-GEIS Central Hub coordinated an afternoon program with presentations by Dr. Charlotte A. Gaydos of the Johns Hopkins University School of Medicine, Baltimore, MD, Dr. Mary-Ann Shafer of the

University of California at San Francisco and Dr. Joel Gaydos of DoD-GEIS. In FY05, the DoD-GEIS became a partner with the Centers for Disease Control and Prevention, Atlanta, GA, and many other organizations and groups to initiate planning for the International Conference on Emerging Infectious Diseases 2006, to be held in Atlanta, GA.

Tri-service Epidemiology and Infectious Diseases Laboratory Teleconferences

In addition, the DoD-GEIS arranged for and conducted DoD-wide telephone conference calls twice monthly for key epidemiologic personnel. The proceedings of these "Epi-Chiefs" meetings were transcribed and the entire transcriptions and summaries are available for review by the military medical leadership and participants as clinical information For Official Use Only. Typically, the military medical services epidemiology centers at CHPPM, AFIOH and NEHC have taken the opportunity to discuss current information regarding outbreaks and related concerns with DoD-GEIS Central Hub staff and other partners, to include many key laboratory programs, and with regular participation NORTHCOM, AFMIC, AFIP, Health Affairs and others. In September 2005 the DoD-GEIS initiated a monthly, DoD-wide clinical/research laboratory telephone conference meeting entitled the "Clinical Desk." The objective of this meeting was to bring together clinical infectious disease providers, laboratory specialists and public health experts from the DoD-GEIS Central Hub to discuss and improve the availability and use of tests for emerging infectious agents, and to assist in the identification of case reports and suspected disease clusters of epidemiological significance that need special laboratory support. The minutes of the "Clinical Desk" meeting supplements that of the "epi-chiefs' minutes and should assist situational awareness of emerging infections events and promote strengthening of professional relationships among military medical professionals with expertise in infections. There have been many examples of active duty of beneficiary outbreaks that were identified by one service's epidemiology system that was not known to the other two services, yet clearly affected their populations. The "Clinical Desk" revealed examples of isolated case reports of physicians from MTF's ordering testing for high-interest illnesses for patients after tropical exposures, and the clinical investigations having gone completely unreported in the preventive medicine channels. In another case, routine professional list-serves and WHO publications identified reports of Marburg virus infection in Angola; subsequent communications with the USEUCOM surgeon identified that this was of high interest to the military leadership, which resulted in a NAMRU3 staff member being deployed to investigate Marbug on a military cooperative mission. This event is later discussed in the NAMRU3 Cairo section of the report, but shows how communication in the DoD-GEIS network can facilitate provision of timely expertise and service in response to an urgent public health emergency that directly addresses military combattant commander priorities and concerns.

MHS Summaries Section

The Military Health System (MHS) DoD-GEIS programs in FY05 continued to grow in capabilities and expertise, cooperating across miltary Services and programs, facilitating progress and beneficial collaborations. MHS DoD-GEIS programs address vulnerabilities to new, emerging and re-emerging infectious diseases according to the disease priorities and goals expressed in the DoD-GEIS strategic plan. DoD-GEIS links many diverse medical projects and activities in over thirty countries as listed in Appendix D. DoD-GEIS projects and partners link the MHS with the OCONUS medical research labs, the MTF's, and geographic COCOM activities in many ways, including by systematically sharing medical information in the "Epi-Chief's" teleconferences mentioned above and in the weekly HIO Update publications in Appendix B. The following section describes some highlights of those activities and illustrates important connections among these programs. A unifying feature of DoD-GEIS projects is the focus on influenza and respiratory diseases of epidemiological significance for military populations. AFIOH's DoD Global Influenza Surveillance weekly reports and NHRC's Febrile Respiratory Illness Surveillance Update weekly reports are both distributed weekly to authorized Department of Homeland Security and Department of Health and Human Services (DHHS) personnel, and republished for the fifty States' Epidemiologists through CDC's secure

electronic Epidemic Information Exchange, Epi-X available at URL: http://www.cdc.gov/epix/.

WRAIR Division of Preventive Medicine
In 2003, a case series revealed that three of 18 military patients of severe pneumonia in the CENTCOM region tested positive for Q-Fever by IFA. Testing of an additional 22 military members with non-severe pneumonia illuminated an additional 5 individuals with serological evidence of Q fever. This high proportion of Q-Fever seroconversions led investigators of WRAIR's Division of Preventive Medicine to initiate an expanded investigation to estimate the incidence of Q-Fever infection in troops deployed to Iraq, and to determine if a larger epidemiological investigation of Q-Fever in US troops deployed to Iraq was warranted.

In FY05 these investigators conducted a sero-epidemiological survey of Q fever in OIF deployed troops. Records were sought through PASBA in San Antonio, TX, based on ICD-9 codes that were compatible with a potential Q fever infection. From analysis of these records, 950 service members were identified who during the study period were at one time deployed to Iraq and potentially exposed to the microbial agent of Q fever but had not been definitively diagnosed with illness from Q fever. A list of these service members was then sent to the Army Medical Surveillance Activity (AMSA) so that pre and post-deployment sera could be obtained from the DoD Serum Repository.

By the end of FY 2005, the investigators had submitted to their IRB a research plan to examine for evidence of Q fever in 1800 samples (about 900 pre-deployment and 900 post-deployment sera) by IFA testing at the AFIOH laboratory, and additional EIA testing at USAMRIID. Results of these investigations are pending.

It is anticipated that in FY06 the results of the IFA and the EIA tests can be used to determine an approximation of the incidence of Q fever among deployed troops in Iraq, answering an important question raised in the earlier investigation of severe pneumonia cases, as well as to compare the performance of the IFA and the EIA serological tests in identifying Q fever infection in US Forces.

Malaria parasites obtained from US Marines who had acquired falciparum malaria in Liberia

ET investigated stereo-selective aspects of certain drugs and have demonstrated significant differences in enantiomers with regard to efficacy, toxicity, pharmacodynamics and pharmacokinetics. Mefloquine (Lariam) is one of several antimalarial drugs which have chiral centers and are marketed as the racemic mixtures. Mefloquine contains two asymmetric carbon atoms, yielding four optical isomers and has one major carboxy metabolite *in vivo*. The carboxy metabolite has no chiral centers and little or no intrinsic activity. *In vitro*, the resolved isomers display stereo-selectivity against some strains of falciparum malaria, with a 2 fold ratio in favor of the (+) enantiomer over the (-) enantiomer. With regard to metabolism, pharmacokinetic studies have demonstrated that the (+) enantiomer is more rapidly metabolized and is less bioavailable. With regard to neurotoxicity, it has been observed in rodent models that (-) enantiomer mefloquine was more neurotoxic in vivo than the (+) enantiomer component of commercial mefloquine. It was unclear whether this was due to the greater accumulation of the (-) enantiomer in the CNS, or because this isomer was more neurotoxic. Adverse events and emerging resistance are significant confounders in assessing mefloquine compliance. At recent ASTMH meetings (Milhous et al., 2003 and Gerena et al., 2004) ET reported the results of malaria drug susceptibility testing of parasite isolates obtained from US Marines who were non compliant with Lariam prophylaxis and acquired falciparum malaria during deployment to Liberia. We used these strains with varying levels of mefloquine susceptibility (IC50s) ranging from 2 to 20 ng/ml) to explore differences in intrinsic activity of the erythro and threo steroisomers of mefloquine. The results were unremarkable with no significant differences in activity between isomers against these strains. One is left to conclude that clever chiral chemistry of the currently marketed racemic formulations of mefloquine would not be cost effective and would not improve efficacy against emerging resistant strains.

WRAIR Division of Experimental Therapeutics

A specimen protocol was developed by WRAIR Experimental Therapeutics through collaboration with the DoD-GEIS central hub and partners in FY05 to improve the quality of specimens and reports of malaria cases from the DoD labs. Information concerning this protocol has been shared with the Services' epidemiology centers and others in key surveillance activities. Malaria cases occurring in DoD personnel frequently come to attention after the opportunity for collection of usable specimens has passed. For example, it would be important to know whether antimalarial resistance is the cause of a case or an outbreak despite the use of recommended chemoprophylaxis. In addition, these specimens provide an opportunity for in-vitro testing of the parasite against a wide range of antimalarial drugs and for potential correlation of genetic/molecular changes with clinically and militarily important resistance. ET can provide this type of information only if specimens are collected and transported, and this of course depends on widespread awareness that this capability exists and how to access it.

Genetic mutation patterns in P. falciparum used for predicting treatment failure and for surveillance of resistance

WRAIR investigators continued to examine the mutations in *Plasmodium falciparum* dihydrofolate reductase (dhfr) and dihydropteroate synthase (dhps) genes. These mutations have been used as means to predict treatment failure to sulfadoxine-pyrimethamine (SP) and for monitoring/surveillance of resistance to the drug in many areas where malaria is endemic. However, patients' responses to treatment are significantly dependent on factors like host immunity profile of treated patients. In order to investigate the relationship between molecular markers of SP resistance, host immunity and clinical outcome, the association between pre-treatment dhfr and dhps genotypes, age and treatment outcomes was evaluated in 109 children treated with SP for acute uncomplicated malaria in Ibadan, Nigeria. Of the children, 73% were cured with the drug, while 27% failed treatment after 28 days of follow-up. All children infected with parasites harboring less than two dhfr/dhps mutations were cured with SP. The dhfr triple (Asn-108/Ile-51/Arg-59) mutants or the dhps double mutants (Gly-437/Glu-540) were independently associated with SP treatment failure in children aged less than 5 years, but not in older children. The dhfr and dhps quintuple mutant (dhfr triple mutant + dhps double mutant) was the genotype most strongly associated with SP treatment failure (OR = 24.72, 95% CI = 8.24-74.15) in both younger and older children.

Work continued with evaluations of the malaria strains obtained from the Marines returning from Liberia to assess antimalarial susceptibility to slower acting drugs such doxycycline, tafenoquine and antifolate antimalarial drugs. The clinical relevance of doxycycline *in vitro* susceptibility has never been determined. Bona fide therapeutic failures have not been documented and correlated with laboratory IC50s. One potential doxycyline failure from Afghanistan was described, but a specimen was not received for testing. In the cases of the Marines returning from Liberia, all patients were initially given doxycycline because their fevers were of unknown origin. Ten samples were successfully cultured, but no remarkable differences were observed relative to the control strains. IC50s ranged from a low of ~100ng/ml to a high of ~400ng/ml. Similar findings were made with regard to proguanil susceptibility. Despite resistance to both cycloguanil and pyrimethamine, all parasites were uniformly susceptible to proguanil (IC50s ranging from ~200 ng/ml to ~400ng/ml), but were at least six fold less susceptible than the multidrug resistant W2 strain (IC50 3600ng/ml) from Indochina. Testing against the active triazine antifolate WR99210 demonstrated marked susceptibility (IC50s ranging 0.02 to 0.06 ng/ml) and no cross resistance with cycloguanil or pyrimethamine.

The most striking observations in this group of patients with falciparum malaria were the *in vitro* responses to Tafenoquine reinforcing epidemiological evidence that multi-drug resistant strains are more susceptible to the 8-aminoquine class of drugs. Tafenoquine is a novel 8-aminoquinoline antimalarial being jointly developed by the US Army and GlaxoSmithKline. It is unique in that it

Antimalarial Resistance

Due to the high levels of chloroquine resistance seen in malaria, especially *P. vivax* (Pv), antifolates (pyrimethamine {PYR} and cycloguanil {CYC}) and sulfa drugs (sulfones and sulfamides) have since become the first line alternative to chloroquine. Point mutations in the dhfr gene and dhps gene confer resistance to PYR and sulfadoxine, respectively in both Pf and Pv. ET examined dhfr and dhps point mutations in the Pv isolates from several geographical regions. Sequence polymorphisms in the Pv dhfr gene (Pvdhfr) and dhps gene (Pvdhps) were assessed by PCR and sequencing from blood samples of patients from PNG, Philippines, China, East Timor and Vietnam (n = 79). The Pvdhfr sequence polymorphisms were then compared to 33 other previously published isolates from Thailand, South Africa, South America, North Africa, India and Indonesia. Examination of the 7 codons with known mutations (encoding residues 33, 50, 57, 58, 61, 117 and 173) of the Pvdhfr gene revealed that Indonesian isolates had the greatest range of mutations. The majority of the isolates have double mutations of S58R/S117N. PNG and Indonesia were found to have quadruple mutations of F57L/S58R/T61M/S117T and a quintuplet mutation of N50T/F57L/S58R/T61M/S117T. 18bp repeats were seen in the Pvdhfr of all isolates sequenced. There is a trend that isolates with a higher number of 18bp repeats contain a higher number of mutations. AMRU1 (PNG) was the only isolate to have four 18bp repeats. These 18bp repeats may be due to the effect of drug pressure over long periods of time. In vitro susceptibility tests, with a limited number of isolates, suggest that point mutations (S58R/S117N) correlate with a lower sensitivity to PYR and CYC. This data demonstrates the alarming presence of 4 Pvdhfr mutants in PNG and Indonesia. Sequence comparisons of Pvdhps (encoding residues 382, 383, 512, 553 and 585) revealed only two amino acid changes among the *P. vivax* isolates: A338G (n = 2; Indonesia) and A553G (n = 4; Vietnam). All *P.vivax* isolates had V585 in the Pvdhps. Only those isolates that had mutations in Pvdhps, were found to have mutations in Pvdhfr. The presence of mutations in both Pvdhfr and Pvdhps, due to drug selective pressures of both antifolates and sulfa drugs, emphasizes the urgent need to develop alternative drugs and drug strategies for effectively treating *P. vivax* infections.

is active against all species and all stages of the parasite. Phase II data suggest it will be efficacious as a weekly prophylactic drug, a monthly prophylactic drug, and as a radical cure for Plasmodium vivax with 1-3 doses. Data previously generated at the AFRIMS laboratory from field isolates suggested enhanced activity against multi-drug resistant strains of falciparum malaria. Conversely, the West African NF54 strain (chloroquine & pyrimethamine susceptible) used in human challenge experiments has been one of the least susceptible strains (IC50 greater than 1200ng/ml). In this group of patients from Liberia West Africa, 5 chloroquine susceptible strains had IC50s similar to the NF54 challenge strain (ranging from 300 to 1200ng/ml) while 4 chloroquine resistant strains had lower Tafenoquine IC50s(40-80 ng/ml). One strain appeared to be very susceptible to both chloroquine (IC50 4ng/ml) and Tafenoquine (35ng/ml).

The WRAIR-Australia lab investigated various *P. vivax* (Pv) dhfr alleles with *in vitro* analysis, clinical outcomes, initial transfection work with these alleles. The group at AMI has established very good ties with officials in Papua New Guinea (PNG) and the plan is for us to conduct surveillance work in collaboration with PNG with respect to malaria (both Pv and Pf). There is also a very good possibility to add other infectious diseases (e.g., dengue, HIV). PANBIO has already indicated that they would like to have us use their malaria RDT in PNG. Through this type of collaboration WRAIR staff believes that enhanced infectious disease surveillance for PNG is possible not only for malaria but other infectious diseases as well.

AFIP Directory of Public Health Laboratory Services

The Directory of Public Health Laboratory Services is available on-line to authorized users and can be accessed directly, through links on the AFIP and DoD-GEIS websites. The Directory contains data for over 170 infectious agents and more than 40 government laboratories and provides links to other websites where pertinent information about the infectious agents and their associated diseases can be found. It is password-protected, and laboratory

information is only available to appropriate government users. Over 230 users are registered. Of these, approximately 75% are personnel with .mil or .gov addresses. During the last fiscal year, the Directory website was visited over 4000 times. The addition of military environmental laboratories to the website using an EPA format is an ongoing activity with USACHPPM through the Joint Environmental Surveillance Working Group, and the Laboratory Policy Coordinating Group received briefings with regard to the capabilities and potential of the Directory. Poster presentations describing the Directory were presented at two conferences in FY05 (see references) to increase awareness of the program in the military laboratory and medical community, and additional posters were submitted to conferences scheduled for FY06. Additional public awareness and participation is sought by providing a topical monthly newsletter sent electronically to all users. It provides guidance for using the Directory and contains brief descriptions of relevant news items involving infectious agents along with links to more detailed information. An archive of all newsletters is available on the Directory's website, as is a message board through which users can contact the staff. A version of the Directory is also available on compact disk (CD). The on-line system is operating and is available to authorized users. The database has been updated with current points of contacts and laboratory information. USACHPPM has agreed to support the Directory and promote the inclusion of environmental laboratories in the database, expanding the scope and usefulness of the Directory beyond its original infectious disease focus.

AFIP Laboratory Response Network (LRN)

AFIP is the "military gatekeeper" of the CDC-sponsored Laboratory Response Network (LRN), which is important in national public health emergencies, and this aforementioned DoD-GEIS sponsored project, The Directory of Public Health Laboratory Services, is intended to supplement the LRN system; LRN status is among the data fields that are contained in the AFIP Directory of Public Health Laboratory Services database. Of the sixteen DoD laboratories or MTF's that CDC recognizes as LRN labs, DoD-GEIS has significant projects at 13 of these. AFIP also coordinates College of American Pathology (CAP) certifications, Clinical Laboratory Improvement Amendments (CLIA) activities, and Clinical Laboratory Improvement Program (CLIP) documentations at military clinical and research laboratories within DoD. DoD-GEIS has attempted to cooperatively promote best practices in laboratory and clinical settings, and facilitate recognition of laboratory excellence through certifications as appropriate in DoD research laboratories to enhance the value of the medical information that they produce, as some DoD labs work. Laboratory recognition as CDC and WHO collaborating labs was also encouraged by DoD-GEIS in FY 2005 to promote interoperability, and flexibility in complex emergencies.

AFIP Mortality Surveillance

An important DoD-GEIS-sponsored program is the "Alert Component "part of the Mortality Surveillance Division (MSD) of the Armed Forces Medical Examiner System (AFMES) at the Armed Forces Institute of Pathology (AFIP). This project includes active monitoring of all active duty deaths in real-time for infectious or potentially infectious etiologies, notification of DoD-GEIS in the event of any clusters or unusual types of infections or presentations, and obtaining specimens for more extensive testing and/or archiving whenever possible. The goals of the Mortality Surveillance Division are to establish a mortality surveillance system to monitor Active Duty deaths, to quickly identify those deaths that could be the result of an infectious etiology, and to take timely and appropriate steps to identify the agent or agents. Additionally, MSD strives to notify local preventive medicine and DoD-GEIS personnel of deaths that may indicate a public health response in a timely enough manner to ensure intervention as necessary.

Copies of other related medical and personnel records may be requested in order to supplement the initial information obtained. These might include medical records from the individual's base or hospital (both at residence and the place of death), autopsy reports, AFIP consultations and toxicology studies, personnel records, legal investigations, Safety Center and other special investigations, and other sources of eyewitness accounts. A physician individually reviews all complex cases to validate the medical cause of death. Once the information is gathered and analyzed it is provided to various agencies and DoD leadership who can then use it to make changes in policy and procedure based on objective evidence.

Mortality information sources

Daily collection of mortality information from the Army, Navy, Marine Corps and Air Force Service casualty offices

Collection of death circumstance information from DoD, Federal, and civilian Investigative agencies

Regular contact with both DoD and civilian Medical Examiners to obtain autopsy reports and to request specimen collection and agent specific testing for infectious agents when appropriate.

The goal is, for each active duty case, to obtain as complete a file as necessary to determine the medical cause of death. As information is obtained, it is reviewed to extract the relevant medical diagnostic information, risk factors and circumstances of death and entered into the DoD-Medical Mortality Registry, a computerized and searchable database. This information is constantly updated and amended as additional information is received. Finally, the cause of death, co-morbid conditions and ancillary and risk factors are coded and standardized using ICD-10. In addition to information on each death, up-to-date military personnel information is obtained from the Defense Manpower Data Center (DMDC), and deployment history is obtained telephonically from the unit in suicides, homicides and potentially infectious diseases where travel history is relevant

The mortality registry database has continued to develop, in terms of content, number of cases and, most importantly, process. The alert component has been receiving daily reports from the Army casualty office since late CY2000, and began receiving daily e-mailed or faxed reports from each of the other three service casualty officers in January of 2002. As of 18 October 2005, the registry had 10,163 records from all Services dating back to October of 1997. The accompanying vignette describes the mortality database that is becoming an integral, central tool in this endeavor.

