

# Naval Medical Research and Development- 74 Years of Innovation



**CAPT Adam Armstrong, MC, USN**  
**Commander**  
**Naval Medical Research Center**

Presented by LCDR Mike Prouty

## Disclaimer

I am a military service member. This work was prepared as part of my official duties. Title 17 U.S.C. 105 provides that 'copyright protection under this title is not available for any work of the United States Government.' Title 17 U.S.C. 101 defines a U.S. Government work as 'a work prepared by a military service member or employee of the U.S. Government as part of that person's official duties'.

The views expressed in this presentation are those of the speaker and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense, nor the U.S. Government.

## OUTLINE

- Who we are as an Enterprise
  - Mission
  - Research Products
  - Commands (Laboratories)
- Who we are as Navy Microbiologists
  - What do Navy Microbiologists do?
  - What is our career path?
- Vignette: Biosecurity and Disease Surveillance with Partner Nations



## Naval Medical Research and Development

### Mission

- To conduct health and medical research, development, testing, evaluation, and surveillance to enhance the operational readiness and performance of DoD personnel worldwide

### Vision

- World-class, operationally relevant health and medical research solutions – anytime, anywhere!



## Medical Research's Role in the Military



Navy Medical R&D addresses the baseline health issues that can erode readiness and lethality of our fighting force, whether those be infectious disease, operational stress, warfighter performance, or traumatic injury.

Execute a diverse portfolio of programs directly addressing identified medical gaps and requirements based on Department of Defense and Department of Navy priorities.



5



## Products for the Warfighter

Navy & Marine Corps Enroute Care



Solvent Detergent/Spray-Dried Plasma



Mobile Anesthesia Delivery Module

Streamlined Configuration of Watchbill and Evolutions



Rehabilitation



Traumatic Amputation Osseointegration

Management of Acute Diarrheal Illness during Deployment  
A Deployment Health Guideline and Expert Panel Report

CAPT Mark S. Riddle, MC, USN<sup>1</sup>; Gregory J. Maria, MD<sup>2</sup>; COL Clinton K. Murray, MC, USA<sup>3</sup>; CAPT Timothy H. Burgess, MC, USN<sup>4</sup>; Col Patrick Coonan, FRCP, LRAMC<sup>5</sup>; COL James D. Mancuso, MC, USA<sup>6</sup>; Maj Elizabeth R. Schenck, USAF, MC<sup>7</sup>; Lt Col Timothy P. Ballard, USAF, MC<sup>8</sup>; Jamie Fraser, MPH<sup>9</sup>; and David R. Tribble, MD, DrPH<sup>10</sup> on behalf of the Travelers' Diarrhea Deployment Health Guideline Expert Panel

Deployment Health Guidelines

6



## NAVY R&D “Behind the Scenes”

- Nine Commands located around the globe
- Competitively Funded Research - ~\$275 million budget with 2,000+ personnel
- Active Duty Military
  - Microbiologists, Biochemists, Aerospace Physiologists, Research Psychologists, Entomologists, Medical Doctors, Nurses, Hospital Corpsman
- Government Service Civilians
  - Scientists, Medical Doctors, Support Personnel
- Contract Research Personnel
  - Scientists, Technicians, Medical Doctors, Support Personnel

