Outside Witness Testimony
U.S. Government Response: Fighting Ebola and Protecting America
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The Johns Hopkins University Applied Physics Laboratory (APL) appreciates the opportunity to provide outside witness testimony to the U.S. Senate Committee on Appropriations. We commend the Committee Chair, Co-Chair, and Members for their interest in and support of research and development efforts that safeguard our nation and its citizens from the threat of natural or induced infectious diseases.

The Applied Physics Laboratory is an independent, not-for-profit component of The Johns Hopkins University that has worked alongside federal government sponsors for more than 72 years. We are a University Affiliated Research Center (UARC) that is directly engaged in the application of science and engineering to solve some of our nation's most critical challenges in fields such as air and missile defense, space science and engineering, cyber security, nuclear security and deterrence, undersea warfare, homeland protection, and biomedicine and health care.

The Laboratory's dedicated scientists, engineers, and supporting staff members focus on activities that are vital to sponsors in the Department of Defense, the National Aeronautics and Space Administration, the Department of Homeland Security, the Intelligence Community, and many federal agencies. We also maintain independent research and development programs that explore and advance emerging technologies and concepts to address future national priorities. In the area of biomedicine and healthcare, we collaborate closely with the Johns Hopkins School of Medicine and School of Public Health to provide applied science and technology solutions.

The ongoing Ebola outbreak across multiple countries in West Africa, and the limited introduction of Ebola to Western countries, including the U.S., vividly illustrates the need for our nation to strengthen its ability to predict, detect, and respond to natural or induced infectious diseases. While many organizations focus on behavioral or clinical interventions, APL focuses on developing advanced technologies and methodologies that address the complementary requirements of detecting, modeling, and rapidly responding to infectious disease outbreaks.

The following examples illustrate our promising research to date in the area of disease surveillance and its application to the current Ebola outbreak.

Detecting

Since the late 1990s, APL has partnered with the Department of Defense and many state and local health departments to develop the Electronic Surveillance System for the Early Notification of Community-based Epidemics, more commonly called ESSENCE. This system collects, processes and analyzes data such as over-the-counter medicine sales, emergency department complaints, and school absenteeism rates to detect the onset of disease within communities across the nation earlier than is possible using traditional methods such as laboratory tests or clinical diagnoses. The system collects these health indicators from a variety of sources, analyzes the data, and notifies users when statistical anomalies occur, indicating a potential disease outbreak that could cause widespread illness or death.

Current ESSENCE users include the Department of Defense, Veterans Health Administration, and numerous state and local health departments. In response to the Ebola cases detected at Texas Health Presbyterian Hospital Dallas, APL worked with Tarrant County (Dallas) officials to refine the use of their ESSENCE system to aid in detecting additional cases. This refined query methodology was shared with other system users across the country, including public health departments in the National Capital Region.

Recognizing the potential utility of this technology in a global context, APL has been working with the Armed Forces Health Surveillance Center to develop an open-source electronic disease surveillance toolkit for use by health officials in regions and nations with limited resources. This effort, the Suite for Automated Global Electronic bioSurvellance (SAGES) initiative, leverages the technology and experience gained in the development and deployment of ESSENCE. The SAGES system is built with the same data visualization features, and has been used by governments in Cambodia, the Philippines, Peru, Cameroon, and Thailand, as part of efforts to help them improve their disease surveillance programs in support of the Global Health Security agenda. We have proactively developed deployment plans in case this system is desired for use in countries within the Ebola-impacted region.

Modeling

In response to the growing threat of natural or induced infectious disease outbreaks, as well as the growing prevalence of drug-resistant viruses and bacteria, APL is applying its technical expertise in systems biology, optics, and biological assay development to address our nation's readiness to combat these emerging threats. Though still in their nascent stages, our efforts hold promise to contribute significantly in future crises such as the Ebola outbreak.

Leveraging technology developed through a Defense Advanced Research Projects Agency (DARPA) effort called Prophecy – which aims to predict the spread and speed of viral mutations – APL, with a team that includes Johns Hopkins Bloomberg School of Public Health and Harvard, has developed tools to allow researchers to accurately characterize the body's antibody response, paving the way for rapid development of novel therapies and detailed characterization of candidate vaccines.

The Prophecy technology performs millions of concurrent evolutionary experiments to predict the sensitivity of a therapy to a mutating virus. The technology is now deployed as part of the $76 million Johns Hopkins University Center of Excellence for Influenza Surveillance and Research, funded by the National Institute for Allergy and Infectious Diseases, to assess the efficacy of antiviral drugs. From a national security perspective, such technologies are key enablers that allow us to rapidly and affordably evaluate risks and respond to emerging disease outbreaks, drug-resistant bacteria, food-borne illnesses, potential pandemics, and biological-weapons attacks.

Rapidly Responding

In response to the threat posed by the ongoing Ebola outbreak in Western Africa and the deployment of U.S. military forces and public health officials to the impacted region, APL scientists and engineers were asked by the Joint Program Office for Chemical and Biological Defense to support development of an Ebola portal that consolidates disparate data from multiple sources into a web-based tool to support operational commanders and headquarters officials. Leveraging its biosurveillance capabilities, APL worked under the Joint Program Executive Office for Chemical and Biological Defense in close coordination with the Defense Threat Reduction Agency and the Combatting Terrorism Technology Support Office to create and deploy an unclassified, networked collaboration portal that provides access to currently available information from all sources. Officials monitoring the situation and operational commanders are adopting the portal as a means to maintain real-time situational awareness of events unfolding in the impacted region.

Additional APL research investments that could prove effective in the fight against Ebola include biosensors for rapid detection of the Ebola virus as well as advanced decontamination materials. APL has also partnered across Johns Hopkins University to develop concepts for personal protective equipment (PPE) that use novel methods of protecting patients and healthcare providers.

Conclusion

For the past seven decades, APL has applied its expertise to ensure our national security. The threats posed to our nation and its citizens by natural or induced infectious disease outbreaks are significant and ever-present. Federal investments are needed to develop technologies to detect, model, and respond to this threat. We commend Members of the Committee for bringing this matter to the attention of the American public, and thank you for your sustained support of science and technology.