Another development of note has been the implementation of full body CT scans for all fatalities autopsied at Dover Port Mortuary. This DARPA-sponsored project has been implemented with the goal of evaluating post-mortem CT as a viable replacement for full, conventional autopsy. While the vast majority of cases scanned to date have been from trauma, we are looking forward to evaluating the technique in natural deaths and exploring it's potential to identify regions of infectious changes.

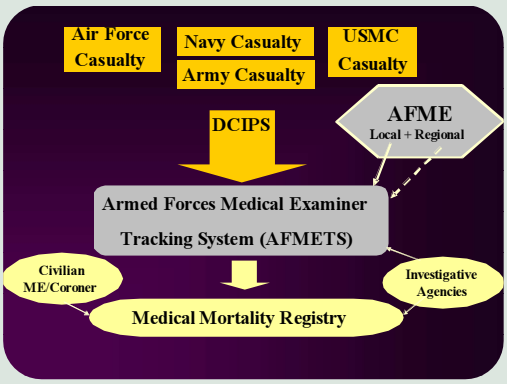
Fatality investigations

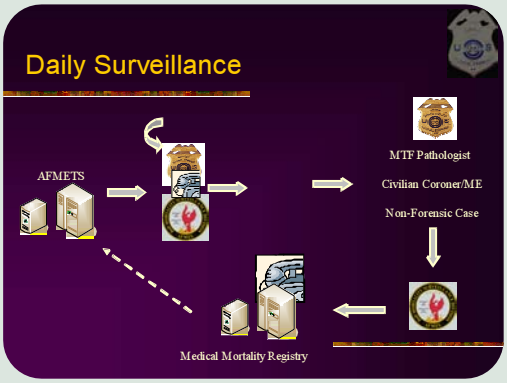
The number of active duty fatalities during FY 05, were compared to the average annual number of deaths from 1998-2002. Combat deaths from Iraq and Afghanistan in FY 05 were compared with all active duty (AD) deaths. Accidental deaths were also examined in detail, including the number of aviation and motor vehicle crashes. AFIP investigators also compiled reports of non-traumatic and otherwise unclassified "illness" or "determination pending" deaths during FY 2005. *All* of these non-traumatic AD deaths were reviewed thoroughly for a possible infectious cause, and some of these were determined to have laboratory evidence of an infectious cause of death with no underlying immunocompromise. The results were shared with the appropriate military medical and public health officials to assist in communicable disease control activities. Examples of diseases or conditions that were suspected or investigated include: Influenza A virus, bacterial and viral pneumonia, and sepsis.

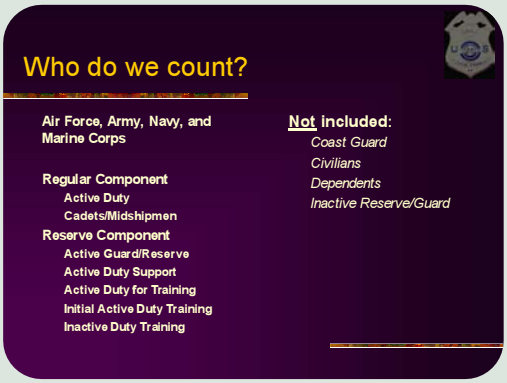
Naval Health Research Center (NHRC) and AFIP infectious disease, pulmonary and cardiovascular branches were extensively consulted as part of the process of identifying an infectious etiology when the cause of death was not apparent among active duty populations. It should be reassuring to US and international public health officials that influenza is specifically considered as a possibility in non-traumatic deaths among the AD population, and that it is policy and practice to systematically obtain influenza testing for AD personnel when death occurs from a respiratory illness.

Mortality surveillance reports currently consist of routine, weekly mortality reporting with summary analysis to Army, Navy and Air Force leadership. These reports are used to monitor major categories of death in real-time, allowing for response when indicated. In addition, DoD-GEIS Central Hub staff are notified via e-mail when infectious or potentially infectious deaths occur and when deaths exceed expected levels. In early 2006, AFIP anticipates producing a six-year summary of all active duty deaths from 1998-2005, to include a breakout for infectious cases, as well as a first annual summary.

The most significant change in FY05 has been the development of the Armed Forces Medical Examiner Tracking System (AFMETS) by the staff of the Mortality Surveillance Division and a team of contract programmers. AFMETS was initially populated by 2 related systems: The Defense Casualty Information Processing System (DCIPS), and DCIPS-Forward. DCIPS-Forward messages are the preliminary casualty reports that are sent from the field to the centralized Service-specific Casualty Office. They are received in an email drop box that is queried by the AFMETS server every 30 minutes. New messages are automatically downloaded and imported into AFMETS. Currently, AFMETS only receives DCIPS-Forward from the Army and the Marines. The Air force is currently beta testing DCIPS-Forward at select sites. We expect the system to be receiving all Air Force DCIPS-Forward messages beginning in January 2006. The Navy is waiting for the new web-enabled version of DCIPS-Forward before adopting it. AFIP expects the new version to launch in January 2006. In addition to DCIPS-Forward, AFMETS receives a DCIPS extract from each of the Services on a daily basis. The extract is a more formal casualty report that has more complete demographics and that has been verified by the centralized Casualty Offices. Army Human Resource Command (HRC) queries each of the Service's DCIPS servers once a day for all records that were modified within the last 24 hours and posts them to a secure server for download. The process of downloading and importing the extracts has been fully automated since September 2005. DCIPS extracts have a lag of from 14 to 48 hours. Army HRC is currently establishing direct connections with the other Services. Once connections are established, AFMETS will be able to get DCIPS data multiple times throughout the day. The AFMETS system will "self-correct" by overwriting the DCIPS-Forward message with the DCIPS Extract as it comes in, but by gaining access to the preliminary DCIPS-Forward messages, the Alert Component of the Mortality Surveillance System will be receiving the most rapid notification of active duty and activated reserve component fatalities possible. While AFMETS is designed to be an operational tool for the Medical Examiners, it will also become the centralized location for storing all autopsy reports generated by any pathologist in the Armed Forces Medical Examiner system and will generate and store the Overseas Death Certificate (DD2064) when appropriate. The AFMETS system is already greatly enhancing the Mortality Surveillance Division's ability to perform real time surveillance, and as it develops it will become an ever more valuable tool for performing both the Alert and Registry components of this mission.







18th Medcom, Korea

The Department of Defense, Global Emerging Infections System (GEIS) has provided financial support and guidance to The Office of the Deputy Chief of Staff for Force Health Protection (FHP), 18th Medical Command since 2001 for the surveillance of emerging mosquito-, rodent-, and tick-borne diseases in Korea. Additionally, the Armed Forces Medical Information Center has provided supplemental support since 2002. This has enabled FHP to form collaborative bonds with the Korea National Institute of Health (KNIH), Korea Center for Disease and Control (KCDC), the Ministry of National Defense (MND), and various universities in Korea, in addition to working with WRAIR, USAMRIID and AFRIMS to resolve important medical entomology issues that are critical to the protection of Soldiers, family members and civilians deployed to Korea.

The overall goal of the FHP, through the support of DoD-GEIS/AFMIC and other agencies, is to provide an overall health surveillance system that identifies risk, vector/reservoir populations, and strategies for the reduction of these health threats. The data gathering and analysis of vector-borne diseases, vector-control evaluations, and taxonomic, behavioral, and distribution studies enables FHP to develop more effective vector and disease control strategies. Programs for identifying vector/disease trends and reduction strategies include:

- Analysis of historical and current Korean and US cases of malaria and Japanese encephalitis (JE) through coordination with KNIH/KCDC through human surveillance and reporting systems to identify trends of disease;
- Identification of malaria and JE and other arbovirus infected mosquitoes to more precisely identify areas of potential transmission, especially in view of latent forms of malaria that do not present symptoms for 6 – 18 months after infection;
- Identification of potential tick-borne diseases, to include Anaplasma/Ehrlichia spp., Rickettsia spp. (Spotted Fever Group Rickettsia, Lyme and other pathogens), and Bartonella spp.
- Identification of rodent-borne disease (hantaviruses, scrub typhus, leptospirosis, and murine typhus) rates, annual and seasonal distributions, and rodent intestinal parasites and ectoparasites;
- Resolving *Anopheles* spp. taxonomic issues that provide for malaria vector studies and developing models for risk analysis through identification of species distribution and vector potential;
- Surveillance of Soldiers knowledge of malaria, and their attitudes and behavior for developing an improved vector-borne disease education to improve usage of personal protective measures (PPM) while at field training sites or residing in malaria-risk areas;
- Mosquito, tick and rodent surveillance programs to identify population trends, bionomics, habitat associations, and species distributions to develop vector control strategies that results in improved protection for Soldiers deployed to Korea; and
- Evaluate vector control strategies that effectively reduce vector populations and disease risk.

Vector-borne diseases continue to be a major health threat to US Forces Korea (USFK) personnel throughout Korea. Vivax malaria, once eradicated from Korea, returned with a vengeance in 1993 and peaking in 2002 with more than 4,000 reported cases. The implementation of chemoprophylaxis among ROK military in 1997 slowed the spread of malaria and resulted in its decline through 2004, in addition to providing protection for US Soldiers deployed to or training in malaria high-risk areas where the ROK military employed its use. However, CY05 rates are similar to those of the previous year, indicating that malaria rates may have stabilized; implying that implementation of additional malaria control strategies may be needed. Collaborative meetings with the MND and KNIH/KCDC allow FHP to follow developments that may affect the health of USFK personnel and evaluate currently employed USFK policy.

The Walter Reed Biosytematics Unit (WRBU)-WRAIR, in collaboration with FHP and KNIH has provided invaluable contributions that contributed to the resolution of the taxonomic status of *Anopheles* spp. belonging to the Hyrcanus Group. The taxonomic status of *Anopheles* mosquitoes has been in disarray and previously there were only

three species belonging to the Hycanus Group in Korea. Now it is recognized that there are five species and most recently, the additional two species have been named (*An. belenrae* and *An. kleini*) and the name of a third spp. (*An. lesteri*) resolved. In addition, preliminary studies have shown that all five of the species are found north of Seoul near the DMZ, with *An. sinensis*, *An. pullus* and *An. kleini* being the most abundant. However, south of Seoul, *An. sinensis* accounts for more than 95 % of all Hycanus Group collected. Both *An. sinensis* and *An. kleini* have been shown to develop sporozoites (KNIH/AFRIMS). Suspected differences in anthropophilic behavior may provide possible answers as to why malaria has not rapidly spread south as previously predicted.

Larval mosquito surveillance and the identification of members of the Hycanus Group, through PCR protocols developed by WRBU and collaboration with KNIH will assist in identifying larval habitats that may affect the distribution of these mosquitoes as well as provide insights into improved control strategies.

The Center for Health Promotion and Prevention (CHPPM)-Japan provided assistance for assaying malaria infected mosquitoes collected at selected installations throughout Korea. Data showed that for CY03, CY04 and CY05 (incomplete), malaria infected mosquitoes were found throughout Korea, with greater numbers of infected mosquitoes collected near malaria high-risk areas near the DMZ and where most of malaria among US Soldiers is attributable. However, it is difficult to understand why we don't observe more cases than we see of malaria among US Soldiers, family members and civilians, unless the positive mosquitoes, believed to be primarily *An. sinensis* (based on species distributions), is an inefficient vector.

USAMRIID continues to provide support for the assay of culicine mosquitoes for arboviruses. These data show that JE virus continues to circulate near the DMZ where Soldiers train and are often exposed to biting mosquitoes. Additionally, Getah virus (non-human disease) and an unnamed flavivirus have been identified. Surprisingly, no JE infections have been found at installations south of Seoul where JE vectors are found in abundance and were the site of encephalitis infections (Busan) during the Korean War. While previous studies by us have shown that *Cx. tritaeniorhynchus* (primary JE vector) is not readily attracted to man, they are collected in human-bait collections. The status of transmission of JE virus to US Soldiers without disease (no USFK cases reported for > 20 years) is unknown.

The evaluation of vector control strategies has shown that ULV fogging for some installations to control vector mosquito populations is not effective. ULV fogging provides a false sense of protection to the Soldiers, increasing the risk of not utilizing PPM when in field training environments. Thus Soldiers need to be educated and alternative measures, to include PPM, need to be employed by Soldiers to provide increased protection to the soldier while training.

Ticks have been collected by standard dragging and flagging techniques for various habitats and from rodents throughout the year to identify species distributions, habitat, and bionomics. Sampling techniques are biased as flag/drag collections resulted in genera compositions of > 95 % *Haemaphysalis* and < 5 % *Ixodes*. However, > 99 % of all ticks taken from rodents/insectivores near the DMZ were *I. nipponensis*. In collaboration with Chonbuk University, we have identified an abundance of pathogens among ticks, to include at least five *Ehrlichia/Anaplasma* spp., one *Rickettsia* spp. (Spotted Fever Group Rickettsia) and at least four *Bartonella* spp. All genera have members that have been identified as human pathogens in Korea. USAMRIID has initiated the isolation of arboviruses from ticks collected in Korea.

The rodent-borne disease surveillance program was initiated in the fall 2000 as a result of hantavirus infections in US Soldiers. This program has continued and resulted in important epidemiological and bionomic data, primarily for Hantaan virus and scrub typhus. Low rates of leptospirosis and murine typhus circulate in wild rodent populations. Data shows that high rodent populations are found in habitats that provide cover (thick stands of tall grasses and dense crawling vegetation), while much lower populations are associated with earthen berms separating rice paddies. While hantavirus rates may be high along the earthen berms, the number of rodents infected (based on area) with

hantaviruses often far exceed that of the rice paddy populations. These studies have provided evidence for FHP to develop risk assessments that provide strategies to reduce rodent-borne disease infections.

These surveillance systems for vector-borne diseases provide USFK the capability to collect and assess data associated with anticipated exposures and to rapidly deploy and implement appropriate countermeasures. For example, US malaria patients infrequently used repellents and other means to protect themselves, even when reporting numerous bites. Thus a better and more effective Soldier and Commander education program needs to be developed that will provide the Soldier with knowledge of how to prevent disease and not be a casualty during training. In addition, the identification of disease agents in Korea provides medical personnel with the tools to more quickly identify potential pathogens in US patients. Thus, the continuation of effective and efficient surveillance systems that not only include the human component, but also the vector/reservoir components are required for the greatest predictive values in reducing DNBI, and are especially important in view of limited military resources.

U.S. Center For Health Promotion And Preventive Medicine – Main

The Epidemiology and Disease Surveillance Directorate of the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM) partnered with DoD-GEIS in FY05 to assess disease occurrence during recent operations in the central command area of responsibility (CENTCOM AOR), specifically Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF). Under the auspices of this collaborative agreement, USACHPPM established data use agreements to secure quarterly data extracts of unclassified hospitalization, medical air evacuation, and personnel data for service members deployed to the CENTCOM AOR as of October 2001, the inception of OEF. To date, analyses of the hospitalization and evacuation data collected have focused predominately on traumatic conditions and/or broad categories of illness; there is not a sufficient, systematic analysis being conducted that contributes to an understanding of endemic or epidemiologically significant diseases associated with current operations.

Through this DoD-GEIS sponsored surveillance endeavor, the USACHPPM will apply epidemiologic expertise and data warehousing capabilities to fully explore and document disease outcomes reported through these data sources. Efforts are underway to "scrub" and integrate this data into a comprehensive database that will allow analysts to better define the actual burden of disease in-theater as well as associated risk factors, and will facilitate exploration of epidemiologic patterns, which could potentially allow identification of emerging infectious disease clusters and characterization of identified outbreaks. Expansion and improvement of these initial analyses are anticipated as additional data sources become available.

In conjunction with this surveillance and analytic initiative, DoD-GEIS provided training funds to allow select staff to convene for a tri-service symposium to address relevant analytic questions and explore additional deployment health surveillance systems that could enhance ongoing analyses of in-theater medical outcomes. The symposium included representatives from DoD Health Affairs, CENTCOM, and the three service public health sectors (USACHPPM, Air Force Institute of Operational Health (AFIOH), Naval Health Research Center (NHRC), and the Naval Environmental and Preventive Medicine Unit Seven (NEPMU-7)). Participants discussed health surveillance systems and reporting practices used in the CENTCOM theater through each echelon or level of care. Topics included: 1) inpatient and outpatient medical encounters, 2) tracking application data to include medical air evacuations, 3) disease and non-battle injury (DNBI) and reportable medical events (RME) reporting processes, 4) disease/injury of clinical and operation importance, and 5) supplemental data sources or needs (e.g. trauma registries, laboratory and exposure data). The symposium provided a forum for discussion of notable limitations encountered which affect data quality/ completeness as well as potential solutions. In so doing it enabled participants to gain a better understanding of available and emerging deployment health surveillance capabilities and has fostered continued tri-service collaboration.

U.S. Center For Health Promotion And Preventive Medicine – West

Personnel at the United States Army Center for Health Promotion and Preventive Medicine West (USACHPPM-West) continued a multi-year disease surveillance program in Honduras, El Salvador, and Guatemala. In FY05 USACHPPM-West initiated a laboratory based surveillance program to determine the infectious cause of illnesses in patients seeking medical care at host country health care facilities. Program activities focused on characterizing the pathogens associated with febrile, respiratory, hemorrhagic, encephalitic and meningitis syndromes. Participating DoD laboratories received samples from host country public health authorities and evaluated these for evidence of infection. This work also facilitated influenza surveillance begun in FY05.

The data accumulated through disease surveillance programs such as this are necessary to develop and implement effective intervention activities as well as to better understand the threat posed by emerging pathogens. Unfortunately, Central American governments, like many nations, have limited resources and only monitor selected diseases that local health officials consider a priority. The inability to survey for more agents has left medical authorities guessing as to the cause of illness or death for a large percentage of patients. As an example, health care providers frequently are limited in clinically diagnosing the causes of meningitis, encephalitis, and hemorrhagic syndromes. Laboratory personnel in many Central American medical facilities can only assay for the causative agents of select bacteria, malaria, and dengue. Typically, the causes can only be determined in a small percentage of patients. This situation has lead medical authorities in Honduras, El Salvador, and Guatemala to seek assistance from the DoD to improve the disease surveillance capabilities in their countries.

MOH personnel in Guatemala are collecting specimens from influenza surveillance using CHPPM-West/AFIOH protocols and reagents. This program began in FY05 as a collaboration of CHPPM-West, the DoD Global Influenza Surveillance program, the Ministries of Health of Guatemala, El Salvador and Honduras with SOUTHCOM support. MOH personnel will ship supernatant from these cultures to AFIOH for confirmation. The original nasal material is stored at -70 and is available if required. Guatemala MOH authorities are interested in expanding these surveillance activities to other locations in their country. MOH personnel in El Salvador and Honduras are set to begin their programs with specimen collection within the next few weeks and all three nations will have their influenza surveillance incorporated through AFIOH/DoD-GEIS into WHO and CDC influenza networks. While world attention is focused on influenza threats primarily coming from Asia, it is important to remember that a pandemic stain or a new strain can arise anywhere

CHPPM-W personnel provided training and reagents to MOH personnel so that they can independently monitor their human populations for medically important diseases. Due to these efforts, MOH personnel in all three participating countries can serologically evaluate human specimens for the agents that cause West Nile virus, Venezuelan Equine Encephalitis, Rickettsioses, and Ehrlichiosis using commercially available kits. CHPPM-W personnel are assisting MOH personnel develop protocols so they can make their own kits, which are more economical to use than commercially produced kits; CHPPM-W personnel will continue to transfer technology to MOH personnel to help them monitor emerging and reemerging diseases. At the end of one such training session, the Minister of Health for Guatemala personally met with CHPPM-W personnel to formally close the training activities and award training certificates.

Public health workers in Honduras and Guatemala were trained in laboratory methods that included Polymerase Chain Reaction and Indirect Fluorescent Antibody assays and demonstrated the use of laboratory methods to assay for vector and rodent-borne disease. The training activities helped host country government agencies to more effectively monitor patient populations for infectious diseases. The program biologist collected 110 rodents from four Honduran Departments in an effort to define rodent-borne diseases by region of the country. Results from analysis of tissues harvested from these rodents and those evaluated in years past showed evidence of Hantavirus and Leptospirosis infection. DoD laboratory personnel continue to evaluate ticks for spotted fever group Rickettsial and Ehrlichial agents. To date, investigators have successfully amplified several DNA fragments using Rickettsia and Ehrlichia specific PCR primers from tick isolates. USACHPPM-West personnel are currently sequencing these fragments for comparison to those of known pathogenic agents.