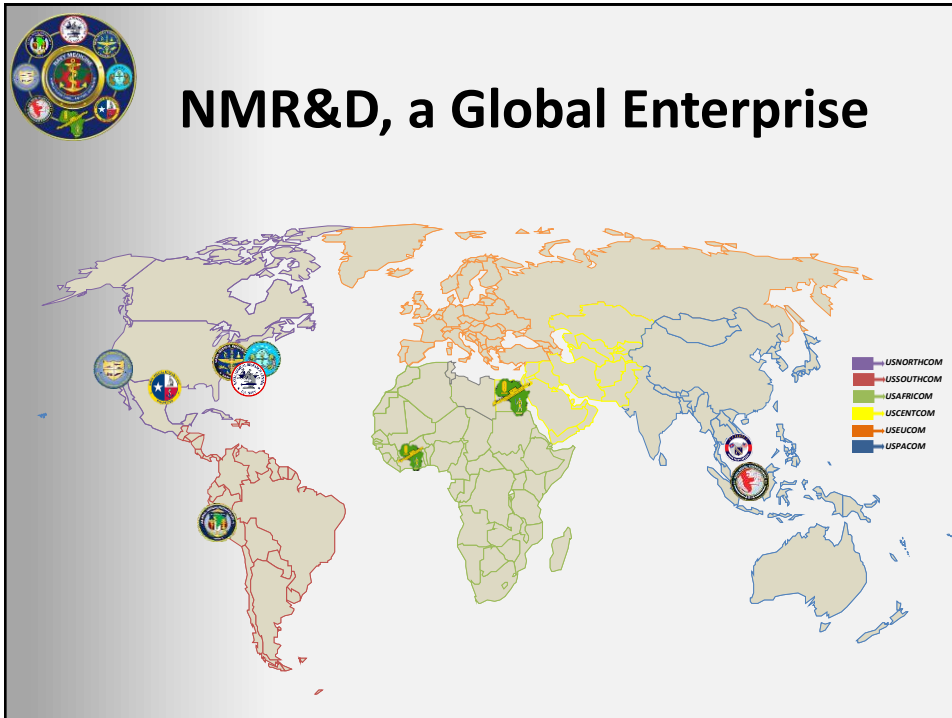
7



## R&D Products “Behind the Scenes”

- Peer-Reviewed Publications and Technical Reports
  - 281 peer reviewed publications, 18 technical reports (FY17)
- U.S. Patents
  - 9 issued / 19 filed
- Partnerships MOU/ CRADA
  - 168 MOU/MOAs, 228 Cooperative Research Agreements

8



## Naval Medical Research Center

Silver Spring, MD



- Headquarters laboratory for the R&D Enterprise
- Research Expertise in
  - Infectious Diseases
  - Operational and Undersea Medicine
  - Biological Defense
  - Bone Marrow (Radiologic Defense)
  - Advanced Development of Medical Technology
- Recent accomplishments
  - Clinical testing of malaria vaccine: attenuated whole organism vaccine for warfighter protection
  - Developed a rapid diagnostic test for Ebola virus
  - Advances in predicting heterotopic ossification a complication of wound healing in battle casualties
  - Provides advanced diagnostics for Military Treatment Facilities- Naval Infectious Diseases Diagnostics Laboratory (NIDDL) provides state-of-the-art diagnostics for emerging diseases (Zika, bird flu, dengue, Chikungunya)
  - Established clinical practice guidelines to treat diarrheal infections in the deployed warfighter
  - Successfully treated multi-drug resistant bacterial septicemia with phage therapy under eIND



NMRC's main laboratory shared with Walter Reed Army Institute of Research, Silver Spring MD



NMRC's Biological Defense Research Directorate, Frederick, MD

## Naval Health Research Center

San Diego, CA



- **DoD Deployment Health Research Center**

- Designated in 1999
- Re-designated in 2009

- **Research Expertise in**

- Operational Readiness and Health
- Military Population Health
- Operational Infectious Diseases

- **Recent accomplishments**

- Completed Authorized Medical Allowance List (AMAL) standardization for Naval Operating Forces
- Conducts medical R&D OPLANS / Wargaming
- Developed Automated Heat Stress System (AHSS)
- Provides highly realistic training for Independent Duty Corpsmen
- Conducts operational infectious diseases surveillance- reports delivered weekly to clinicians
- Conducts vaccine FDA approved trials in recruit populations (norovirus / adenovirus)



Point Loma, CA



11



## NAMRU-D (Dayton, Ohio)

- **Close relationship with USAF 711<sup>th</sup> Wing**

- **Robust programming in**

- Aerospace medicine including spatial disorientation, hypoxia, fatigue, vibration
- Toxicology

- **Examples of recent accomplishments**

- Assisted the F-22 pilot performance and safety evaluation
- The Kracken- Disorientation Research Device
- Tested a novel antimicrobial nanoparticle therapy for potential DNA mutagenic and genotoxic effects



Dayton, OH



Disorientation Research Device

## Naval Medical Research Unit – Dayton

Dayton, Ohio



- **Close partnership with Air Force Research Lab & USAF 711<sup>th</sup> Human Performance Wing**
- **Research Expertise in**
  - Human performance in aerospace medicine including spatial disorientation, in-flight physiologic episodes, operational decision making, aircrew neck and back pain
  - Toxicology and health effects of environmental and physiological stressors
  - Benchtop, animal and human research
- **Recent accomplishments**
  - Supported the USAF in F-22 pilot performance
  - The Kracken- Disorientation Research Device online
  - Conducts research and modeling of health effects of potential contaminants in operational environments
  - Construction of \$20M state-of-the-art disorientation research device



Dayton, OH



13

## Naval Medical Research Unit – San Antonio

San Antonio, TX



- **Close relationships with USAF 711<sup>th</sup> and 59<sup>th</sup> Wings and U.S. Army Institute for Surgical Research (USAISR)**
- **Research Expertise in**
  - Combat Casualty Care and Operational Medicine
  - Diagnostics and Interventions for Directed Energy Injury
  - Craniofacial Health and Restorative Medicine
- **Recent accomplishments**
  - Developed and evaluated novel therapeutics, devices, and surgical techniques to treat hemorrhagic shock in theater
  - Led multi-disciplinary collaborations to reduce post-surgical infections
  - Developed methods to prevent and treat craniomaxillofacial infections using non-antibiotic research approaches including phage and nano-targeted therapy
  - Characterization of hemostatic agents and methods



HQ Building, San Antonio, TX



Tri-Service Research Laboratory (TSRL)

14



## Naval Submarine Medical Research Laboratory

Groton, CT



- **Strategically located at the Naval Submarine Base New London, adjacent to Submarine Forces**
- **Research Expertise in**
  - Submariner health, performance, psychological fitness, and escape/survival
  - Diving physiology and effects of underwater blast
- **Recent accomplishments**
  - Provided needed risk information to Navy and NASA concerning safe atmospheric CO<sub>2</sub> levels
  - Demonstrated countermeasure for jet lag during long-distance transportation of Navy Special Operations Forces
  - Initiatives underway to: improve submariner access to mental health resources; predict optimal psychological traits; develop guidelines for standoff distance from underwater blast; and develop situation awareness-enabling technologies



15

## Naval Medical Research Unit THREE

Cairo, Egypt



- **Host: Ministry of Health; Operates in the CENTCOM and AFRICOM areas of responsibility**
- **Research Expertise in**
  - Infection Prevention & Control
  - Biosurveillance
  - Tropical Public Health (malaria, emerging diseases, yellow fever, enteric diseases, entomology)
  - Sepsis and Antimicrobial Resistance
- **Recent accomplishments**
  - Conducting medical engagement in Jordan to study hospital acquired infections
  - Facilitated USG Ebola-related laboratory response in Liberia
  - Expanding Entomology research in Nigeria
  - Expanding operations at detachment in Ghana (West Africa)



NAMRU-3, Cairo, Egypt

Due to facility safety concerns, NAMRU-3 has relocated to alternate locations in Cairo until a permanent relocation site is identified.

16



## Naval Medical Research Unit SIX

Lima, Peru



- **Host: Ministry of Defense—Navy**
- **Research Expertise in**
  - Global Health (malaria, emerging diseases, dengue and Chikungunya, Zika, enteric diseases, entomology)
  - Biosurveillance for emerging and re-emerging diseases
- **Recent accomplishments**
  - Maintains the first *Anopheles darlingi* mosquito colony for malaria research
  - Provides technical assistance to military health authorities in SOUTHCOM AOR to enhance force health protection
  - Maintains a broad febrile illness study portfolio informing US military and host nation health authorities on influenza, Zika, dengue, and other pathogens of concern
  - Collaborates with industry partners to perform field testing/evaluation to support FDA clearance of novel diagnostic devices for the early and rapid diagnosis of multiple neglected and emerging diseases



17

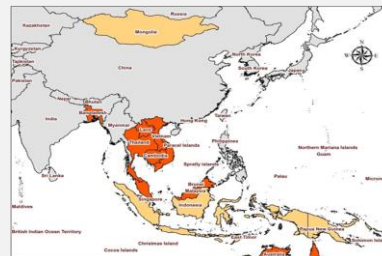
## Naval Medical Research – Asia Naval Medical Research Unit TWO