Currently, investigators assist host country health care workers survey patients for infectious agents that are of public health importance. Joint teams of DoD and host country biologists also collect arthropods, rodents and farm animals and evaluate harvested tissues for disease causing pathogens to determine transmission routes. Project activities also include carrying out outbreak investigations. Thus far, project personnel have uncovered evidence that several previously undetected rodent and vector-borne agents are causing significant human illness in the region. Host country medical and public health authorities use findings from these surveys to improve disease surveillance capabilities in their countries and to draft contingency plans for reducing disease during natural disasters. Training host country public health workers in disease surveillance methods is a priority. Classroom and field training was provided to Ministry of Health public health personnel in all three host countries; DoD personnel instructed laboratory personnel on appropriate techniques involving serological and molecular methods for detection of pathogenic agents, specimen collection, and field collection methodologies. These activities improved host country laboratory capabilities to independently assay for many pathogenic agents of public health importance including West Nile virus, spotted fever group rickettsial and typhi group agents, leptospirosis, and dengue viruses.

Brooke Army Medical Center

Brooke Army Medical Center (BAMC) was selected as a DoD-GEIS center of excellence for leptospirosis beginning in FY05. During the initial year of funding the primary mission was to develop working relationships with overseas DOD labs and provide leptospirosis diagnostic capabilities. BAMC investigators visited the overseas labs in Egypt, Kenya, Thailand and Peru. During those visits common interests and areas of collaboration were established. Technical support was provided in the development of microscopic agglutination testing (MAT) and molecular approaches to diagnosis were discussed with the various labs. BAMC also arranged shipment of human serum samples from ongoing acute febrile illness studies for performing MATs as either quality control or initial screening. Quality control MATs were performed for samples from NAMRU-3 in Egypt.

During this period, BAMC screened 5 primer sets against numerous serovars of pure leptospire culture. Although no primer was ideal, the combination of various primers is allowing for a matrix approach to rapid diagnosis of leptospirosis. This project is continuing to assess other primers and serovars of leptospirosis to determine the applicability of these techniques to a wide range of leptospire serovars. BAMC investigators are also assessing this technique with animal specimens to evaluate the test efficacy *in vivo*.

This work has resulted in national presentations in FY05 at the American Society of Microbiology selection for FY06 presentations at the International Leptospirosis Society meeting in Thailand and the American Society of Tropical Medicine and Hygiene (ASTMH) meeting in Washington. In addition BAMC will host a symposium titled “Current Strategies in the Management of Leptospirosis” at ASTMH.

The overall goals of developing a center of excellence for leptospirosis are being enhanced by the collaborative projects under development with the overseas labs and through sharing of expertise across a variety of laboratories across the DoD.

NMRC Rickettsial Disease Department
Rickettsial diseases are found throughout the world and they are a risk to endemic and visiting populations. Little is known of the extent of the risk for these acute febrile diseases that may be life threatening and are often debilitating. Providing reagents and the know how to detect Rickettsial diseases throughout the world is a benefit to both the US Military as well as to host countries. Many examples of this are to be found in the overseas laboratory sections of this report.

Rickettsial diseases, including epidemic typhus, murine typhus, Rocky Mountain spotted fever, Mediterranean spotted fever, scrub typhus, ehrlichiosis, trench fever and others, are endemic or re-emerging diseases in much of the developing world. In addition, antibiotic resistance and prophylaxis breakthroughs have been reported with *Orientia tsutsugamushi*, the agent of scrub typhus. The DoD overseas laboratories, supported in part by the DoD-GEIS program, are measuring the extent of Rickettsial diseases, including their threat to military operations, and the emergence of antibiotic resistance. They perform initial testing of specimens with reagents provided through this program. In addition, NMRC provides training to perform the assays and acts as a reference laboratory to perform confirmatory testing. Significantly, there is and will continue to be a need for a DoD reference laboratory for confirmation of serologic and molecular biologic detection results and to culture live rickettsiae in BSL-3 laboratories.

Rickettsial diseases are difficult to diagnose because symptoms are often non-specific, sharing characteristics with many other febrile illnesses. Rapid serologic tests, such as the non-specific Weil-Felix test and the rickettsia-specific enzyme immunoassays and rapid flow devices (RFD) are helpful, and provide some epidemiologic data. The sensitivity of these tests is limited by the delay in onset of host antibodies to rickettsiae which usually take 7 to 21 days after onset of disease to reach a detectable level. Specificity is limited by the variations and cross-reactivity in antigens between Rickettsial groups, species and even serotypes within a species. Complex indirect immunofluorescence assays (IFA) incorporating batteries of antibodies can increase accuracy. The preparation of reagents for the gold standard serodiagnostic assays such as the enzyme linked immunosorbent assay (ELISA), indirect immunoperoxidase assay (IPA) and the IFA test require the propagation of rickettsiae in infected yolk sacs of embryonated chicken eggs or cell cultures. Recombinant proteins are beginning to take the place of some of these whole cell antigens (e.g. Kp r56, Kt r56, Gm r56), but most still require specialized labs to produce the reagents. To detect emerging species and strains as causes of human disease, isolation of the causative agent is necessary. But, isolation is hazardous and requires special training and biological safety level (BSL)-3 laboratories because of the high risk of laboratory acquired infections.

The Rickettsial Disease Department (RDD) of the Naval Medical Research Center (NMRC) is ideally suited to performing, training others to perform and developing diagnostic assays. RDD has personnel trained in performing serological assays (ELISA, IFA, RFD), molecular biology assays (PCR, quantitative real-time PCR (qPCR), microarrays) and isolation techniques (yolk sacs, tissue culture) and has BSL-3 laboratories dedicated to work with rickettsiae. The laboratory has developed FDA-certified tests for typhus, spotted fever, and scrub typhus. These include ELISA, Dip-S-Ticks, and RFD. Previously, the U. S. Army Military Infectious Disease Research Program (MIDRP) supported the reference lab functions of the department, but in recent years their emphasis has shifted to vaccine, drug and diagnostic, design and development tasks. Currently DoD-GEIS supports RDD reference laboratory functions and collaborative work with rickettsial diseases projects at NMRCD, NAMRU-2, NAMRU-3 and AFRIMS.

The military relevance of rickettsial diseases cannot be ignored. Scrub Typhus, a leading cause of morbidity and mortality during WWII, was responsible for especially heavy losses in McArthur's New Guinea campaign. Epidemic (louse borne) typhus was a severe problem in the Mediterranean area, especially in Egypt and Italy, due to the large numbers of displaced civilians; a phenomenon that could easily repeat in the humanitarian missions which current military forces are called to carry out. Rickettsial diseases continue to occur with considerable disease burden in Asia, Oceania, Australia, Africa, the Mediterranean area, and Russia. In addition, they continue to cause disease in military troops. Recently, the rickettsial agents of epidemic typhus and Rocky Mountain spotted

fever have been identified as potential biological warfare agents. Thus, it is vital that DoD have a competent reference laboratory to maintain the reagents and expertise to confirm identification of these threats on short notice and this is the work of RDD.

Utilizing methods previously developed for the production of the diagnostic assays shown in Table 1, reagents were produced this year for use in-house and in overseas laboratories. Following up on a DoD-GEIS funded projected at NMRCD RDD utilize quantitative real-time and standard PCR assays to characterize the newly identified spotted fever rickettsiae found in tick collected in northern Peru during an febrile illness investigation. With PCR generated amplicons, multilocus sequence typing was used to characterize the new proposed species of *Rickettsia, candidates* Rickettsia andeanae. The results of this work have been presented at the 4th International Conference on Rickettsia and Rickettsial Diseases. Logroño, Spain June 18-21, 2005. Additional DoD-GEIS supported investigations are in the reports and publications from NMRCD, Lima, Peru, AFRIMS, Bangkok, Thailand and NAMRU-3, Cairo, Egypt.

Diagnostic assay reagents have been provided to NAMRU-3, AFRIMS and NMRCD for ongoing DoD-GEIS funded studies.

Table 1. Reagents and assays made for diagnosing/detecting the following diseases/agents:

Diseases	Agents	Serologies	PCR Assays
Scrub Typhus Group			
Scrub typhus	*O. tsutsugamushi*	IFA, ELISA, WB	PCR; quantitative real-time PCR
	Rickettsia Genus Specific		PCR; quantitative real-time PCR
Typhus Group			
Epidemic typhus	*R. prowazeckii*	IFA, ELISA, WB	PCR; quantitative real-time PCR
Murine typhus	*R. typhi*	IFA, ELISA, WB	PCR; quantitative real-time PCR
Spotted Fever Group			
	Group Specific	IFA, ELISA, WB	PCR; quantitative real-time PCR
Rocky Mountain spotted fever	*R. rickettsii*	IFA, ELISA, WB	PCR; quantitative real-time PCR
Boutonneuse fever	*R. conorii*	IFA, ELISA, WB	PCR
African Tick Bite Fever	*R. africae*	IFA, ELISA, WB	PCR
Cat flea typhus	*R. felis*	ELISA	PCR; quantitative real-time PCR
Unknown	*R. montanensis*	ELISA	PCR; quantitative real-time PCR
Unknown	*R. amblyommii*	ELISA	PCR, quantitative real-time PCR
Ehrlichiosis & Anaplasmosis			
Human Monocytic Ehrlichiosis	*E. chaffeensis*	IFA,	PCR; quantitative real-time PCR
Human Granulocytic Anaplasmosis	*A. phagocytophilum*	ELISA, WB	PCR
Bartonella Group			
Bartonelliosis	*B. bacilliformis*	Under development	PCR
Trench fever	*B. quintana*	IFA	PCR
Borrelia			
Relapsing fever	*B. recurrentis*		PCR; quantitative real-time PCR
Lyme disease	*B. burgdorferi*	commercial assays	PCR

U.S. Army Medical Research Institute of Infectious Disease

In FY05, The U.S. Army Medical Research Institute of Infectious Disease (USAMRIID) continued to serve as a national resource for the isolation and identification of infectious disease agents that require handling at Biosafety Level (BSL) 3 and 4. In this capacity, USAMRIID served as a DoD and WHO reference center for the hemorrhagic fever viruses and other arthropod-borne viruses. The Institute also provided confirmatory diagnostic support for many overseas and domestic laboratories. Development and fielding of new diagnostic assays, technology transfer to other government and civilian organizations, production and stockpiling of critical reagents, and an ability to respond rapidly to outbreaks of emerging and re-emerging diseases have all been important components of the USAMRIID program. DoD-GEIS support enables USAMRIID to maintain its capabilities in diagnostics of infectious diseases through the development and testing of assays. Collaborations with the DoD overseas laboratories and with their DoD-GEIS sponsored programs offer scientists unique opportunities to field test assays and at the same time provide valuable reagents and expertise to collaborators.

Through collaborations with DoD-GEIS, USAMRIID:

1. Serves as a DoD reference center and WHO collaborative center for emerging or re-emerging infectious diseases including the arthropod-borne viruses and the hemorrhagic fever viruses
2. Maintains readiness to diagnose emerging and re-emerging infectious diseases as they appear in DoD assets, spheres of interest, and during deployments, through diagnostic assay development, reagent production, and testing
3. Provides diagnostics training to military and civilian personnel and organizations
4. Supports disease outbreak investigations as necessary

USAMRIID served as a DoD reference center and WHO collaborative center for diagnostic testing of human specimens for evidence of infection with emerging or re-emerging infectious diseases including the arthropod-borne viruses and the hemorrhagic fever viruses. In FY05, the USAMRIID laboratories conducted 333 diagnostic assays for a variety of arthropod-borne and hemorrhagic viruses as well as relevant bacteria and toxins (Table 1). The assays were requested by CONUS and OCONUS DoD facilities representing three services. This year the diagnostic efforts spanned a

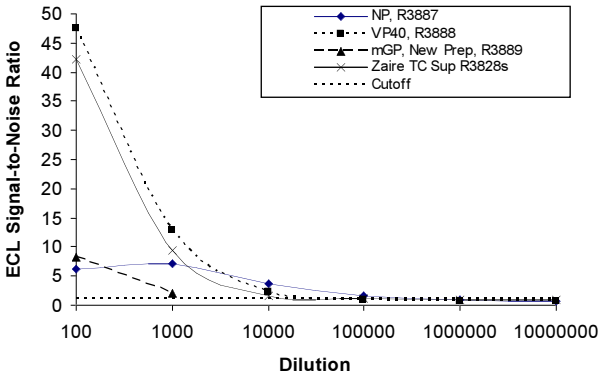
Table 1. FY05 DoD-GEIS diagnostic tests for arthropod-borne and hemorrhagic viruses and other infectious diseases conducted by request of DoD facilities

Diagnostic Assay	Tests Conducted
West Nile virus	130
Rift Valley fever virus	26
Dengue virus	26
Venezuelan equine encephalitis virus	2
Eastern equine encephalitis virus	2
Sandfly fever virus	56
Hantaviruses	16
Crimean-Congo hemorrhagic fever virus	26
Severe Acute Respiratory Syndrome (SARS) virus	1
Brucella	1
Botulinum toxin	46
Yersinia pestis	1

wide range of disease syndromes in attempts to identify the cause of diseases occurring in DoD spheres of interest. The largest number of samples tested was from military personnel deployed to Iraq. Last year USAMRIID developed an Iraq Panel of relevant diagnostic assays to viruses known to occur in the area. The panel includes IgG and IgM ELISAs for West Nile, Rift Valley fever, dengue, sandfly fever-Naples, sandfly fever-Sicilian, and Crimean-Congo hemorrhagic fever viruses. All of the specimens submitted for testing were the result of undiagnosed febrile illness. Of the 13 samples tested with this panel none demonstrated evidence of infection with any of these six viruses. We are continuing to improve the panel as other agents for inclusion are identified.

Maintenance of readiness to diagnose emerging and re-emerging infectious diseases as they appear in DoD assets, spheres of interest, and during deployments, requires continual diagnostic assay development, reagent production, and testing. Assay development this year focused on transitioning ELISA assays to electrochemiluminescence (ECL) assays. The ELISA has been the standard immunodiagnostic assay for a long time, but the DoD is moving toward ECL because of its greater sensitivity, shorter run times, and easier use in the field. ECL-based assays for Ebola and brucella detection were transitioned from ELISA to ECL format in FY05. In general, the ECL format improved the sensitivity of the assays by 10-fold and reduced the run times from about 4 hr for a standard ELISA to about 1 hr for the ECL. USAMRIID also evaluated the use of baculovirus produced recombinant Ebola proteins as a substitute for native protein preparations. One of the greatest difficulties in working with some of the arthropod-borne viruses and many of the hemorrhagic viruses is the need for high biological containment, BSL-4. This requirement makes development and reagent production expensive, labor intensive, and dangerous. Taking advantage of DTRA funded studies; investigators are evaluating the feasibility of using recombinant antigens as substitutes for inactivated viral preparations now in use. Utilizing recombinant proteins will make commercial contracting of reagent production possible; reducing costs, labor, and allowing better quality control. The first proof-of-concept recombinant assay substituted Ebola-Zaire recombinant sGP, NP, and VP40 proteins for the native proteins in infected cell lysate. Recombinant proteins functioned well as compared to native proteins in both the ELISA (data not shown) and ECL assays (Graph 1).

Graph 1. Comparison of native and recombinant protein reactivity in ECL assays for the detection of Ebola virus.



Development of the SARS immunodiagnostic assay continues. The monoclonal antibodies resulting from the fusion in FY04 have been evaluated and a number warrant further testing. A standard sandwich ELISA using the monoclonal antibodies and a rabbit polyclonal SARS antibody is currently being developed and will be evaluated for sensitivity and specificity as reagent stocks are produced. Specific activity of each SARS monoclonal antibody was determined when used as a detector (sandwich top) or a capture (sandwich bottom) antibody. Various antigen preparations were tested with each antibody and the best reagents were determined for further assay development.

To maintain readiness and support development of arthropod-borne and hemorrhagic fever virus assays, continued production of antigens and antibodies is required. In FY05, the arenavirus, Lassa-Josiah; the alphaviruses Highlands J and VEE subtype ID, IF, II, IIIA and IV; the filovirus, Marburg-Ravn; and the bunyavirus, Rift Valley fever were produced for assay development or to replenish stocks. Seed stocks of the flaviviruses, St. Louis encephalitis and langat and the arenavirus, Junin, were established. Significant efforts were made to grow antigenic stocks of five other stains of Lassa virus and four stains of CCHF virus, however further adaptation of these low passaged

viruses to cell culture is required. Strains of coronaviruses related to SARS for assay specificity evaluation have been obtained for propagation in the coming year; the viruses include A59, JHM, MHV (mouse), TGEV, HCV (human), BCV (bovine). Larger scale production of the SARS monoclonal antibodies for further assay evaluation was accomplished in FY05. In addition, various Rift Valley fever and CCHF-specific monoclonal antibodies from the USAMRIID repository were propagated for evaluation and possible inclusion to existing assays in the coming fiscal year.

Disease outbreak support was accomplished in FY05 primarily through support of in-house diagnostic testing. Collaborative DoD-GEIS studies in Egypt and Kenya continued to be supported. In FY05, reagent kits for over 1000 IgM and IgG immunodiagnostic tests for each of the following viruses were supplied to DoD-GEIS collaborators at NAMRU3, Cairo, Egypt: tick-borne encephalitis, Hantaan, Puumala, CCHF, and dengue viruses. USAMRIID supplied kit reagents (each enough for 1000 tests) for diagnosis of IgM and IgG antibodies for dengue, Sindbis, Rift Valley fever, CCHF, yellow fever, West Nile, and Chikungunya viruses in support of the Undiagnosed Febrile Illness protocol at KEMRI/WRP, Nairobi, Kenya; also USAMRIID investigators made a site visit to the KEMRI/WRP laboratory to improve and extend collaborations. This visit resulted in a number of recommendations such as changing the storage and shipping conditions of samples from -20C to +4C to improve the likelihood of virus isolation; adding limited sampling of patients at medical centers that feed district hospitals where most of the samples are now taken; improved coordination and communication with entomologists testing mosquito populations in the areas where Undiagnosed Febrile Illness samples are collected; possible addition of brucella testing to current capability; better coordination of field testing of assays; and confirmatory testing of virus isolates positive serum samples at USAMRIID.

USAMRIID has participated in a DoD study on the effect of Ribavirin use in hantavirus cases in soldiers deployed to Korea entitled "Intravenous Ribavirin for the Therapy of Hemorrhagic Fever with Renal Syndrome (HFRS) in the 121st General Hospital (Seoul, Korea): A Phase 2 Study." In addition USAMRIID collaborated with CDC Division of Vector-Borne Infectious Diseases, Fort Collins, Colorado to test human serum samples collected in Guinea, West Africa for Rift Valley fever virus and supplied the SOP and reagents for 500 IgG assays.

The USAMRIID effort has a direct impact on the DoD-GEIS response and readiness capabilities and is essential for the protection of the Warfighter. USAMRIID serves as a DoD reference center and WHO collaborative center for diagnostic testing of human specimens and provides the DoD-GEIS program with diagnostic capabilities for arthropod-borne and hemorrhagic fever viruses. This is accomplished through testing of clinical samples and the close interaction with submitting clinicians and diagnosticians in an attempt to identify the disease causing pathogen and determine the appropriate course of treatment. Our DoD-GEIS diagnostic readiness is maintained through the constant renewal of diagnostic reagents for testing and development of new and improved assays. Diagnostic training of military and civilian personnel and organizations is manifested through our support of the Field Identification of Biological Warfare Agents (FIBWA) Course, accomplished by supplying diagnostic reagents, specific-agent assays as well as additional training and consultation for students and instructors as needed. Through the DoD-GEIS program, USAMRIID maintains the ability to respond to disease outbreaks in the field and/or support collaborators responding to arthropod-borne and hemorrhagic fever virus disease.

Air Force Institute For Operational Health

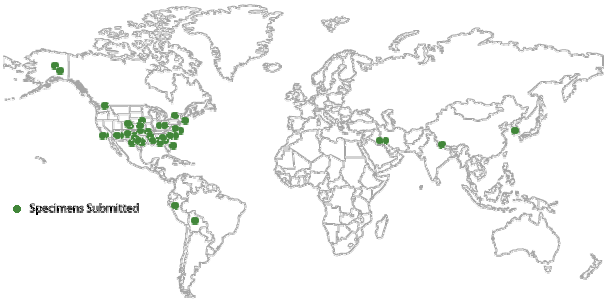
The Air Force Institute for Operational Health (AFIOH) has been involved in influenza surveillance since 1976, when Project Gargle was first initiated at key AF installations worldwide. Since 1996, when the AF was designated as the Executive Agent for Influenza Surveillance, AFIOH has annually expanded the number and location of facilities providing specimens to the DoD Global Sentinel Influenza Surveillance Program, in conjunction with the Joint Influenza Surveillance Working Group. AFIOH has participated in DoD-GEIS programs since the first beginnings of the professional network, and has been frequently recognized as one of the DoD-GEIS success stories.

In FYO5 AFIOH's emerging infectious zdisease work focused on influenza, *Chlamydia*, and noroviruses. The influenza projects included providing important training in the use of molecular techniques to screen for influenza at our partner institute of the Armed Forces Research Institute of Medical Sciences (AFRIMS) in Bangkok. The training bore fruit shortly after it was completed, when an outbreak among Bhutanese refugees was rapidly determined to be influenza B (This story is highlighted in the vignette.)

Operation and Expansion of the DoD Global Sentinel Influenza Surveillance Program and the DoD Influenza Archive)

2004-05 Non-Sentinel Influenza All

2004-05 Non-Sentinel Influenza B



2004-05 Non-Sentinel Specimens

2004-05 Sentinel Influenza A

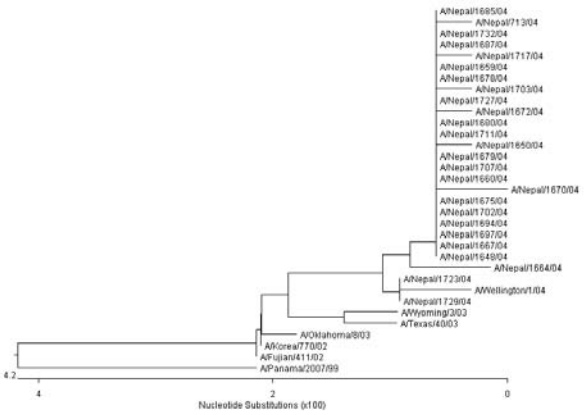
2004-05 Sentinel Influenza All

2004-05 Sentinel Influenza B

2004-05 Sentinel Influenza-B

2004-05 Sentinel Specimens

The major program funded by DoD-GEIS is the DoD Global Sentinel Site Influenza Surveillance Program. The 2004-2005 influenza season saw the inclusion of several new sentinel sites, including two Army locations, Landstuhl Army Medical Center (LRMC) in Germany and Ft Drum in NY. During the 2004-2005 influenza season (03 October 2004 through 30 April 2005), AFIOH received and processed 3,439 specimens from sentinel, non-sentinel, and DoD overseas medical research sites. These include specimens from 11 countries from Europe, Asia, South America and the Middle East – notably from deployed sites Qatar, Kuwait and Iraq. Of the 990 influenza positives that were isolated from these specimens, all were typed and approximately 77% were subtyped. In addition, over 250 isolates had the hemagglutinin gene sequenced and compared to the human vaccine component strains. Additional refrigerators were added to enhance the capability of an influenza archive. In addition to Nepal outbreak featured in the vignette, AFIOH provided laboratory support for a variety of respiratory disease outbreaks including illness clusters that



Dendrogram/phylogenetic tree showing DoD flu isolates with the others

occurred in deployed forces. Isolates from each of these activities are shared with CDC and WHO.

The diversity of isolates obtained through this system is a remarkable demonstration of its value. The US military, CDC, WHO and other nations depend upon this surveillance to identify trends in influenza and to obtain isolates to provide for useful vaccines. As our specimens and cultured isolates become increasingly important, the proper archiving of both original specimens and isolates has become essential to the program; several refrigerators have been purchased to begin this project. Future prospects including housing the archive of all DoD specimens collected from all laboratories participating in the program.

Rapid Diagnostics supported

AFIOH has developed 3 influenza fluorogenic real-time PCR probe sets for the rapid detection of influenza viruses from clinical isolates. These probe sets were funded by DoD-GEIS and have been designed, developed, and validated by the AFIOH laboratory at Brooks City-Base. Two probes are type specific, capable of detecting influenza A or B. The third probe is subtype specific and targets H5 influenza. Two other human influenza H3 and H1 subtype specific probes are currently being designed, tested, and evaluated in clinical isolates at AFIOH. The AFIOH probes will be tested and validated in collaboration with AFRIMS during the 2005-06 season.

Education, Training, and Establishment of New Sentinel Sites

AFIOH assisted CHPPM-W in setting up influenza surveillance infrastructure for Central America in Honduras, Guatemala, and El Salvador. AFIOH has supplied CHPPM-W with reagents, primers, and positive controls for influenza and select other respiratory viruses, as well as shipping packages and cold gels for the Central America sites. CHPPM-W in turn has been able to test specimens from the sites for influenza, either to validate the host country's laboratory results or to test specimens that the host country cannot, due to resource limitations. For example, CHPPM-W has detected an influenza B from a Guatemalan specimen via PCR that was tested as negative via DFA from the host country. Specimens from JTF-Bravo in Honduras have also been routed to AFIOH for testing as well: since May 2005, 14 specimens have

AFIOH trains AFRIMS personnel on molecular approaches to influenza; first month after training detects outbreak of influenza B.

This season GEIS supported one of the molecular biologists to go to AFRIMS to train the staff there in the use of the RAPIDS machine and the primers and probes for universal influenza A, universal influenza B, H1, H3, and a more nearly experimental H5 assay. One objective of this training was to provide a means of identifying the strain of influenza at this forward location, smack in the middle of the avian influenza crisis, with the tools necessary to detect a possible avian influenza specimen earlier than would be possible at that laboratory before. Mr. Luke Daum, a molecular biologist and graduate student in the PhD program at the University of Texas Health Sciences Center San Antonio, went and trained 5 personnel. The staff soon had an opportunity to use the valuable training when an outbreak of influenza again occurred among Bhutanese refugees in Nepal (see Daum et al, Emerging Infectious Disease, Aug 2005). This time the AFRIMS team in Bangkok was able to identify influenza B specimens., which was confirmed later in culture at AFIOH. This first outbreak helped demonstrate both the utility of having a forward capability at AFRIMS and the universal A and universal B primer and probe sets AFIOH provided to AFRIMS.

Like last year's influenza A outbreak, the influenza B outbreak in Nepal is important because it appears to be a cross between the two prevailing B strains, having hemagglutinin similar to B-Victoria and neuraminidase similar to the vaccine strain B-Yamagata. This change is important because only the B-Yamagata is in this year's influenza vaccine. Like the California-like A strain that was detected in Nepal before it became the dominant strain in the 2004-2005 season, this influenza B outbreak may also be a harbinger of a dominant B strain not covered in the vaccine this season.

been received, with influenza A isolates detected in May, June, and August (many current specimens from October still have results pending). The groundwork for a surveillance system has thus been established during FY 2005 to test specimens from Central America for influenza, through a collaborative effort between AFIOH, CHPPM-W, and Ministries of Health of the host countries.

Chlamydia trachomatis

AFIOH maintains the largest *Chlamydia* testing facility in the DoD, testing approximately 200,000 specimens annually from Air Force and Navy sites around the world. A comparison study of Air Combat Command (ACC) bases and the rest of the Air Force show in preliminary results that routine testing of males as part of annual exams may have an effect in reducing the prevalence of *Chlamydia* in both males and females. An ongoing study of *Chlamydia* and health consequences within 2 years of positive tests is another effort of the AFIOH emerging diseases program.

Naval Health Research Center

Laboratory Capacity Supported

GEIS funds were used to maintain viral culture laboratory for testing of approximately 3,000 specimens in FY05. These specimens included febrile respiratory illness (FRI) specimens from basic trainees, shipboard sailors, a U.S.–Mexico border population, DoD fatal cases, and outbreak support of deployed forces.

The growth and development of molecular testing capabilities continued to progress during FY05. Polymerase chain reaction (PCR) testing is now the primary test for adenovirus and influenza, greatly increasing our ability to respond expeditiously to

the needs of our customers. Tests for coronavirus, human metapneumovirus (hMPV), rhinovirus were also optimized. Several laboratory tests were developed, including a multiplex test for pneumonia diagnosis, a test to differentiate live vaccine strain influenza from wild-type influenza, and a PCR test to differentiate vaccine adenovirus type 4 strain from wild-type adenovirus type 4 strains. Techniques for PCR testing of ambient temperature specimens stored in ethanol were refined and, ultimately, improved.

Outbreak Investigations Supported

NHRC provided laboratory diagnostic support to NEPMU-5 for an outbreak of FRI on a U.S. Coast Guard Cutter, the USCGC Fir, in February 2005. Approximately 50% of the crew became ill, and mission readiness was compromised and, despite the crew having been reported as vaccinated, we found that most of the 18 specimens collected were positive for influenza A (H3N2, California-like). These isolates were sequenced at NHRC and shared with CDC. Additional support was provided to NEMPU-5 for a FRI investigation aboard the USS Preble in August 2005.

NHRC has also provided laboratory support for 11 fatal or severe respiratory illness cases during FY05. Most of these were referred through the mortality surveillance program at AFIP. Key findings included one active duty individual and one inactive reservist that died with evidence of influenza infection.

NHRC was requested to provide assistance with diagnosis of two different clusters of respiratory illnesses among deployed forces in the Gulf. In one outbreak, a high percentage of *Streptococcus pneumoniae* and *Haemophilus influenza* was identified, potentially contributing to the morbidity seen. In the second, testing at the Navy laboratory in Cairo, Egypt identified Q-fever as the likely causative agent from a high percentage of IgM positive tests in acute sera. Samples from this outbreak, collected using room temperature techniques developed at NHRC/AFIP, are still in process at NHRC.

NHRC also provided rapid laboratory confirmation of adenoviral etiology during FRI rate "spikes" that were identified at training camps by our FRI surveillance program. These spikes occurred at 7 of 8 camps under surveillance during FY05.

Rapid Diagnostics Supported

NHRC provided several Navy ships and 2 NEPMUs with the ability to perform rapid PCR testing for adenovirus, influenza A/B, *M. pneumoniae*, and *C. pneumoniae* utilizing their existing PCR equipment. Diagnostic capability for H5N1 avian influenza was provided to NEPMU staff, but not to the ships.

Training Supported

Throughout the year, NHRC sent laboratory personnel to conduct training aboard several ships and at 2 NEPMUs. Medical personnel at each site/ship were trained in the use of LightCycler PCR testing for detection of adenovirus, influenza A/B, *M. pneumoniae*, and *C. pneumoniae* in respiratory samples in deployed settings. A Study Coordinator visited four recruit training sites to train new research assistants in specimen collection and other study procedures. The research assistant at San Ysidro Health Center (the border FRI site) was also trained in study procedures through on-site visits by NHRC staff. During a visit to NHRC, laboratory personnel trained 2 individuals from Singapore in viral culture techniques for collaborative surveillance.

Syndromic Based Outbreak Detection Projects Supported

NHRC continued to use autoregressive modeling of FRI rates at recruit camps to perform syndromic surveillance for FRI, reporting on a weekly basis to all parties. A more detailed explanation can be seen at http://www.nhrc.navy.mil/GEIS/Studies/ forms/ FRIepidemicmodelingfaq.pdg and current FRI Rates Status can be viewed at http:// www.nhrc.navy.mil/ GEIS/findings/fri_benning.htm.

Epidemiology Capacity Supported

In addition to the DoD-GEIS-funded studies and surveillance projects, NHRC performed a variety of epidemiological studies during FY05. Some of these respiratory disease studies included determining the effectiveness of the influenza vaccine among basic trainees during the 2004-2005 season, calculating the incidence of novel pathogens (e.g. coronavirus, hMPV, rhinovirus) among basic trainees, conducting surveillance for circulating strains of Group A streptococci among basic trainees, and the study of environmental factors associated with adenoviral febrile respiratory illnesses in recruits at MCRD-SD.

Clinical Capacity Supported
NHRC regularly provided basic training centers with CAP-approved viral test results from recruits with FRI, and provided AFIP with culture and PCR results for a variety of pathogens in fatal case tissues that were referred to us.

Resources/Staff Time Spent on Influenza/Pandemic Preparedness
The molecular lab at NHRC utilized approximately 2.5 full-time employees to develop, test, optimize, and validate the following: 1) influenza primers for our lab and field use (including H1, H3, H5, and N1 and N2); 2) optimizing room temperature collection techniques for capturing influenza cases for laboratory testing…a capability with the potential to greatly expand our ability to provide global surveillance coverage; and 3) subtyping and sequencing of influenza isolates from recruit, shipboard, outbreak, and border populations. Influenza sequence information and isolates were shared with CDC.

Force Health Protection/ COCOM / Military Health System Activities Supported
NHRC's ongoing FRI surveillance among recruit and shipboard personnel greatly contributes to the health of these populations. Data from these surveillance efforts were provided to DoD Health Affairs and the Army Acquisition community, and were used to write the proposal and protocol for the upcoming Phase III clinical trial of the adenovirus vaccine.

Other Cooperative Activities
- California Department of Health Services – Adenovirus
- VA Medical Center, Houston, TX – *Streptococcus pneumoniae*
- University of Colorado Health Sciences Center – Coronavirus
- Lovelace Institute, Albuquerque, NM – Adenovirus
- University of Minnesota – Group A *streptococcus*
- VA Medical Center, Boise, ID – Group A *streptococcus*
- University of Iowa - National adenoviral surveillance
- CDC – Influenza characterization
- Ministry of Defense of the Republic of Singapore
- San Diego County Department of Health – Influenza surveillance

Other Dissemination of Findings
Updates are regularly disseminated through several avenues, such as: 1) a weekly e-mail update of FRI rates and lab findings sent to collaborators and DoD public health officials; 2) NHRC personnel regularly participate in the bi-weekly conference call with DoD-GEIS partners; 3) a semi-annual newsletter profiling NHRCs current endeavors; and 4) maintaining the Navy node DoD-GEIS web site, www.nhrc.navy.mil/geis.

Naval Environmental Health Center
The Navy Environmental Health Center (NEHC) is the service health surveillance hub for Navy Medicine with a primary mission to maintain and guide preventive medicine activities in support of Force Health Protection. These efforts include disease surveillance, vector ecology, industrial hygiene, environmental health, entomology, occupational medicine and health promotion. NEHC coordinates 4 subordinate commands situated to support preventive medicine needs of Navy and Marine Corps units within their specific areas of responsibility:

Four Navy Environmental and Preventive Medicine Units (NEPMU) and their regional coverage

NEPMU-2 Norfolk, VA
Eastern United States and Western Atlantic

NEPMU-5 San Diego, CA
Western United States and Eastern Pacific

NEPMU-6 Pearl Harbor HI
Western Pacific, Central and East Asia

NEPMU-7 Sigonella, Italy
Europe, Africa and Middle East

These activities coordinate preventive medicine efforts with operational forces. These forces include Commander of the US Atlantic and Pacific Fleets (also serving as the Naval Component for US Northern Command), Naval Forces Central

Command, and Marine Forces Atlantic and Pacific. NEHC works directly with the numbered US Navy Fleets (Two, Three, Five, Six and Seven), the Chief of Naval Operations (CNO) and the Headquarters US Marine Corps (HQMC).

NEHC and DoD-GEIS are critical partners in responding to disease threats. This includes outbreak response and identification/control of emerging diseases. In FY05, NEHC and its NEPMUs, with some funding and with close consultative support and professional guidance from DoD-GEIS, have implemented four initiatives:

1. Design and establish laboratory surveillance of Norovirus-related gastrointestinal illness upon Navy vessels and throughout the Department of Defense (DoD). This project continues to highlight the burden of Norwalk-like viruses on mission completion. (NEPMU-6)
2. Develop Electronic Laboratory Reporting (ELR) capabilities using Health Level 7 (HL-7) data. This project began to support *Acinetobacter baumannii* surveillance in the DoD. (NEHC)
3. Enhance respiratory surveillance activities in the Western Pacific and CENTCOM region. These efforts have increased preparedness for Department of Defense influenza and other febrile respiratory surveillance activities. (NEPMU-5, NEPMU-6, NEPMU-7)
4. Increase communication and collaboration among DoD Preventive Medicine community using a software package called GROOVE. (NEPMU-5)

Using HL7 Data for Surveillance of Infections with Antimicrobial Resistant Pathogens

Assessments showed that microbiology data from the HL7 lab results project can provide the ability for surveillance of positive cultures and antimicrobial resistant patterns for select organisms including *Acinetobacter baumannii* (Ab) and Methicillin-resistant *Staphylococcus aureus* (MRSA). A pilot project began supporting surveillance of Ab. Methods were standardized to produce descriptive graphs for positive Ab cultures. Additionally, initial methods were developed for retrieving and analyzing sensitivity profiles from the HL7 data.

HL7 lab results are quite large in terms of memory requirements, taking up at least 1G of hard drive space per month. Until February 2005, epidemiology resources were dedicated to this project and lab results data were being analyzed using personal hard drives, requiring extensive time. Database administrator skills were required to set up an IM/IT environment that promoted rapid and automated analysis of the data. The pilot project supporting Ab surveillance was temporarily suspended so that a strong IM/IT infrastructure solution could be set up, enabling rapid analysis and interpretation of the data. The data is now stored on a secured server, though technical problems remain.

Even though not complete as of the close of FY05, results to date have a significant impact on the DoD's surveillance and detection capabilities. Electronic clinical lab results were an untapped resource for rapid monitoring and tracking of various antibiotic resistant organisms. Project results highlight the utility of such data in addressing emerging concerns (e.g., *Acinetobacter baumannii*) that the DoD is currently unable to track without extensive time and resources. Results further show that this data stream can be developed and organized to support rapid detection, surveillance and initial description of emerging threats facing our forces.

In addition, a preliminary methodology has been established to assess if and how HL7 lab results can enhance the current passive medical event reporting system. Lab results data need to be assessed for each disease of interest. Assessment should include: identification of lab tests specific to the disease, ability to set up automatic queries that will flag desired lab results with enough sensitivity and specificity, evaluation of MTFs reporting positive labs to investigate completeness of the data, evaluation of specimen collection time and time that NEHC received the lab result, etc. Preliminary review of HL7 data for use in malaria, tuberculosis, and leishmaniasis surveillance is being conducted.

NEHC's day to day activities often brought close consultation and collaboration with DoD-GEIS. DoD-GEIS and NEHC staff work together and share new information and ideas with regard to ongoing emerging disease investigations such as Methicillin-resistant *Staphyloccocus aureus* (MRSA) among recruit and special training units, multi-drug resistant tuberculosis in the recruit setting, malaria concerns among deployed Marine forces, and influenza-like illness outbreaks among highly vaccinated populations. Bi-weekly telephone conferences sponsored by DoD-GEIS now serve as NEHC's forum to share information across the services regarding ongoing epidemiologic investigations of concern. DoD-GEIS has also served as a forum for discussion of the Navy's ongoing consideration of the practicality of using Quantiferon for routine tuberculosis screening.

Similar to national and international trends, MRSA continues to threaten specific Navy and Marine Corps subpopulations. Effects of prevention and control measures have been limited. Thus, the reality of this emerging disease burden is just now being realized. A DoD-GEIS-sponsored antibiotic resistant organism conference in May 2004 provided the ability to share experiences across the services, voice research needs that may assist with prevention and control, present the current state of MRSA in various military hospital and community settings, and communicate with non military public health subject matter experts such as CDC.

NEHC and the NEPMUs have assisted each Navy Medicine command to prepare avian influenza and pandemic influenza response plans this past FY. Several NEPMUs have worked in close collaboration with DoD-GEIS overseas laboratories to integrate febrile respiratory illness surveillance in communities of operational significance. We continue to work with Atlantic and Pacific fleet surgeons to prepare pandemic influenza response plans. DoD-GEIS offers the latest information in international guidance and instruction from other public health entities including the WHO. Furthermore, DoD-GEIS has served as a focal point to integrate Navy activities at the DoD level.