- **Host(s): Singapore: Ministry of Defense; Cambodia: Ministry of Health**
- **Research Expertise in**
  - Biosurveillance of infectious diseases
  - Pathogen characterization/bioinformatics
  - Drug resistant malaria therapeutics
- **Recent accomplishments**
  - Established Middle East Respiratory Syndrome-Corona Virus (MERS-CoV) surveillance in SE Asia
  - Supports Global Health Security through laboratory upgrade with Cambodia Ministry of Health and Royal Cambodian Armed Forces
  - Evaluation of vector control and abatement devices in Laos
  - Conducts SMS-based disease surveillance in Cambodia to provide real-time disease trend data
  - Conducting Therapeutic treatment efficacy studies to reduce malaria burden in SE Asia



NMRC-Asia HQ in Singapore. NAMRU-2's laboratory in Phnom Penh, Cambodia



18

## What is a Navy Microbiologist?



*The Washington Times - Wednesday, April 12, 2017*

## Navy Microbiologists

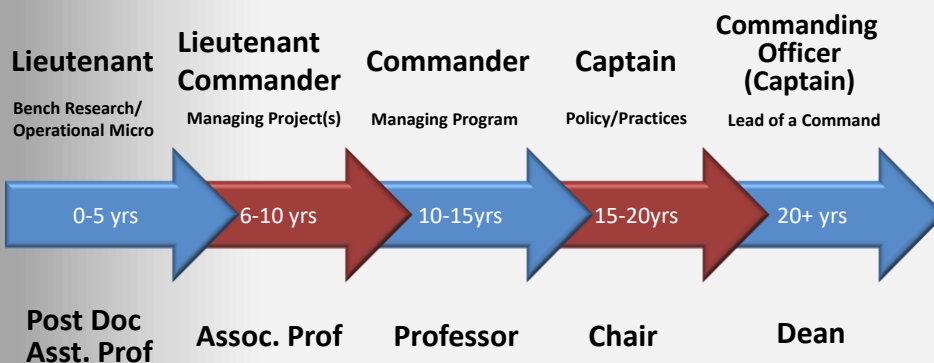
- Recruit PhD level microbiologists
- Diverse background in microbiology specialties
- Direct commission as a Lieutenant in the United States Navy
- Support Navy Mission by providing force health protection, infectious disease research and surveillance and global health engagement
- Approximately 50 Active Duty Microbiologists



## Working in All Aspects of Microbiology



## Navy Microbiologist Career Path



# Why do we need Navy Microbiologists?

NMRC-Asia / NAMRU-2  
Singapore/ Phnom Penh



NAMRU – 3, Cairo, Egypt



NAMRU-6, Lima, Peru



## Navy OCONUS Research Laboratories

- Define the epidemiology and immunology of military relevant infectious disease agents
- Evaluate diagnostic tests, vaccines, drugs and insect control/protection measures
- Develop host nation public health laboratory and epidemiology capacity

### NMRC-Asia / NAMRU-2 est. 1944

PACOM AOR

Focus on malaria, dengue, respiratory diseases, influenza, antimicrobial resistance, diarrheal disease.

### NAMRU-3 est. 1946

AFRICOM, CENTCOM, and EUCOM AORs

Focus on influenza-like illness, acute febrile illness, diarrheal diseases, hemorrhagic fever, HIV, meningitis and infection control.

### NAMRU-6 est. 1983

SOUTHCOM AOR

Focus on disease prevention strategies, clinical trials, chemotherapeutics, diagnostics, epidemiology, and ecology.





# **SMS BASED DISEASE SURVEILLANCE AMONG ROYAL CAMBODIAN ARMED FORCES (RCAF)**

Department of Health, Cambodia Ministry of  
Defense and US NAMRU-2 Det. Phnom Penh

## **Background**

- Cambodian Ministry of National Defense (MoND) deploys troops and sailors to remote bases through Cambodia. These personnel are isolated and exposed to numerous infectious disease threats.
- MoND lacks an integrated disease reporting system. Inability to quickly detect and respond to the presence of disease outbreaks at military bases.
- NAMRU-2, in cooperation with MoND, began an SMS based system for diseases surveillance in August 2011 (RCAF Region 3), expanded in December 2012 (Royal Cambodian Navy) with second expansion in January 2016 (RCAF Regions 4 and 5).