Navy Environmental Preventive Medicine Unit - 5

The DoD-GEIS influenza sentinel surveillance system is an essential tool for DoD's public health institutions for the early identification of emerging respiratory pathogens like the novel coronavirus causing Severe Acute Respiratory Syndrome (SARS) and new strains of common organisms like influenza (e.g. avian influenza).The Western United States has two large geographic areas that serve as major DoD ports of embarkation and debarkation, Pacific Northwest (Washington State) and Southern California (San Diego and Camp Pendleton). Respiratory pathogen surveillance in these areas is important to monitor viral presence and spread. The influenza surveillance program incorporated two new sentinel sites in these areas (one in each) for the 2003-2004 flu season. In order to ensure these sites' continued, successful participation in the surveillance program, it is important to have annual site visits to promote the influenza surveillance program, give professional presentations on influenza and coordinate the collection and shipment of specimens. In order to maintain appropriate outbreak investigation and response capabilities, NEPMU-5 needs to maintain limited molecular techniques (i.e. rapid PCR) for various respiratory pathogens; this capability and equipment currently exists at NEPMU-5, however, there is no funding resource for the necessary primers, probes and reagents.

In FY05 NEPMU-5 sought increased communication with West Coast Navy providers and sentinel sites regarding influenza surveillance and the threat posed by avian influenza in Asia. Examples included lectures on influenza, surveillance and the threat of avian influenza to various operational medicine forums (Carrier Medical Conference, Operational Medicine Symposium, II MEF providers' conference in Iraq) and contact and coordination with Navy Medical Center San Diego and Bremerton Naval Hospital influenza surveillance coordinators. To address the molecular testing issues, the program addressed procurement and maintenance of molecular testing capabilities for pathogens of operational significance for use by NEPMU-5 in CONUS and FDPMU in deployed settings. Testing reagents and primer/probe sets for *Chlamydia pneumoniae, mycoplasma pneumoniae* and RSV and norovirus were obtained commercially. Adenovirus and influenza testing capability came from Naval Health Research Center. In FY05 this capability was used for surveillance for respiratory pathogens during deployment to Iraq and in outbreak investigations.

Preparation for OIF deployment somewhat limited opportunities for increased communication with the sentinel sites during the 2004-5 flu season and severely limited contact with the sentinel sites. Further, the main points of contact at both sites will reassigned this year, as is often a problem in the maintenance of an effective surveillance network. It will be important to continue close contact with the facilities to ensure the continuation of the program. Increasing the awareness and preparedness of deployed and afloat forces to the threat of pandemic influenza is an important activity and has prompted improvements in the current implementation of surveillance systems in general on board Navy ships (DNBI specifically). NEPMU-5 was involved with the investigation of a large norovirus outbreak among recruits at MCRD and an outbreak of febrile respiratory illness among OIF personnel. In both cases primers procured as part of this project were used to rule in or rule out diseases of operational significance.

There is an urgent need for an information distribution and sharing system that allows rapid evaluation of, and collaboration on, issues affecting the DoD active duty population. E-mail, although useful, is neither flexible nor robust enough to handle the collaborative communication needs of the DOD Preventive Medicine community. An ideal system would be flexible, scalable and easily used in a variety of locations, including austere field conditions—allowing rapid communication and data sharing between the field and higher headquarters. In addition to simply sharing data, the system should act as a collaboration workspace, allowing various activities from presentations and meetings to collaborative document creation and editing to project management (i.e. allow flexibility in the tools used in the collaborative workspace). Such a system would allow outbreak investigation teams improved reach back and communication capabilities, enable community discussion (either DOD wide, service specific, or interest group specific) of hot topics, and facilitate long-range policy workgroups.

In FY05, a pilot project was conducted with DoD-GEIS support involving purchase of 25 licenses of a commercial off the shelf Program, Groove Virtual Office, which satisfies these requirements. This software was deployed out of NEPMU-5 to be used in determining the usefulness of such a program to DoD entities. The goal of this project was to demonstrate the usefulness and feasibility of a virtual collaborative workspace for DoD preventive medicine personnel

Groove was also used for several other collaborations and investigations:

- Research collaboration between NAMRU-3, NAMRU-2 and NEPMU-5. Groove was used to facilitate communication and collaborative writing between researchers at these institutions.
- Locally at NEPMU-5 Groove was used to coordinate data storage and reporting for a largeinvestigation into a possible association between Mefloquine and vestibular dysfunction.

A novel means of communication while conducting an outbreak investigation

Twenty-five licenses for Groove Virtual Office were procured and distribution of the licenses began with Navy preventive medicine personnel willing to adopt the new technology/software. Soon after the licenses were procured an outbreak of influenza among US Coast Guard personnel in San Diego occurred. This was an ideal situation for the demonstration of Groove's usefulness as the interested parties crossed various organizational boundaries (Navy PM and research, Coast Guard, DoD and local public health). Groove was successfully deployed among the local investigation team and was used to coordinate investigation activities, store data for easy access to everyone on the team and to write reports and updates in a collaborative fashion. However, the Coast Guard PM representative found it difficult to download the software secondary to limited bandwidth and NHRC personnel were forbidden to install the software secondary to existing network regulations.

This case study highlights the main findings of this project, that Groove is extremely useful even if used only at the local level. Its usefulness increases as more people can access Groove; however, there are some barriers to installation and use that prevent universal use by DoD personnel.

- Groove is currently being used to coordinate multiple outbreak investigations in OIF. All data and communication for outbreak activities occurs via Groove. Information is being shared among personnel in CONUS, Iraq (MNC-I and II MEF), and Egypt (NAMRU-3).
- Groove is used for the day to day management of the Forward Deployed Preventive Medicine Unit in Iraq. All reports, calendars, taskings, issues and plans are kept and disseminated via Groove. This allows the rear chain of command complete visibility of current activities without having to send regular, separate reports.

Groove is an excellent technology, a peer-to-peer network, that works extremely well and has the potential to revolutionize the way DoD preventive medicine personnel work and communicate. Groove was used by the Navy to coordinate relief efforts in Indonesia after the tsunami and in the Gulf Coast after Hurricane Katrina; wider use could have greatly enhanced communication of vital public health and other information across services and bridging many gaps created by the loss of civilian infrastructure. However, the current state of computer networks within the DoD and their various managers and security policies prevent the smooth deployment of Groove to everyone at this time. Although Groove is quite useful at the local level and between the few DoD personnel that have been able to install it, maximum benefits will come when increasing numbers of people have access. Microsoft Corporation recently purchased Groove so it is possible that in the not too distant future this technology will be more widespread, possibly even an industry standard, and available to more DoD personnel.

Navy Environmental Preventive Medicine Unit - 6

The primary objective of this program is to increase specimen submissions from the Asia/Pacific region with a focus on key geographic locations and forward-deployed ships. Specific information gained through the submission of specimens will be shared with the submitting facility and, where appropriate, with other sites. A secondary objective, no less important, is to increase the number and understanding of people trained via CME lectures and surveillance system training, and the performance of rapid influenza test kits in practice situations in Military Treatment Facilities in Asia. The capability to use CDC's test reagents for SARS-CoV testing will be developed giving NEPMU-6 a mobile SARS-CoV testing ability for use in outbreak investigation and response.

Enhancement of influenza surveillance throughout the Western Pacific was accomplished through providing academic presentations, training and supplies to partner organizations, consultative work on pandemic influenza preparedness with military treatment facilities (MTFs) in the region, and the exploration of collaborative potential at the overseas laboratories. The principal investigator was invited to speak on the topic of pandemic influenza preparedness at the TRICARE Pacific conference in November 2004. Conference attendees represented the highest echelon of leadership in the Military Health System (MHS) in the Pacific including the Pacific Command (PACOM) and US Forces, Korea (USFK) Surgeons, the command surgeons from Commander, Pacific Fleet (CPF), Pacific Air Force (PACAF), and MTF Commanding Officers from all MTFs. This presentation provided the opportunity to engage key decision makers within military medicine in the Pacific on the important issues surrounding pandemic influenza preparedness. PACOM has subsequently developed the first combatant command pandemic plan and exercise.

In addition, program training was provided to 63 healthcare providers at USNH Guam, USNH Yokosuka, and the Navy Medical Clinic, Pearl Harbor. Supplies in the form of rapid influenza tests were provided to the US Consulate, Hong Kong Health Unit, and Navy Medical Clinic Pearl Harbor.

In an effort to improve outbreak response capabilities throughout the region, NEPMU-6 approached both of the DoD's overseas laboratories in search of collaborative agreements for training, outbreak and current project partnership opportunities. In light of regional concerns about AI in Asia and the Pacific, and in view of the recent successes with SARS, NEPMU-6 looks forward to many opportunities for collaborative work with these regional partners.

A new influenza surveillance opportunity with the Commonwealth Health Center (CHC), Saipan, was identified, and coordination and support was initiated. Saipan is a member state in the Commonwealth of the Northern Marianas Islands (CNMI) and is home to a number of U.S. - based

garment manufacturing facilities. They receive approximately 1000-2000 temporary workers from Asia, predominately from Southern China per month. Saipan is also host to three to four U.S. warships and U.S. Military Sealift Command vessels per month. These facts make Saipan uniquely well-situated for influenza surveillance since the collection of isolates from there will serve as an important force health protection tool for the U.S. Fleet and as provide an indication of influenza subtypes currently circulating in Southern China.

This project also supported the purchase of reagents for LightCycler and Rapid RT-PCR equipment allowing its use in the CDC Laboratory Response Network (LRN) program. NEPMU-6 has CDC reagents for SARS-CoV and are acquiring these for influenza A (H5N1) giving the NEPMU world-class diagnostic capability for use during outbreak investigations.

GEIS support has helped to integrate the DoD Global Influenza Surveillance program with MTF pandemic influenza preparedness planning throughout the Pacific with NEPMU's assistance. DoD-GEIS sponsorship affords this program with enhanced credibility and improved access to high level decision makers within the MHS. It has also afforded the opportunity to pursue partnerships with both the Navy Medical Research Unit 2 (NAMRU2) in Jakarta and the Army's Armed Forces Research Institute for Medical Science (AFRIMS). This is an extremely important partnership opportunity that should result in improved capability for the field diagnosis of important respiratory diseases and better outbreak investigation preparedness for all entities involved.

Outbreaks of viral gastroenteritis (VGE) have been a large problem in the military for many years. Of the few outbreaks fully studied, most were caused by human caliciviruses. The original and most famous strain of these is Norwalk Virus and its relatives, together called *Norovirus* (formerly Norwalk-Like Viruses). *Norovirus* (NV) were recently estimated to cause 23 million cases of gastroenteritis in the U.S. each year, or two-thirds of all infectious diarrhea cases (*Campylobacter* accounted for 2.4 million cases/yr). Although the illness is neither life-threatening nor of long duration, the outbreaks may affect and completely incapacitate large numbers of personnel in the military unit. Deployed ships in particular have been hit hard by *Norovirus* outbreaks, although ground units have also been affected. There is no ready treatment; an oral vaccine possibly could be developed. Although the outbreak may originate from a meal, the main problem is the person-to-person spread that follows. No CLIA-approved NV assay exists, and no DoD laboratory of which we are aware conducts research or clinical testing for NV.

While few outbreaks were reported during FY05, the largest outbreak ever recorded during the project's years occurred during winter and spring of 2005. Only one outbreak aboard a study ship occurred in FY05, when the USS NIMITZ had 208 VGE cases in OCT 2004, with a Genogroup I NV confirmed. Figure 1 shows the number of big deck shipboard outbreaks by quarter since the project started. Most outbreaks have occurred since SEP 11, 2001; the number of deployments surged after that point. After a cluster of six ship outbreaks occurred during the last five months of CY 2002, the project expanded from monitoring the two Pacific-based ships deployed at any one time to all ships, all the time. The low number of reportable outbreaks this year may be due to the widespread use of disinfectant hand-washing stations recently put on most of these ships. On the other hand, ship deployment schedules have also decreased from OEF-OIF highs. For shore units, the Marine Corps Recruit Depot in San Diego (MCRD-SD) had its annual outbreak reach over 2300 cases and stretch from January to April, apparently caused by a similar NV strain as isolated a few times before (Table 1).

The NEPMU *Norovirus* study has ended, as the goal to raise awareness of the morbidity in military units has been achieved with the convening of the Military *Norovirus* Conference and the numerous VGE outbreaks shown to be associated with Norovirus detection. New strains have been discovered; probably due to the fact military strains are acquired worldwide. Work with binding affinity has shown unique patterns leading to knowledge of why certain individuals become ill and others do not. Navy ships are better than civilian cruise ships to study outbreaks, as they are underway for longer periods of time and the crews are easier to track. The goal of having deployable diagnostic capability has been shown several times aboard ship, and now in the field during major combat. The future in this

field will be with the research laboratories, however, the NEPMUs have proven to be a valuable, inexpensive asset to interact with operational forces and collect specimens.

Navy Environmental Preventive Medicine Unit - 7

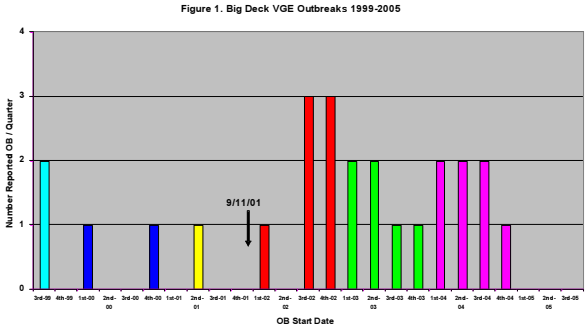


Table 1. Viral Gastroenteritis Outbreaks at Marine Corps Recruit Depots (MCRD) at San Diego and Parris Island, CY 2002-2005. Note how a Genogroup II strain similar to VA387 has been detected in four outbreaks at MCRD-SD since 2002.

Unit	Location	Date	Cases	Norovirus Genogroup / Related Strain
MCRD	San Diego, CA	JAN 02	136	**GII / VA387**
MCRD	San Diego	MAR 02	23	GI / Chiba (same as MAR 02 BELLEAU WOOD OB)
MCRD	San Diego	OCT 02	288	Norovirus positive, no specimens sent to CHMCC
MCRD*	Camp Pendleton, CA	FEB 03	40	**GII / VA387**
MCRD	Parris Island, SC	FEB 03	232	GII / Argentina
MCRD	San Diego	JAN 04	615	**GII / VA387**
MCRD	Parris Island	JAN 04	100?	Negative (0/3 stools)
MCRD	San Diego	DEC 04 – APR 05	2300	**GII / VA387**

*MCRD San Diego recruits during Crucible field training at nearby Camp Pendleton

In FY05 NEPMU-7 sought to increase the number of sentinel sites and specimen submissions for febrile respiratory disease surveillance through the DoD-GEIS Influenza Surveillance Program, particularly focused on deployed field locations within USCENTCOM. Two USCENTCOM deployed field sentinel sites, Camp Arifjan Troop Medical Clinic (TMC), Kuwait and Camp Buehring TMC, Kuwait were established in 2005 and are expected to be fully operational sites for the 2005-2006 influenza season. Other objectives included to developing enhanced working partnerships among the DoD Global Influenza Surveillance Program, AFIOH, NAMRU-3 and NEPMU-7, to increase the number of military medical personnel trained in respiratory disease surveillance and to broadly improve surveillance efforts in areas of strategic importance having large numbers of deployed troops. NEPMU-7 worked to strengthen tri-service surveillance integration by establishing two deployed sentinel sites at U.S. Army clinics serving joint U.S. military and coalition forces and staffed primarily by U.S. Navy medical personnel, utilizing AFIOH and NAMRU-3 laboratory and surveillance infrastructure. Over 200 medical and laboratory personnel at the two sites received training during multiple site assist visits and educational sessions on topics including:

a. DoD Global Influenza Surveillance Program

b. Historical reporting of febrile respiratory diseases and implementation of surveillance

c. Importance of surveillance at the DoD, national and international levels

d. Current influenza vaccine formulation and influenza vaccine programs

e. Diagnosis and treatment of influenza

f. Pandemic influenza and avian influenza planning initiatives at local and theater levels

The chains-of-command for Combined Forces Land Component Command (CFLCC) and Area Support Group—Kuwait (ASG—Kuwait) expressed their support of the surveillance efforts as an integral part of force health protection and public health infrastructure, largely as a result of numerous briefings and organizational partnerships. In addition, the influenza surveillance program directly enhanced outbreak identification and response capabilities in the CENTCOM AOR. A cluster of community-acquired pneumonia cases in deployed soldiers at Camp Buehring, Kuwait was rapidly identified in April 2005 by recently trained providers. AFIOH was instrumental in providing diagnostic testing for the outbreak investigation. NAMRU-3 provided consultative services and prepositioned additional supplies at the sentinel sites to enhance future outbreak capacity. While influenza diagnosis and surveillance capabilities were directly enhanced through these efforts, increased expertise and enhanced levels of cooperation strengthen preparations for outbreaks of all infectious respiratory diseases.

National Aeronautics And Space Administration

The GSFC produces monthly vegetation anomalies for Africa and the Saudi Arabian Peninsula and global Sea Surface Temperature (SST) and Outgoing Longwave Radiation anomalies to assist in identifying regions of anomalous climatic conditions that may lead to an increase in RVF outbreak risk. Identification and mapping of risk areas involves tracking and computation of a persistence index of above normal vegetation conditions, associated with above normal rainfall, in RVF endemic regions.

In FY05, this project provided early warning satellite vegetation and rainfall products that alerted FAO, WHO, and NAMRU3-Cairo to regions at risk in Yemen and Saudi Arabia (Figure 1) and supported field investigations in collaboration with the Yemen and Saudi Arabia Ministries of Health. GSFC also provided USAMRU-Kenya with vegetation index anomaly maps, time series and SST data in support of field investigation during the Chikungunya outbreak along the East African coast (Lamu and Mombasa, Kenya) and the Indian Ocean Islands (Comoro, Mauritius and Reunion) from July 2004 to May 2005.

GSFC continues to provide monthly electronic reports on environmental conditions influencing RVF risk for continental Africa, Madagascar and the Arabian Peninsula via the DoD-GEIS website. WHO, FAO, and the DoD Overseas Labs use these to support of continental surveillance and control efforts.

Armed Forces Research Institute Of Medical Sciences

This year has repeatedly demonstrated the importance of infectious disease surveillance and public health preparedness. The tsunami event of December 2004, described by the UN General Secretary as the greatest natural disaster of the century, presented the region with a humanitarian crisis that tested the medical and humanitarian communities' ability to respond. The threat of a pandemic of highly pathogenic influenza focused the world's attention on a potentially devastating public health crisis without reducing the need to continue surveillance for other infectious diseases. Despite these challenges, AFRIMS has continued to expand into new regions and new areas of work, growing while maintaining focus on core missions and competencies. In recognition of AFRIMS continuing regional efforts and leadership, the WHO designated AFRIMS a WHO Collaborating Centre for Laboratory Reference, Training, and Investigation of Emerging Infectious Diseases in 2005.

GEIS at AFRIMS has assumed an increasingly central role in the overall AFRIMS mission, both in terms of guidance and coordination provided to the institute and in terms of support services provided to the departments and researchers within those departments. The program has established an institute-wide research support section to facilitate interdepartmental and external collaborations, allowing DoD-GEIS to capitalize on the strengths of our partners while providing the necessary support to them. The research support section includes a grants assistance office, a public relations specialist, and a training coordinator. In the past year, the grants assistance office has processed several grants aimed at obtaining NIH funds to support influenza surveillance and to support our efforts in establishing a platform for infectious disease surveillance in South Asia. The training coordinator ensures that both our internal and external training programs, such as the DoD-GEIS-sponsored overseas rotations, provide the maximum benefit to both the institute and to the participants. Finally, our public relations professional seeks to increase awareness of the institute's activities, promote the image of AFRIMS, the US Government and Department of Defense, and to develop collaborative relationships with potential partners.

A major project undertaken by AFRIMS is the expansion of our emerging infection surveillance program into South Asia. On 1 January 2005, DoD-GEIS assumed responsibility for the AFRIMS field station in Nepal, the Walter Reed Army Research Unit – Nepal (WARUN). The twenty-four person unit, including two physicians, study nurses, laboratory technicians, and data management personnel, has transitioned from being a

department-specific asset designed for clinical trials to a field station devoted to fulfilling DoD-GEIS missions in a region previously unrepresented by DoD-GEIS. Because of Nepal's location between India and China and its varied ecology, WARUN is ideally located to study a wide variety of infectious diseases. WARUN provides AFRIMS and the research community with the premier platform in Nepal capable of performing infectious disease surveillance as well as product development and validation. DoD-GEIS has already brought ELISA capabilities to this laboratory and in the next year will bring microbiology and PCR technologies. WARUN and AFRIMS staff were heavily involved in an investigation of an influenza outbreak in Nepal this year (see vignette), already showing a return on investment in surveillance capabilities.

AFRIMS, through DoD-GEIS support, is breaking into new areas in Southeast Asia as well. AFRIMS Virology has launched the first-ever initiative to investigate emerging diseases in the Philippines. A DoD-GEIS-funded study has enabled AFRIMS to bolster national diagnostic capabilities for the important endemic diseases of dengue and Japanese encephalitis. This will enable the identification of specimens that can then be subject to testing for such diseases as chikungunya, scrub typhus, rickettsial diseases, and West Nile virus. This study will provide solid data to assist military planners in applying preventive strategies for troop deployments to the Philippines.

In Cambodia, DoD-GEIS funded two major projects managed by the Departments of Enterics and Immunology. AFRIMS established a microbiology laboratory and initiated a diarrhea illness surveillance project at the National Pediatric Hospital in Phnom Penh that is filling a large gap in the knowledge base of the etiologies and antimicrobial sensitivity patterns of diarrhea illnesses in the region. Additionally, the Department of Immunology completed a DoD-GEIS-funded project as a partnership between the Cambodia National Malaria Center and AFRIMS to provide baseline data on the prevalence of malaria countrywide. DoD-GEIS is now coordinating interdepartmental efforts to develop field sites in more remote areas of the country for surveillance of malaria, enteric pathogens, acute febrile illness etiology, and influenza.

In Thailand, AFRIMS continues its close collaborations with both the Royal Thai Army and the Ministry of Public Health. In collaboration with the Thai Component of AFRIMS, DoD-GEIS continues to fund and provide technical support for an extensive project that collects socio-demographic information and serum on all enlistees into the Royal Thai Army, approximately 60,000 young men annually from every province of Thailand. This information is used to map and track HIV prevalence among this group and serves as a powerful resource for investigating new or reemerging infections in the region. DoD-GEIS also continues to support a Royal Thai Army surveillance system to detect outbreaks and perform surveillance on infectious disease threats along Thailand's borders with Cambodia, Laos, and Burma. This data is then shared with the Ministry of Public Health, which is unable to gain access into many of these areas otherwise. And, DoD-GEIS promotes coordination of surveillance efforts between ministries in the Thai government, being the key sponsor of an internet-based zoonotic illness reporting system that horizontally and vertically links the Ministries of Public Health and Livestock Development to ensure that both the human and animal manifestations of zoonotic illnesses are visible to all agencies involved in their control.

Regionally, AFRIMS, through DoD-GEIS funding, is involved a variety of other projects. The Enterics Department continues to perform regional diarrhea illness etiology and antimicrobial sensitivity surveillance and to develop and validate rapid diagnostics to perform this surveillance. The Entomology Department performs collaborative surveillance for rodent-borne diseases. The Department of Immunology is engaged in regional antimalarial sensitivity testing and on developing new technologies to perform this testing in the field. The Department of Virology has maintained a regional program for Japanese Encephalitis Virus surveillance. And, all departments have continued the AFRIMS tradition of providing training local and international scientists and physicians, both at the central laboratory facilities in Bangkok and at the various field stations throughout the region.

The coming years will provide DoD-GEIS at AFRIMS with many opportunities to continue this important work.

An example of DoD-GEIS' ability to coordinate various elements within AFRIMS and capitalize on external partnerships is when DoD-GEIS personnel at WARUN in Katmandu, Nepal, were requested to investigate an outbreak of an influenza-like illness in Bhutanese refugee camps located in southeastern Nepal in July 2005. The sites were investigated by WARUN personnel working with local NGOs and samples were collected on sixty-six patients along with illness information. The samples were tested by rapid kits, which showed influenza as the probable etiology. Matched swabs were inoculated onto viral transfer media and shipped to WARUN and then on to AFRIMS, where the Department of Virology performed RAPID-PCR, where Influenza B was determined to be the etiology and Highly Pathogenic Influenza was excluded. Samples were then sent to the Air Force Institute for Occupation Health, where confirmatory testing and molecular characterization was performed.

On 26 December 2004, a tsunami struck Southeast Asia, creating widespread destruction and loss of life and resulting in perhaps the largest humanitarian relief operation in memory. Well-before the establishment of the Combined Support Force to coordinate US military assistance to the relief efforts, AFRIMS civilian and military personnel were involved in the response and relief efforts under the direction of the US Embassy. AFRIMS provided two physicians and bilingual nurses to the Ministry of Public Health's rapid assessment teams, who worked in conjunction with the US Centers for Disease Control and Prevention. Following the immediate response phase, AFRIMS provided a US military physician to the World Health Organization's military-liaison team working with the Combined Support Force responsible for providing assistance to tsunami-affected areas. This officer served as a critical link between CSF personnel, the WHO, and other DoD-GEIS assets worldwide. AFRIMS' tsunami-related work continues, even after the world's attention has been drawn elsewhere. Both the Department of Immunology and the Department of Entomology continue to work closely with the Ministry of Public Health to assess and mitigate health risks brought about by this disaster and the ensuing population movements.

U. S. Army Medical Research Unit – Kenya

The basis for current DoD-GEIS activities at USAMRU-K is the network of surveillance sites throughout Kenya: Alupe Sub-District Hospital along the Kenya-Uganda border, St. Mary's Mission Hospital in Western Kenya, New Nyanza Provincial Hospital in Kisumu, Isiolo District Hospital in the semi-arid North, and Malindi District Hospital, along the coast. There are laboratory and personnel resources at each site. Clinical officers and laboratory technicians form the foundation of these personnel. They recruit volunteers based on the unique criteria in each surveillance protocol.

There were three active surveillance protocols in the past year: Acute Febrile Illness Surveillance in Kenya, Epidemiology of Malaria and Drug Sensitivity Patterns in Kenya, and Epidemiology of Diarrheal Illness in Kenya. A new protocol, Influenza Surveillance in Kenya, has been approved by Kenya Medical Research Institute (KEMRI) scientific and ethical review committees.

The Epidemiology of Malaria and Drug Sensitivity Patterns in Kenya is a continuation of ongoing surveillance in four of the study sites. This year, St. Mary's Mission Hospital was added as a new site. This study seeks to further determine the epidemiology of malaria in various regions of Kenya and to assess the antimalarial resistance patterns in the various regions. In this study, each site enrolls up to five volunteers per day. After several modifications were approved in this protocol, the study began in March of this year with the onset of the rainy season. Approximately 331 sets of specimens were collected.

The Enterics study (the Epidemiology of Diarrheal Illness in Kenya) has been in the works for several years and finally saw its first month of surveillance in the third quarter of this year. The objectives of this study are the following: to identify the bacterial, viral and parasitic causes of diarrhea in Kenya; to establish the antimicrobial susceptibility patterns of enteric pathogens in Kenya; to identify the

virulence factors associated with pathogenic bacteria; and to identify the virulence factors associated with pathogenic bacteria. This study also utilizes the DoD-GEIS surveillance network. Approximately 140 specimens were collected in the first month of surveillance. We have obtained bacterial isolates from these specimens and determined the relative fractions *Shigella* spp., *E. coli,* and *Salmonella* spp. Presumptive isolates for *Campylobacter* spp. and *Vibrio* spp. are pending speciation analyses.

In the Acute Febrile Illness in Kenya protocol, we enroll up to ten patients per site per week with fevers of unknown etiology. Testing for malaria is performed at the sites. Serum is sent to Nairobi to assess for viral hemorrhagic fevers and other arboviruses. In the past year, cases of Chikungunya and West Nile Virus have been detected through this study.

The Influenza Surveillance in Kenya protocol will be the new protocol for USAMRU-K in the coming year. This achieved approval by KEMRI this year. One laboratory officer was trained at NAMRU-3 in preparation for the upcoming influenza surveillance in Kenya, along with two KEMRI lab officers. This protocol will be a collaborative effort with CDC, KEMRI, USAMRU-K, and NAMRU-3. The main laboratory for this study will be the KEMRI National Influenza Center. Volunteers are anticipated to be recruited from the DoD-GEIS surveillance sites as well as a newly selected site in Nairobi. We expect surveillance to begin in early 2006.

We have collaborated with USAMRU-K Entomology in the entomological investigations in Kombewa division, Western Kenya in the past year. The primary objective of this study, which has been conducted since 2004, is to provide baseline entomological information on malaria transmission in Kombewa District, and simultaneously monitor malaria transmission intensity by anophelines during a malaria vaccine trial.

Outbreak response has become an increasingly coordinated and collaborative effort. Outbreak assistance is usually at the request of either the Kenya Ministry of Health (Disease Outbreak Management Unit) or World Health Organization. We often collaborate with the International Emerging Infections Program (CDC) for laboratory analyses and/or fieldwork. This year, a lot of effort was devoted to laboratory analyses on Chikungunya. We began our involvement with Chikungunya in Lamu in August 2004. We continued to be involved in outbreak assistance, as it continued along the Kenyan Coast, then appearing in the Comoros.

The DoD-GEIS Enterics Lab also assisted the Ministry of Health in an outbreak of watery diarrhea illness in the Nairobi slums in mid 2005. The team determined the outbreak to be from multiple microbial agents including *Vibrio cholerae* and *Shigella dysenteriae*.

Quality Assurance was a major theme this year among all of the DoD-GEIS labs: malaria, Arbovirology, and Enterics. The Enterics Lab has led the way with the QA program. Notable achievements have been in the following areas: maintenance of cold chain, thermometer and balance calibration, quality control of reagents and assay kits, and corrective action policy.

Education and training are a focus of DoD-GEIS at USAMRU-K. Degree programs are one of the ways in which this is accomplished. Personnel are sponsored for all levels of degrees, at several institutions, and in different labs or departments. This year, there were three individuals sponsored for PhDs, four for Masters, one for BSc, and one for a postgraduate diploma. Two of these degrees were awarded this year. Also in the past year, we conducted annual training for both Nairobi and study site personnel, sent five laboratory technicians to the WRAIR/USAMRU-K Microscopy course in Kisumu, and have held weekly seminars on a variety of topics. We have also had a successful year of student attachments. This program allows students from local schools to spend time in selected DoD-GEIS laboratories during their university years to gain practical experience.

Increasing communication between our study sites, our laboratories, and other interested parties has been a goal this year. This is a unique challenge when often internet is not feasible and even phone service is poor. We decided to start a small quarterly newsletter and by local vote, it was titled, the GEIS Gazette. The Gazette features protocol updates, research highlights, case reports, and any

interesting contributions from DoD-GEIS personnel or any interested party.

Naval Medical Research Center Detachment
The U.S. NMRCD continues to be the sole US DoD overseas medical research unit in the Western Hemisphere, and as such serves a critical role in the global network of surveillance and response for emerging infectious diseases that constitutes the DoD-GEIS program. The proximity to the continental United States and frequent travel (both via air and land) between the two regions underscores the unique location and need for infectious diseases surveillance vis-à-vis the biosecurity of the United States.

The DoD-GEIS program at NMRCD is in alignment with the strategic goals and the overall DoD-GEIS mission as described in the recent 5-year plan 2005-2009 outlined in Appendix A. Integral to our mission in South America are the following: outbreak response preparation, detection, investigation, microbial agent identification, and communicable disease control and prevention. The four goals identified by DoD-GEIS have been addressed by our FY05 projects: (1) surveillance and detection; (2) response and readiness; (3) systems research, development and integration; (4) cooperation, public health capacity building, and training.

At NMRCD, the DoD-GEIS program has continued to serve as the bridge between the other scientific departments in order to promote cooperation and the multi-purpose use of ever more precious funds. The Febrile Syndromic Surveillance sites in 3 countries have also been used to collect diarrhea, malaria and now influenza isolates for testing. Many of the sites now use the same scientific protocols and SOPs to enroll patients and obtain data more efficiently. We continue to organize internal symposia with the scientists to discuss ongoing projects, budgets, alternate funding sources and future directions of the program with relation to the goals of DoD-GEIS and the overall mission of NMRCD. These meetings have engendered cooperation between the departments and provide the Officer-in-Charge with updates of ongoing projects. The next one is planned for Nov 2005.

The DoD-GEIS Program at NMRCD also has sought out collaborations with other military and non-military organizations to further the DoD-GEIS missions. We have planned projects and symposia with US SOUTHCOM, including newly proposed collaborations with the Brazilian military and a planned symposium in Uruguay. We have continued our collaborations with PAHO in the training of outbreak management. We have been successful in obtaining limited funds from USAID to cost share for additional courses and training opportunities within Peru. We have secured an agreement with CDC to send a trained virologist from the Special Pathogens Branch to be permanently stationed here at NMRCD and bring expertise in hemorrhagic fever viruses and to assist in outbreak investigations. Additionally, we have collaborated with scientists and epidemiologists from the Peruvian Ministry of Health and Navy as well as Bolivia to investigate several outbreaks of disease.

One of the most critical capacities that NMRCD possesses is our ability to conduct comprehensive outbreak investigations. We have provided formal and informal advice, laboratory support, and epidemiological teams to respond to requests for assistance. We have responded to outbreaks of dengue in Lima, dengue hemorrhagic fever in Iquitos, several outbreaks of Cyclosporiasis, and uncharacterized diarrhea. We have additionally provided epidemiologic and laboratory support to Ecuador for a rabies outbreak and to Bolivia for a Hantavirus outbreak. These outbreak responses have often involved multiple departments' resources, as well as significant collaborations with the Ministry of Health and the regional health directorates. We can provide any or all of the following: epidemiological consultation, fieldwork, laboratory assistance and training, supplies and media, and the relevant scientific expertise.

One of the most significant accomplishments in this area was the establishment of standardized pack-out kits for outbreaks that are ready to go at a moment's notice. Additionally, we have developed an SOP for outbreak investigation response so that each department can efficiently respond to requests for assistance, while simultaneously keeping the leadership of NMRCD and DoD-GEIS Central Hub staff informed. We have continued to cross train scientists, clinicians, epidemiologists, veterinarians, and entomologists so that multiple roles can be filled when the need arises. An outbreak-training course for NMRCD personnel is scheduled for Oct 2005.

Formal classroom training in outbreak investigation continues to be a major DoD-GEIS asset at NMRCD. In FY05, we provided training to public health officials in Peru, Argentina, Chile, and Costa Rica. Many of our scientists and senior laboratory technicians teach in these courses. In addition to building the public health capacity and ability of these countries, these courses often serve as a springboard for future collaborations with the scientific departments (i.e., febrile surveillance in Paraguay and Bolivia). We expanded collaborations with PAHO, USAID and the Ministry of Health to include cost sharing for 3 courses in Peru and to provide instructors and tutors for the courses. We developed and implemented the first outbreak investigation course for GMO level US military health care providers. This was first presented at the Army Force Health Protection conference in Kentucky, and has been scheduled to be taught at National Naval Medical Center in December 2005. We acquired video-teleconference capability this year, which has allowed distance learning within and outside of Peru. We continue to support other courses such as Biostatistics, Bioethics, and NMTEC Military Tropical Medicine. In addition, we translated out premier 5-day outbreak course into English to be disseminated to other DoD-GEIS partners.

Also through DoD-GEIS funding, we developed the first Medicine in the Tropics elective rotation for USU medical students. Eight 2nd year USU students spent 4 weeks here in Peru learning public health, surveillance, lab diagnosis and clinical tropical medicine. This program was an efficient use of DoD-GEIS funds in that it was cost shared with our administration department for housing and the Military Tropical Medicine Course for platform.

Electronic surveillance programs have served to address all the DoD-GEIS goals extremely well, and include ALERTA DISAMAR for transmissible disease and outbreak notification, and EWORS for timely outbreak detection. The ALERTA DISAMAR system was expanded to include over 17 sites in Peruvian Army in addition to 98% of the Peruvian Navy. We incorporated disease surveillance aboard Peruvian Navy ships in the Amazon region and added DNBI type data. The ALERTA system continues to detect numerous outbreaks. These efforts have led to timely awareness within the Peruvian Navy of disease outbreaks and enhanced cooperation between their health services and our research support. Additionally, we have established baseline levels of disease for many regions within Peru. EWORS was deployed for the first time in South America in Peru – current plans are to expand sites to include Lima and several other provinces. We are working closely with NAMRU-2 to further this surveillance platform.

The DoD-GEIS Program's interactions with the various scientific departments at NMRCD have led to a wide array of successes. We have expanded the capability of febrile illness surveillance, and are rapidly expanding our capability to detect influenza in South America, including avian strains in local birds. Surveillance for resistance among malaria and enteric pathogens continues and new efforts in *Cyclospora* spp. are in development. Entomologic surveillance of *Aedes* and Anopheline mosquitoes continues in Lima and Iquitos and remains one of our most timely projects with the arrival of dengue in Lima after a 60-year absence.

We will continue to expand our surveillance capacity in areas like influenza and febrile surveillance, partnering with individual government ministries, SOUTHCOM, CDC, WHO/PAHO, and academic institutions to maintain the biosecurity of the United States in the future. We will also develop novel methods to display these data, including the use of the internet and through scientific publications.

Naval Medical Research Unit - 2

Timely and reliable surveillance data and investigative capabilities are the cornerstones of an effective public health outbreak response system. NAMRU-2's DoD-GEIS-funded projects have been on the forefront in characterizing and mitigating regional infectious disease threats and assisting developing countries to build effective outbreak surveillance, investigative, and diagnostic infrastructures. NAMRU-2 has fostered an extensive network of collaborative relationships throughout the region, and importantly, with those countries most vulnerable in coping with new or re-emerging disease entities.

Fiscal Year 2005 was marked by significant regional public health challenges, such as the continuing emergence of human H5N1 influenza, the re-emergence of dengue fever. The massive devastation in Aceh caused by the December 2004 earthquake and

tsunami posed significant risks to internally displaced persons and residents of Aceh where almost 100,000 people were killed. NAMRU-2 provided outbreak response assistance in nine outbreak investigations, including support for Indonesia's human H5N1 case investigations.

NAMRU-2's strategic positioning in Jakarta has provided for collaborative host-national satellite surveillance platforms throughout the Southeast Asia. NAMRU-2 expanded its influenza surveillance project in Southeast Asia. In Indonesia, the hospital-based passive influenza-like illness surveillance network expanded from six to 20 sites across the archipelago. It has been instrumental in providing diagnostic support to the Ministry of Health in identifying Indonesia's first human H5N1 cases and ruling out suspected cases. Identification of H5N1 and transporting isolates to the US CDC has facilitated the improvement of microneutralization and PCR assays to detect H5N1. This network has also provided unique characterization of the influenza strains circulating in Indonesia. Influenza viruses were isolated from 304 individuals (14% isolation rate), and 255 of these were characterized completely. To date, 208 (81.6%) have been identified as influenza B viruses and 47 (18.4%) as influenza A viruses.

NAMRU-2 has been active in conducting malaria surveillance studies in Indonesia and the Pacific. In Indonesia malaria epidemiology resistance surveys were completed in three sites, including one Indonesian military camp, yielding useful prevalence data in Java as well as anti-malarial drug resistance patterns. NAMRU-2 also completed a malaria epidemiology and anti-malarial drug resistance surveillance program in Vanuatu, screening over 4000 people. The experimental syndromic surveillance system, "Early Warning Outbreak Recognition System," (EWORS, version 3.5), was also modified this year to improve the capture of influenza-like illness outbreaks. This version was deployed in existing sites and in new sites created this year in Cambodia, Vietnam and Vanuatu.