## MoND Goals

- Integrated reporting system: Reporting sites – Regional Office (Main stations) – DoH of MoND
- Routine data/information sent to command office/DoH of MoND → Daily/Weekly/ Monthly/Yearly
- Data/information sent to Headquarter/DoH of MoND → Weekly/ Monthly/Yearly
- Detection disease outbreaks → Rapid Response Team (RRT) at Command Office or Headquarter/DoH of MoND

## System Design

**Unit Level Reporting  
–empirical diagnosis**



Simple cell phone



Smartphone

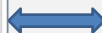
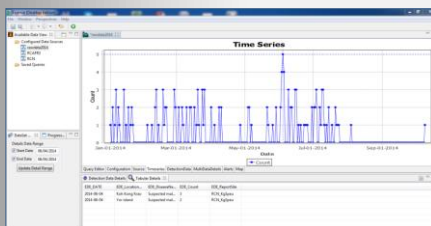
**Main Station**



Computer



**EDE/OE  
Analysis and Graphs**



**DoH of MoND/NAMRU-2**





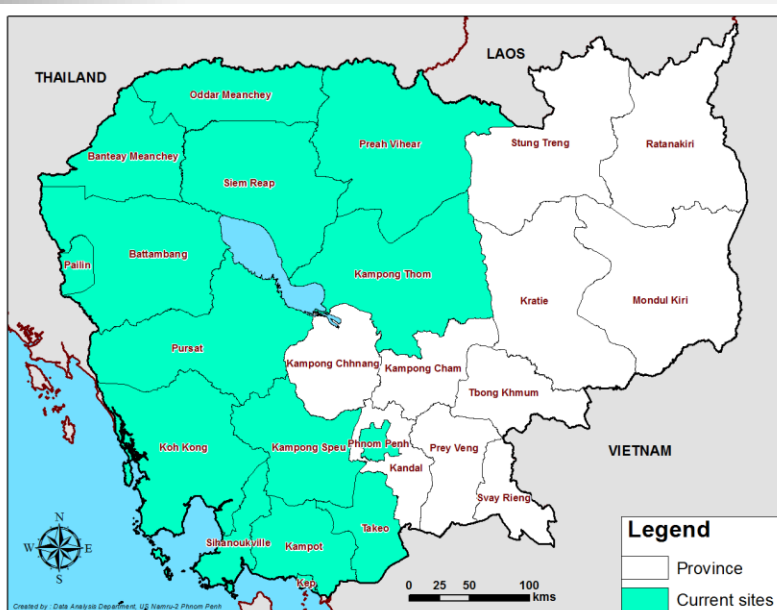
# Diseases List (DNBI)

Disease Code	Disease Name
D1	Acute diarrhea
D2	Acute Fever with Rash
D3	Acute Flaccid Paralysis
D4	Influenza like illness (ILI)
D5	Dengue Fever or Dengue Hemorrhagic Fever
D6	Meningitis or Encephalitis
D7	Acute jaundice
D8	Diphtheria
D9	Rabies
D10	Neonatal tetanus
D11	Body injuries
D12	Burns and corrosions
D13	Poisoning by drugs medicaments and biological substances
D14	Suspected radiation
D15	Acute lower respiratory tract inflammatory (pneumonia)
D16	Suspected malaria
D17	Unknown disease
D18	Traffic accident
C1	Consultation
S1	Sick in Quarters





## Coverage of SMS program- 58 sites



## Achievements

### SMS activities

- **Initial Training** : **120** military personnel were trained: **46** from RCN, **20** from RCAF Region 3, **24** from RCAF Regional 4, and **30** from RCAF Regional 5.
- **Yearly Refresher Training** : **60** military personnel were trained: **23** from RCN (**23** reporting sites), **10** from RCAF Region 3 (**10** reporting sites), **12** from RCAF Regional 4 (**12** reporting sites), and **15** from RCAF Regional 5 (**15** reporting sites).
- **Basic IT training** : **13** military personnel were trained: **02** from HQ of RCN, **02** from Ream Naval Base, **02** from HQ of Kampong Speu Command, **02** from RCAF Region 3, **02** from RCAF Regional 4, **02** from RCAF Regional 5, and **01** military personnel from DoH of MoND.

## Results (Feb 2017)

# SMS received by Main Stations

Main Station	Years							Total
	2011	2012	2013	2014	2015	2016	2017	
RCAF Regional 3	2,024	4,453	4,438	3,922	4,945	5,682	967	26,431
RCAF Regional 4						7,462	1,168	8,630
RCAF Regional 5						10,458	1,961	12,419
Royal Cambodian Navy Kg Speu		22	2,403	3,202	6,735	7,464	1,250	21,076
Royal Cambodian Navy HQ			3,417	3,684	2,844	2,923	501	13,369
Royal Cambodian Navy Ream		197	3,159	3,120	2,733	3,057	540	12,806
<b>Total</b>	<b>2,024</b>	<b>4,672</b>	<b>13,417</b>	<b>13,928</b>	<b>17,257</b>	<b>37,046</b>	<b>6,387</b>	<b>94,731</b>

# Results (Feb 2017)

# Cases Reported

	2011	2012	2013	2014	2015	2016	2017	Total
Consultation	6,945	10,192	20,026	14,866	17,031	45,315	7,528	121,903
Sick in Quarters	1,508	1,464	1,599	1,010	1,868	1,845	280	9,574

Disease Name	2011	2012	2013	2014	2015	2016	2017	Total
Acute diarrhea	365	448	3,766	2,931	3,407	9,248	1,267	21,432
Acute fever with/without rash	104	202	2,408	519	314	427	48	4,022
Acute flaccid paralysis	0	0	3	8	6	2	0	19
Acute jaundice	25	0	23	22	22	15	0	107
Acute lower respiratory tract inflammatory	0	0	0	159	215	1,769	193	2,336
Body injuries	117	144	480	754	873	2,878	393	5,639
Burns and corosions	57	79	342	193	148	358	51	1,228
Dengue Fever or Dengue Hemorrhagic Fever	41	2	91	23	28	34	0	219
Diphtheria	0	0	8	13	11	13	0	45
Influenza Like Illness	263	216	4,139	4,044	5,351	17,001	2,536	33,550
Meningitis/encephalitis	2	0	88	3	0	14	0	107
Neonatal tetanus	0	0	12	2	0	0	0	14
Outbreak (unknown disease)	0	0	6	0	0	0	0	6
Poisoning by drugs medicaments and biological substances	30	12	47	36	65	105	18	313
Rabies	0	0	14	0	1	1	0	16
Suspected malaria	0	0	123	184	37	231	4	579
Suspected radiation	0	0	0	3	1	0	0	4
Traffic accident	0	0	0	0	0	0	91	91



1<sup>st</sup> Workshop



## Phase 2-Laboratory Based Diagnosis and Applied Epidemiology

- NAMRU-2 trained 4 RCN and 4 RCAF laboratory technicians for 6 months at NAMRU-2 laboratory
- Provided support for laboratories at Ream Naval Base and Preah Vihear Base



Basic Epidemiology Training



Completion of Lab training at NAMRU-2 for military personnel

## Conclusion

- SMS system is an “easy to use” system, only more caution is needed when inputting the data and sending SMS.
- Regular refresher training is needed (2 times/year), especially regarding disease definitions.
- Emphasize follow up on reports received from reporting sites, especially if related to disease outbreaks → Rapid Response Team.
- Transition to laboratory based diagnostics coupled with epidemiological analysis adds robustness to surveillance program.



## Benefits to MoND



- Provides real time disease surveillance; response to outbreaks
- Quantifies DNBI to target preventative measures
- Allows for medical materiel planning
- Supports civilian health who utilize military medical facilities





## Benefits to DoD



- Allowed expanded mil:mil activities outside of Region 3 in Cambodia
- Provides PACOM with real time disease trends in a military population in Cambodia
- Showcase of cooperation for other SE and S Asian countries (Laos, Vietnam, Indonesia, PNG)
- Enhances host nation stability

## RCAF Forces Deployed to Africa



Anyone see an issue?

# Thank You



For Further Information please feel free to contact:

LCDR Michael Prouty

[michael.g.prouty2.mil@mail.mil](mailto:michael.g.prouty2.mil@mail.mil)