Results from diarrhea study completed this year provided new data on the contribution of rotavirus in diarrhea in Indonesia. Over 40% of all diarrhea cases had confirmed rotavirus. In addition, genotyping of the rotavirus has shown that approximately 70% are of the G9 genotype. The significance of this finding relates to the development and deployment of two novel rotavirus vaccines which both do not include the G9 genotype (Merck G1, G2, G3 and G4; Glaxo-Smith-Kline G1). Although, early data demonstrates that there may be some cross-protection to the G9 genotype by the G1. These findings will provide Indonesian vaccine manufacturers with the additional rotavirus epidemiological data in which the inclusion of G9 rotavirus may provide a greater degree of efficacy in reducing both the morbidity and mortality related to diarrhea disease among pediatric patients across Indonesia.

In response to the Aceh tsunami and Nias earthquake disasters this year, NAMRU-2 supported the US Embassy with clinicians to provide rapid health assessments and medical care. In collaboration with the Ministry of Health and supported by USAID, NAMRU-2 deployed and staffed a reference laboratory to support the World Health Organization's surveillance for infectious diseases of epidemic potential. This lab processed specimens from over 330 people and identified pathogens that helped direct treatment. In fact, data from a NAMRU-2 study helped the WHO make antibiotic treatment recommendations to clinicians treating patients with diarrhea.

NAMRU-2 also conducted extensive regional training in outbreak investigation, malaria microscopy, GIS mapping in malaria surveillance, entomology, and laboratory diagnostics, such as PCR to detect Influenza A H5N1, a modified equine red blood cell-based hemagglutination inhibition assay to detect human H5N1 antibodies. Two outbreak investigation courses were conducted this year, in Sri Lanka and Vanuatu, providing training to over 60 clinicians, laboratory scientists, laboratory technicians, and epidemiologists. In addition to providing malaria prevention and control guidance and ELISA and PCR training, NAMRU-2 created and compiled 16 sets comprising 1600 malaria slides for microscopy training for the Indonesian Ministry of Health. An insectory was also built for the Indonesian Ministry of Health and supplied with critical colonies by the Entomology Department. To improve the diagnostic capabilities of the Indonesian Ministry of Health, laboratory technicians from the Ministry have received training diagnostic assays, from PCR to ELISA.

One of NAMRU-2's multi-year projects, the regional web-based outbreak notification platform, www.ASEAN-disease-surveillance.net, was successfully transitioned to the Indonesian Ministry of Health who will take complete managerial and financial responsibility for the ASEAN project. At the end of this project, new usage increased from just over 1000 in May 2003 to 15,589 in May 2004 to 23,000 this year.

NAMRU-2 developed the infrastructure and the protocol for a multi-year febrile surveillance study to be conducted in Cambodia. This project will provide data on the etiologies of acute febrile illness affecting Cambodians and is expected to begin in FY06. A new pediatric diarrhea study was developed and begun this year that will test for a more comprehensive range of pathogens than the general population diarrhea surveillance study completed this year. In its first month, it has enrolled and collected specimens from over 400 children.

Naval Medical Research Unit - 3

During FY 05, NAMRU-3 provided outbreak response and reference laboratory support for operational US troops and coalition partners in CENTCOM. Additional military-military assistance was provided to the Angola Military, coordinated by EUCOM. Significant outbreak investigations were conducted in 8 countries: Jordan–Typhoid, November 2004; Yemen - Dengue 3, December 2004-April 2005; Angola – Marburg, May 2005; Iraq/OIF – Cryptosporidiosis, July-August 2005; Kazakhstan - Avian Influenza, August 2005; Kenya - Brucellosis diagnostic assistance, July-August 2005; Sudan dengue 3 & HEV outbreaks, September 2005; Bright Star, Alexandria, Egypt - enteric disease, September 2005.

FY05 was notable for expansion of DoD-GEIS-funded direct operational support by NAMRU-3 to deployed U.S. military forces in the Middle East. The Military Surveillance Network initiated during FY04 was conceived primarily to support field commands and address the threat and impact of enteric disease among the currently >140,000 US troops deployed to Afghanistan, Iraq, and other locations in the CENTCOM and EUCOM regions. Deployment surveys of >23,000 respondents yielded important information about the incidence and impact of diarrhea, other common illnesses and non-combat injuries that threaten the health of our troops. Observational studies continue to collect enteric and respiratory specimens from the region and identify ETEC as the most common etiology and Enteroaggregative *E. coli* as an important emerging pathogen. Our efforts to understand optimal and effective treatment grew with the finding that loperamide with single dose antibiotic regimens resulted in clinical cure in less than 48 hours with median diarrhea cessation of 4 to13 hours. In addition, we provided significant support to the regional Bright Star exercise during September and October, augmenting our staff with 3 Preventive Medicine Residents from USUHS who conducted acute enteric and febrile respiratory illness surveillance, and provided general public health and outbreak investigation support.

The NAMRU-3 Disease Surveillance Program focused on strengthening laboratory capacity and developing a regional network for bacterial meningitis. During 2005, surveillance continued in Sudan and Yemen, and collaborators in Syria and Pakistan were trained and incorporated into the network. Currently, the regional bacterial meningitis surveillance network consists of 23 hospitals in 4 countries. Over 1,500 cases have been enrolled.

Viral Hepatitis infections in Egypt were studied by analyzing 1415 patients with no serologic evidence of viral agents A-C and by initiating a hepatitis C case control study. Of seronegative patients, 333 (24%) tested positive for HEV IgG and random subsets of HCV patients showed 18% positive for HEV. Combined with recent outbreak data from Sudan and Iraq, this suggests that HEV may be a significant disease threat in the region.

Hospital-based sentinel surveillance for pneumonia was conducted in three sites in Egypt, among children less than 5-years old. The median age of enrollment was 9 months; 58% of cases were male. Evaluation of the dates of onset revealed increased numbers of cases enrolled approximately every 3 months with the highest peaks between March and June.

Typhoid fever continues to be a significant public health threat in the Middle East and Central Asia. We performed antimicrobial susceptibility testing (AST) for 5 antibiotics on *Salmonella enterica* serotype Typhi (ST) isolated from febrile patients in these regions. Of 417 ST isolates, 123 (30%)

were multi-drug resistant (resistant to ampicillin, chloramphenicol, and TMP-SMZ). No resistance was detected to ciprofloxacin or ceftriaxone.

NAMRU-3 influenza surveillance activities provided the only information on circulating viruses in Kazakhstan, Kyrgyzstan, Ukraine, Saudi Arabia, Syria, Oman and Egypt to the WHO and CDC. This region has a population of over 500 million that would otherwise not be sampled. During FY05 we: assisted USAMRU-K in developing their influenza surveillance program; initiated surveillance activities in Nigeria, Georgia, Azerbaijan, and Uzbekistan; formalized a Middle East (WHO-EMRO) regional influenza network for surveillance (6 countries) and outbreak response (23 countries); and established a collaboration with the Central Public Health Laboratory in Baghdad. Activities in targeted countries included training and laboratory capacity. We directed the collection of more than 4500 respiratory samples in 8 countries, directly processed 3658 samples, isolating more than 750 influenza viruses, including 83 influenza A and 423 influenza B subtypes with selected isolates forwarded to CDC for further characterization. This year our results indicated a northern hemisphere seasonal pattern of influenza A, significant influenza B virus activity continuing into summer and no unusual outbreak activity. We continue to work with WHO and Saudi Arabia to perform surveillance during the Hajj pilgrimage, one of the most signficant global events that could contribute to genesis or dispersal of a pandemic strain. We provided respiratory disease diagnostic capacity for US forces in CENTCOM, including troops on R&R at Camp As Sayliyah, Qatar; at camps Buehring and Arifjan, Kuwait; at Al Asad Air base, Iraq; and in the CENTCOM Bright Star exercise in Egypt.

Egypt is a concentrating point for birds migrating from western Asia and eastern Europe to central and southern Africa. NAMRU-3 has established an avian influenza surveillance program to monitor current and recombinant influenza viruses in migratory and domestic birds, pigs, and humans in contact with these animals. In FY05, 806 cloacal swabs from migratory birds were collected; influenza A viral RNA was detected in 100 by RT-PCR. From the PCR positive samples, 5 viral isolates were obtained, including two H10N7 viruses. This surveillance is important for the annual human vaccine decision and critical for protecting agriculture resources in the US and Egypt by monitoring for highly pathogenic recombinant viruses. The outbreak investigation conducted in Kazakhstan resulted in culture and archiving of the current H5N1 strain circulating in Western China. This strain is moving towards Europe and the Middle East via migratory bird pathways. In 2005 the experience of AI surveillance in migratory birds was leveraged to expand this activity to Kenya and Ukraine. Protocols were developed and approved for both countries. In Kenya, a collaboration with KEMRI and a banding group is established with sampling beginning in October 2005. In Odessa, Ukraine, a collaboration with the wildlife conservation group and anti-plague station began in September and to date, more than 2000 birds have been sampled. Testing and analysis is scheduled to begin in October 2005.

FY05 marked the second year that NAMRU-3 conducted DoD-GEIS activities at the Ghana detachment. These included epidemiology training, field work, and laboratory support for leishmaniasis surveillance in the forested Volta Region. This past year, entomological surveillance identified 19 sand fly species, 6 of which are new geographic records for the nation of Ghana.

Finally, the NAMRU-3 Vector Biology Program provided direct assistance to the Preventive Medicine unit at Talil AFB, Iraq, in assessing the effect of insecticide-treated (Pest Tab; lambda-cyhalothrin) tent fabrics against sand fly vectors of leishmaniasis. *Phlebotomus sergenti* was exposed to treated tent surfaces for 1 hr and mortality was recorded 24 hr later. Cloth material lost potency over the course of 3 weeks, killing close to 50% to *P. sergenti*. Both rubberized tent samples were 100% lethal to sand flies during this same interval. After 4 weeks, mortality rates for two rubberized materials dropped to 96% and 74%. Cloth mortality dropped to 44%.

Kazakhstan Avian Influenza (August 2005)

Surveillance of human influenza in Kazakhstan was initiated by NAMRU-3 in 2001. This joint activity has resulted in an excellent relationship between NAMRU-3 and a number of Kazakh health research institutions.

On 11 July, 2005, the farm referred to as "NAN" in the Irtish region of the Pavlodar Oblast noticed significant mortality in geese. The farm had 1900 geese and 300 ducks. Between 11 and 26 July 530 domestic geese died. In general terms, mortality increased exponentially over the 15 day period. Shortly after the bird illness developed one of the farm workers became ill with a severe pneumonia.

On 26 July, samples were obtained from dead and dying geese. Brain, lung, heart, liver, gut, cloanal swabs, and serum were obtained, placed in cryovials, flash frozen in liquid nitrogen, and transported to SRAI at Otar. Additionally, well water, bird feed and water samples were taken from a pond on the farm in which the domestic geese mix with wild birds. All remaining birds were destroyed.

In response to the large-scale poultry die-offs in Pavlodar and flu-like illness among one of the poultry workers, a team from the NAMRU-3 Viral and Zoonotic Disease Research Program (VZDRP) was dispatched within 96 hours to assist the Kazakh National Influenza Center (Republican Sanitary and Epidemiological Center) in Almaty and the Scientific Research Agricultural Institute (Department of Agriculture) in Otar.

The NAMRU-3 team rapidly established a real time PCR laboratory for the analysis of human and avian samples and sequencing of isolates from the Pavlodar outbreak, which involved ~ 500 avian cases and one suspect human case. No influenza RNA was detected in the human samples, but these specimens were taken 9 and 13 days after the patient became ill, so even if this was a case of avian influenza, it was probably too late to detect virus. Subsequent testing of the patient's sera by HAI in country and by micro-neutralization assay in Cairo was unable to confirm the human case as influenza.

At SRAI, virus isolation had already been performed in eggs and HAI testing performed indicating the presence of H5 virus. The NAMRU-3 team confirmed the presence of H5 antigen by real time PCR and demonstrated the N1 gene of Kazakh isolates to have 99-100 % sequence homology with that of the Chinese Qinghai Lake strain. Samples from both domestic geese and wild ducks in Kazakhstan tested positive for H5N1. This confirms further geographical spread westward of the Chinese H5N1 strain of avian influenza. An agreement was reached to release the virus to NAMRU-3 for full H5 gene sequencing and use in micro-neutralization assays.

The NAMRU-3 team equipped Kazakh investigators with sufficient supplies and reagents to perform 100 RNA extractions and 100 conventional PCR reactions each for flu A and H5. Additionally, we provided reagents for sequencing and characterization of the NA gene (PCR reagents and sequencing purification reagents), positive controls for Flu-A and the H5 subtype, and a full set of HAI antisera. The NAMRU-3 team conducted respirator training and observed Kazakh procedures with the experimentally infected geese. Six chickens, 6 domestic ducks and 4 domestic geese were experimentally infected with about 1ml of 20 % saline suspension from one of the infected Pavlodar index geese. Chickens and ducks died by 2 days, with geese showing severe neurologic signs. Procedures in and around the vivarium were observed.

The diagnosis of H5N1 avian influenza from Pavlodar, Kazakhstan, indistinguishable from the strain isolated from wild geese in China's Qinghai lake epizootic, coupled with severe disease in experimentally-infected domestic geese, suggests that a wave of infection may result as cooler temperatures induce wild birds now summering in Russia, Mongolia, Kazakhstan and China to migrate into warmer southern regions. It even seems possible that this virus could reach the Middle East or Africa this winter.

Unprecedented cooperation between physicians, veterinarians and wildlife biologists will be necessary to mitigate the impact of this AI on human and avian populations. NAMRU-3 is well poised to react in a helpful way to this spread with surveillance activities established in Uzbekistan, Kyrgyzstan, Azerbaijan, Georgia, Ukraine, Egypt and Kenya.

Acronyms

Ab	Acinetobacter baumannii
ACC	Air Combat Command
AD	Active Duty
AF	Air Force
AFEB	Armed Forces Epidemiology Board
AFIOH	Air Force Institute for Operational Health
AFIP	Armed Forces Institute of Pathology
AFMEO	Armed Forces Medical Examiner Office
AFMES	Armed Forces Medical Examiner System
AFMIC	Armed Forces Medical Intelligence Center
AFRIMS	Armed Forces Research Institute for Medical Science
AI	Avian Influenza
AMI	Amazon Malaria Institute
AMSA	Army Medical Surveillance Activity
AOR	Area of Responsibility
AR	Antimicrobial Resistance
ASD	Assistant Secretary of Defense
ASEAN	Association of Southeast Asia Nations
ASG	Area Support Group
AST	Antimicrobial Susceptibillity Testing
ASTMH	American Society for Tropical Medicine & Hygiene
BAMC	Brooke Army Medical Center
BSL	BioSafety Level

CAP	College of American Pathology
CCHF	Crimean Congo Hemhhoragic Fever
CDHAM	Center for Disaster & Humanitarian Assistance Medicine
CDC	Centers for Disease Control and Prevention
CENTCOM	Central Command
CFLCC	Combined Forces Land Component Command
CHC	Commonwealth Health Center
CLIA	Clinical Laboratory Improvement Amendments
CNMI	Commonwealth of Northern Marianas Islands
CNO	Chief of Naval Operations
CNS	Central Nervous System
COCOM	Combatant Commanders
CONUS	Continental United States
CPF	Commander Pacific Fleet
CY	Calendar Year
CYC	Cycloquanil
DARPA	Defense Advanced Research Projects Agency
DHFR	Dihydrofolate Reductase
DHHS	Department of Health and Human Services
DHPS	Dihydropteroate Synthase
DMZ	Demilitarized Zone
DNBI	Disease and Non-Battle Injury
DoD	Department of Defense
DTRA	Defense Threat Reduction Agency
ECL	Electrochemiluminescence

EIA	Enzyme Immuno Assay
ELISA	Enzyme Linked Immunosorbent Assay
ELR	Electronic Laboratory Reporting
EMRO	Eastern Mediterranean Regional Office
EPA	Environmental Protection Agency
ET	Experimental Therapeutics
ETEC	Enterotoxigenic Escherichia Coli
EUCOM	U.S. European Command
EWORS	Early Warning Outbreak Recognition System
FAO	Food and Agriculture Organization
FDPMU	Forward Deployed Preventive Medicine Unit
FHP	Force Health Protection
FIBWA	Field Identification of Biological Warfare Agents
FRI	Febrile Respiratory Illness
FY	Fiscal Year
GEIS	Global Emerging Infections System
GSFC	Goddard Space Flight Center
HA	Health Affairs
HCV	Hepatitis C Virus
HFRS	Hemorrhagic Fever with Renal Syndrome
HIO	Health Information Operations
HQMC	Headquarters U.S. Marine Corps
IFA	Immunofluorescence Assays
IOM	Institute of Medicine
IPA	Immunoperoxidase Assay

IRB	Institutional Review Board
JE	Japanese Encephalitis
JHM	Johns Hopkins Medicine
JTF	Joint Forces
KCDC	Korea Center for Disease and Control
KEMRI	Kenya Medical Research Institute
KNIH	Korea National Institute of Health
LRMC	Landstuhl Regional Medical Center
LRN	Laboratory Response Network
MAT	Microscopic Agglutination Testing
MCRD-SD	Marine Corps Recruit Depot – San Diego
MEDCOM	Medical Command
MHS	Military Health System
MHV	Mouse Hepatitis Virus
MIDRP	Military Infectious Disease Research Program
MND	Ministry of National Defense
MOH	Ministry of Health
MRSA	Methicillan-Resistant Staphyloccocus Aureus
MSD	Mortality Surveillance Division
MTF	Military Treatment Facilities
NAMRU	Naval Medical Research Unit
NEHC	Navy Environmental Health Center
NEPMU	Navy Environmental Preventive Medicine Unit
NGO	Non-Governmental Organization
NHRC	Naval Health Research Center

NMRC	Naval Medical Research Center
NMRCD	Naval Medical Research Center Detachment
NORTHCOM	Northern Command
NV	Norovirus
OCONUS	Outside Continental United States
OEF	Operation Enduring Freedom
OIF	Operation Iraqi Freedom
PACAF	Pacific Air Force
PACOM	Pacific Command
PAHO	Pan American Health Organization
PASBA	Patient Administration System & Biostatistics Activity
PCR	Polymerase Chain Reaction
PDD	Presidential Decision Directive
PM	Preventive Medicine
PNG	Papua New Guinea
PPM	Personal Protective Measure
Pv	P. vivax
PYR	Pyrimethamine
RDD	Rickettsial Disease Department
RDT	Rapid Diagnostic Tests
RFD	Rapid Flow Device
RME	Reportable Medical Events
ROK	Republic of Korea
RVF	Rift Valley Fever
SARS	Severe Acute Respiratory Syndrome

SOP	Standard Operating Procedure
SOUTHCOM	U.S. Southern Command
SST	Sea Surface Temperature
ST	Salmonella Enterica Serotype Typhi
STD	Sexually Transmitted Disease
TMC	Troop Medical Clinic
TSN	The Surveillance Network
USACHPPM	U.S. Army Center for Health Promotion and Preventive Medicine
USAID	U.S. Agency for International Development
USAMRIID	U.S. Army Medical Research Institute for Infectious Disease
USAMRU	U.S. Army Medical Research Unit
USCG	U.S. Coast Guard
USCGC	U.S. Coast Guard Cutter
USFK	U.S. Forces Korea
USMBHA	United States-Mexico Border Health Association
USNH	U.S. Naval Hospital
USTRANSCOM	U.S. Transportation Command
USUHS	Uniformed Services University for Health Sciences
VGE	Viral Gastroenteritis
WARUN	Walter Reed Army Research Unit Nepal
WHO	World Health Organization
WRAIR	Walter Reed Army Institute of Research
WRBU	Walter Reed Biosystematics Unit
WRP	Walter Reed Project

Appendix A

Department of Defense

Global Emerging Infections Surveillance and Response System Plan - 2004
The DoD-GEIS mission is to support and coordinate DoD global surveillance, training, public health research and outbreak response capabilities against microbial threats impacting force health protection and national security. Specifically, DoD-GEIS projects support outbreak response preparation, detection, clinical investigation, microbial agent identification, and communicable disease control and prevention.

Goal I: Surveillance and Detection:
GEIS Strategy: Detect and monitor emerging infections, their microbial causes, the diseases they cause, and factors influencing their emergence to protect military health and readiness, the health of DoD beneficiary populations, and other national interests related to biosecurity.

Objectives:
1. Improve and coordinate surveillance, syndromic and laboratory-based. The five DoD-GEIS priorities are as follows:

    a. Respiratory illness syndromes, especially influenza;

    b. Gastroenteritis syndromes;

    c. Febrile illness syndromes, especially dengue and malaria;

    d. Antimicrobial resistance

    e. Sexually transmitted diseases and illnesses.

2. Develop more effective international surveillance networking. Ensure that DoD surveillance is interoperable and complementary with national and international systems and ensures force health protection.

3. Improve capabilities to detect and monitor the emergence, presence and spread of antimicrobial resistance. This includes infections associated with health care, effective infection control programs, appropriate immunizations and other countermeasures by DoD and worldwide partners. Supports a more prudent and effective use of antimicrobials within the DoD health care system

4. Strengthen and integrate DoD efforts to monitor, control, and prevent emerging vector-borne and zoonotic diseases that threaten DoD health care beneficiaries, force health protection, and national biosecurity.

Goal II: Response and Readiness
GEIS Strategy: Implement effective strategies for the prevention and prompt control of emerging infections to include improving communication of information about emerging agents.

Objectives:
1. Use diverse communication methods for wider and more effective delivery of critical public health information, alert messages, and prevention and control recommendations.

2. Establish mechanisms and partnerships to ensure rapid and effective development and implementation of assessment, response, and prevention measures.

3. Promote a public health system within DoD that responds rapidly and effectively to new and/or unusual microbial threats, naturally occurring or intentionally caused. Coordination and collaboration among clinicians, MTFs, MHS laboratories, overseas laboratories, and Service epidemiology and preventive medicine centers are essential.

Goal III: Integration and Innovation
GEIS Strategy: Integrate public health practices and improved capabilities in clinical medicine, laboratory science, epidemiology, information technology, and military medical research to facilitate rapid identification and response to emerging infection threats.

Objectives:
1. Develop information management tools for clinicians, laboratorians, pathologists, epidemiologists, and preventive medicine and public health practitioners to facilitate emerging infectious disease detection, response, prevention and coordination.

2. Improve laboratory infrastructure for the rapid identification of new pathogens according to presenting clinical syndromes, especially priority microbial threats to force health protection and readiness and rapid communication of critical information.

3. Support the timely development, appropriate use, and availability of diagnostic tests and reagents for priority infectious agents.

4. Augment rapid response capabilities to acquire important prophylactic and therapeutic drugs and vaccines. Expand the evaluation of the vaccine production base, vaccine efficacy, cost effectiveness of DoD vaccinations and chemical prophylaxis programs.

Goal IV: Cooperation and Capacity Building
GEIS Strategy: Strengthen national and international partnerships and cooperative relationships that build public health capacity and provide training to defend against microbial threats.

Objectives:
1. Integrate activities within the MHS (e.g., AFIP, USAMRIID, NHRC, and AFIOH), MTFs and forward-deployed military medical units into national and international networks to develop better public health infrastructure (capacity) in support of emerging infections detection, response and prevention.

2. Collaborate, cooperate, coordinate, and communicate with agencies such as CDC, USAID and WHO. Align DoD efforts with current approaches to capacity building such as integrated disease surveillance, so that host countries and the US receive maximum sustainable benefits.from investments supporting detection, response and prevention of emerging infections.

3. Optimize public health and laboratory training for national and international professionals to support emerging infectious disease surveillance and response.

Appendix B

Military Medical Commands Partnering with DoD-GEIS for Selected Projects, FY 2005.
(An asterisk * indicates military Laboratory Response Network (LRN) participating laboratories as recognized by CDC http://www.bt.cdc.gov/lrn/)

1. US Army Medical Research and Materiel Command Ft. Detrick MD (USAMRMC)
   a. US Army Medical Institute of Infectious Diseases (USAMRIID)* Ft. Detrick, MD http://www.usamriid.army.mil/
   b. Military Infectious Disease Research Program (MIDRP) Ft. Detrick, MD http://www.midrp.org
   c. Walter Reed Army Institute of Research (WRAIR) Silver Spring, MD http://wrair-www.army.mil/
      1). Armed Forces Research Institute of Medical Sciences-Thailand (AFRIMS) http://www.afrims.org/
      2). US Army Medical Research Unit-Kenya (USAMRU-K) http://www.usamrukenya.org/default.htm
2. Naval Medical Research Center (NMRC) * http://www.nmrc.navy.mil
   a. US Navy Medical Research Unit 3-Egypt (NAMRU3) http://www.nmrc.navy.mil/namru_3.htm
   b. US Navy Medical Research Unit 2-Indonesia (NAMRU2) http://www.nmrc.navy.mil/namru_2.htm
   c. Naval Medical Research Center Detachment-Peru (NMRCD) http://www.nmrc.navy.mil/nmrcd.htm
   d. Naval Health Research Center (NHRC)* San Diego http://www.nhrc.navy.mil/
3. Air Force Institute of Operational Health (AFIOH)* Brooks City Base, TX http://www.brooks.af.mil/afioh/
4. Armed Forces Institute of Pathology (AFIP)* Washington, DC http://www.afip.org
5. US Army Executive Agency Directorate of the Office of the Surgeon General (OTSG)
6. US Army Center for Health Promotion and Preventive Medicine (USACHPPM) Main, Aberdeen Proving Ground, MD HTTP://CHPPM-WWW.APGEA.ARMY.MIL
   a. CHPPM-West, Ft. Lewis, WA (LRN at MAMC)* http://chppm-www.apgea.army.mil/dsa-west/
   b. CHPPM-South, Atlanta http://chppm-www.apgea.army.mil/dsa-s/
7. Navy Environmental Health Center (NEHC) http://www-nehc.med.navy.mil/
   a. Navy Environmental and Preventive Medicine Unit #2 (NEPMU2) Norfolk, VA http://www-nehc.med.navy.mil/nepmu2/index.htm
   b. NEPMU5* San Diego, CA http://www.nepmu5.med.navy.mil/
   c. NEPMU6* Hawaii http://nepmu6.med.navy.mil/
   d. NEPMU7 Sigonella, Sicily, Italy http://www.sicily.navy.mil/nepmu7/
8. 121st Army General Hospital (121st AGH), 18th Medical Command,* South Korea http://www.seoul.amedd.army.mil/
9. Brooke Army Medical Center (BAMC)* Ft. Sam Houston, TX http://www.bamc.amedd.army.mil/index.htm

10. Landstuhl Regional Medical Center (LRMC) * Landstuhl, Germany
    http://www.landstuhl.healthcare.hqusareur.army.mil/
11. Tripler Army Medical Center (TAMC) * Hawaii http://www.tamc.amedd.army.mil/
12. Walter Reed Army Medical Center (WRAMC) * Washington, DC http://www.wramc.amedd.army.mil/
13. National Naval Medical Center (NNMC) Bethesda MD
14. Wilford Hall Medical Center (WHMC)*, Lackland AFB TX. http://www.whmc.af.mil/

Appendix C

Examples of DoD-GEIS Supported Projects, FY 2005

Overseas Laboratory Program:

- NMRCD-Peru (Surveillance for Influenza and respiratory pathogens; gastroenteritis pathogens; acute febrile illness pathogens; antimicrobial resistance and sexually transmitted infections; outbreak investigations)
- NAMRU-2 – Indonesia (Surveillance for Influenza and respiratory pathogens; gastroenteritis pathogens; acute febrile illness pathogens; antimicrobial resistance and sexually transmitted infections; outbreak investigations, tsunami response)
- NAMRU-3 – Egypt (Surveillance for Influenza and respiratory pathogens; gastroenteritis pathogens; acute febrile illness pathogens; antimicrobial resistance and sexually transmitted infections; outbreak investigations)
- AFRIMS – Thailand (Surveillance for ,Influenza and respiratory pathogens; gastroenteritis pathogens; acute febrile illness pathogens; antimicrobial resistance and sexually transmitted infections; outbreak investigations, tsunami response)
- USAMRU-K – Kenya (Influenza and respiratory pathogens; gastroenteritis pathogens; acute febrile illness pathogens; antimicrobial resistance and sexually transmitted infections; outbreak investigations)
- NASA Remote Sensing – Arbovirus investigations in Africa
- Division of Experimental Therapeutics WRAIR
- Management of WHO Collaborating Center for Anti-malarial Drug Surveillance
- Malaria Microscopy Center of Excellence
- Contingency Reserve at Central Hub for Outbreak Response
- Overseas Laboratory Training Fellowships

MHS Program:

- NHRC
  - Tri-service Population-Based Surveillance for Viral
  - Respiratory Pathogens in High-Risk U.S. Military Personnel
  - Febrile Illness Surveillance Aboard U.S. Military Ships
  - Laboratory Support of respiratory illness outbreaks within DoD

- Febrile respiratory Illness in U.S. Border population
- Etiology and Epidemiology of Pneumonia Among High Risk Military Trainees
- PCR based Molecular Detection System for Respiratory Surveillance Onboard U.S. Naval Ships
- Characterization of Clinical *Streptococcus pyogenes* Isolates from U.S. Military Recruits
- Multiplex PCR for atypical Pneumonia
- Use of Triangulation Identification for Genetic Evaluation of
- Risks (TIGER) Technology for Rapid Pathogen Identification
- Surveillance and Phylogenic Analyses of Novel Pathogens
- Development of PCR-detection methods to distinguish Adenovirus Serotype 4 Vaccine Strain from Non vaccine strain
- Development of RT-PCR Primers for the detection of Norovirus using the LightCycler

• NEHC/NEPMUs

- Increasing Communication & Collaboration & Capabilities for DoD Preventive Medicine stakeholders
- Respiratory Surveillance activities in the Western United States
- Enhanced febrile respiratory disease surveillance in the USCENTCOM region
- Incidence, Epidemiology and detection of Viral Gastroenteritis aboard
- Deployed U.S. Naval vessels and in other DoD units
- Enhanced febrile respiratory illness surveillance and response in the Western Pacific
- Surveillance for Antibiotic Resistance Patterns
- ELR Activities for reportable Medical Events
- Validation study to examine Reliability of SADR/SIDR Coding for Medical Surveillance

• NMRC - Surveillance for Rickettsial and Rickettsial-like diseases

• AFIOH

- Operation of DoD Global Influenza and Respiratory Virus Surveillance
- Education, Training and establishment of new sites
- Influenza Vaccine Effectiveness study
- DoD clinical Influenza and Respiratory Isolate Archive
- Norovirus Identification using an Electrochemilluminescent PCR Assay, Proof of Concept
- Far Forward Laboratory Surveillance in Central America Military Health System

• AFIP

- Directory of DoD Public Health Laboratory Services
- Mortality Surveillance Alert Component

- Korea - (18th MEDCOM)
  - Mosquito Borne Disease surveillance
  - Rodent Borne Disease surveillance
  - Tick Borne Disease surveillance
  - Prevalence of Chlamydia in U.S. Soldiers deployed to Korea
- BAMC - Leptospirosis Center of Excellence
- CHPPM Main - Outbreak Notification Directory, USCentCom, Surveillance, Assessment & Training
- CHPPM West - Surveillance program in Central America
- NSWC - Ultraviolet Light Healthcare Facility Room Disinfection and Decontamination Project after Terminal Cleaning
- WRAIR- Division of Preventive Medicine
  - Seroprevalence and risk factors for Transmission of
  - Q Fever in OIF Deployed Troops
- USAMRIID Diagnostics - Maintenance of DoD Reference Center for the Isolation and Identification of Etiologic Agents and for Diagnosis of Infectious Diseases

Appendix D

Countries and Sites for DoD-GEIS Cooperative Projects, Capacity Building, or Training Activities FY2005 (An asterisk * indicates cooperative projects related to influenza)

Angola	Guatemala*	Nepal*	Sudan
Azerbaijan*	Honduras*	Nigeria*	Syria*
Bolivia*	Indonesia*	Oman*	Thailand*
Cambodia	Iraq*	Pakistan	Ukraine*
Costa Rica	Japan*	Peru*	USA*
Ecuador*	Jordan	Philippines	Uzbekistan*
Egypt*	Kazahkstan*	Qatar*	Vanuatu
El Salvador*	Kenya*	S. Korea*	Vietnam
Georgia*	Kuwait*	Saudi Arabia*	Yemen*
Germany*	Kyrgistan*	Singapore	
Ghana	Mexico*	Sri Lanka	

Appendix E

Topics of DoD-GEIS Articles in FY 2005 Published Electronically Topics of DoD-GEIS Articles in FY 2005 Published Electronically by USACHPPM in "Health Information Operations (HIO) WEEKLY REPORTS"
Available at URL: http://chppm-www.apgea.army.mil/Hioupdate/

30 September 2005 DOD-GEIS: Japanese encephalitis update (MILVAX, CHPPM, outbreaks in PACOM AOR) Download HTML File

23 September 2005 DOD-GEIS: Overseas training for military medical personnel (USUHS, OCONUS labs) Download HTML File

16 September 2005 DOD-GEIS: DoD rickettsial diseases diagnostic support (NMRC, USAMRIID) Download HTML File

9 September 2005 DOD-GEIS: Vaccination guidance post Hurricane Katrina (CDC, MILVAX) Download HTML File

2 September 2005 DOD-GEIS: Hurricane Natural Disaster Update (CHPPM, AFIOH, NEHC, CDC) Download HTML File

26 August 2005 DOD-GEIS: Central America emerging infectious disease surveillance (CHPPM-W, AFIOH) Download HTML File

19 August 2005 DOD-GEIS: AFRIMS emerging infection surveillance and response in Nepal Download HTML File

05 August 2005 CHPPM: NYTimes article on *Acinetobacter baumannii* Download HTML File

29 July 2005 DOD-GEIS: Eco-climatic conditions on the Arabian peninsula favor Rift Valley fever (outbreak alert-warning, NASA, NAMRU3 USAMRU-K) Download HTML File

22 July 2005 DoD-GEIS: West Nile Virus infection status report USA and Canada, 2005, CDC Download HTML File

15 July 2005 DoD-GEIS and avian influenza: WHO, FAO, OIE, USDA discussions Download HTML File

8 July 2005 DOD-GEIS: WHO global influenza preparedness plan Download HTML File

24 June 2005 DoD-GEIS: New WHO International Health Regulations Download HTML File

17 June 2005 Overview of The Department of Defense global, laboratory-based, influenza surveillance program, (AFIOH, NHRC) and Cutaneous leishmaniasis outbreak Ft Campbell from exposures in OIF (USACHPPM, WRAIR). Download HTML File

10 June 2005 Avian Influenza: Human disease in Vietnam Download HTML File

27 May 2005 Public Health Preparedness for Emergencies (CDC, States) Download HTML File

13 May 2005 DoD-GEIS: Avian Influenza A/H5N1 Inventory of US Government Activities Download HTML File

06 May 2005 Download HTML File

29 April 2005 Dengue outbreak in Yemen (NAMRU3) Download HTML File

22 April 2005 Influenza A(H2N2) laboratory accident alert to 89 DoD Labs, (AFIP coordination with CDC, MTF's, LRN.) Download HTML File

01 April 2005: Marburg virus in Angola (NAMRU3) http://usachppm.apgea.army.mil/Hioupdate/HIOweeklyUpdate040105.mht.

25 March 2005: Avian Influenza in North Korea (ESSENCE, 18th MedCom, DoD-GEIS Central hub, Health Affairs) http://usachppm.apgea.army.mil/Hioupdate/HIOweeklyUpdate032505.mht

18 March 2005 Avian Influenza (AI) A (H5N1) Download HTML File

11 March 2005 AFRIMS Responds to Tsunami in Thailand Download HTML File

4 March 2005 Influenza Vaccination and Prevention of Mortality Download HTML File

25 February 2005 Avian Influenza (AI) A (H5N1) Download PDF File

18 February 2005 Outbreak Management Software (OMS) Download PDF File

11 February 2005 NAMRU-2 Outbreak Preparedness-Cambodia Download PDF File

04 February 2005 Avian Influenza (AI) A (H5N1) Download PDF File

28 January 2005 DOD Worldwide Influenza Surveillance Program for Week Ending 15 January – Week 2 Download PDF File

21 January 2005 Influenza Surveillance at NAMRU-3 Download PDF File

14 January 2005 DoD-GEIS Tsunami Assistance (NAMRU2 AFRIMS, NEPMU, NEHC, CDC liaison, WHO liaison) Download PDF File Download PDF File

07 January 2005 DOD Worldwide Influenza Surveillance Program for Week Ending 18 December – Week 52 Download PDF File

23 December 2004 Surveillance for Antimicrobial Resistance in Enteric Pathogens in Thailand Download PDF File

17 December 2004 Overview of Recent Activities at USAMRU-K Download PDF File

10 December 2004 DoD-GEIS: *Acinetobacter* Infections. Download PDF File

3 December 2004 DoD-GEIS: Influenza Genome Sequencing. Download PDF File

19 November 2004 DoD-GEIS at NMRCD Download PDF File

12 November 2004 Download PDF File

05 November 2004 Avian Influenza Download PDF File

29 October 2004 Influenza Download PDF File

22 October 2004 Influenza Vaccine Shortage Download PDF File

15 October 2004 West Nile Virus Download PDF File

08 October 2004 Influenza Vaccine Shortage Download PDF File

01 October 2004 Childhood Influenza-Vaccination in the 2002-2003 Season Download PDF File

Appendix F

Selected Listing of Activities in Support of DoD-GEIS Partners

Military Infectious Disease Research Program
- Leishmaniasis and norovirus diagnostics support
- "Clinical Desk" for microbiological and laboratory consultation in outbreaks
- Malaria microscopy standardization project
- Leptospirosis diagnostics project

United States Army
- Army Force Health Protection Conference presentations

United States Navy
- NEHC Annual Conference presentations

Office of the Secretary of Defense (Health Affairs)
- Annual TriCare Conference (2 slide presentations)
- AFEB meetings
- Surveillance consolidation meetings

US Regional Commands
- DoD-GEIS presentation at CoCom Surgeon's Conference
- DoD-GEIS presentation at both USEUCOM and USPACOM Surgeon's regional medical conferences
- DoD-GEIS Director office visits to USSOUTHCOM, USJFCOM Surgeons
- DoD-GEIS US Mexican Border Health Association conference presentations for USNORTHCOM
- DoD-GEIS Conferences on Acinetobacter and geographical and special imagery and epidemic modeling conference (USNORTHCOM and USTRANSCOM)

US Centers for Disease Control and Prevention and Dept. of Health and Human Services
- Director CDC and DoD-GEIS Director jointly visited USAMRU-K, NAMRU3
- Epi-X, the Epidemic Exchange (DoD-GEIS attended conference as Editorial Board member, and conducted several joint training sessions for about 100 DoD healthcare workers)
- CDC Global Disease Consultation, December 2004.
- Conference Planning for Bi- Annual International Conference on Emerging Infectious Diseases.
- USPHS Annual Commissioned Corps Conference, Slide presentation on
- DoD-GEIS Surge capacity to CDC Emergency Operations Center Atlanta for tsunami
- Interagency Antimicrobial Resistance Committee
- Annual EIS Conference participation

United States Department of State
- SAIC table top exercise planning for pandemic influenza
- AFMIC sponsored conference on medical threat assessments

Pan American Health Organization
- Technical Advisory Group, regional surveillance issues, June 2005
- USSOUTHCOM and PAHO conference Nicaragua, 2 presentations

World Health Organization
- Conference attendance and GOARN member discussions, Lyons, France, March 2005

Professional and Academic Societies
- Am Osteopathic Assn
- ISDA
- ICAAC
- ASTMH
- IOM Microbial Threat Forum and Board on Global Health

Appendix G

Publications/Presentations

Manuscripts:

Abel-Messih IA, T.F. Wierzba, R. Abu-Elyazeed, A. Ibrahim, S.F. Ahmed, K. Kamal, J. Sanders and R. Frenck. Diarrhea Associated with Cryptosporidium parvum among Young Children of the Nile River Delta in Egypt. J Trop Pediatr, Advance Access published on April 14, 2005

Afifi S, Earhart K, Azab MA, Youssef FG, Sakka HE, Wasfy M, Mansour H, Oun SE, Rakha M, Mahoney F. 2005. Hospital-based surveillance for acute febrile illness in Egypt: a focus on community-acquired bloodstream infections. Am J Trop Med Hyg. 73(2):392-9.

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Hyer RN, Covello VT. Effective Media Communication during Public Health Emergencies: A WHO Handbook. World Health Organization, Geneva, July 2005. http://www.who.int/csr/resources/publications/WHO_CDS_2005_31/en/index.html

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