create
collaborate
communicate

24 Month Diagnostics and Biosurveillance Challenge:

***BSV Ecosystem* (BSVE) and Role 0/1 Diagnostic Devices**

DEFENSE THREAT REDUCTION AGENCY | JOINT SCIENCE AND TECHNOLOGY OFFICE | CHEMICAL AND BIOLOGICAL DEFENSE

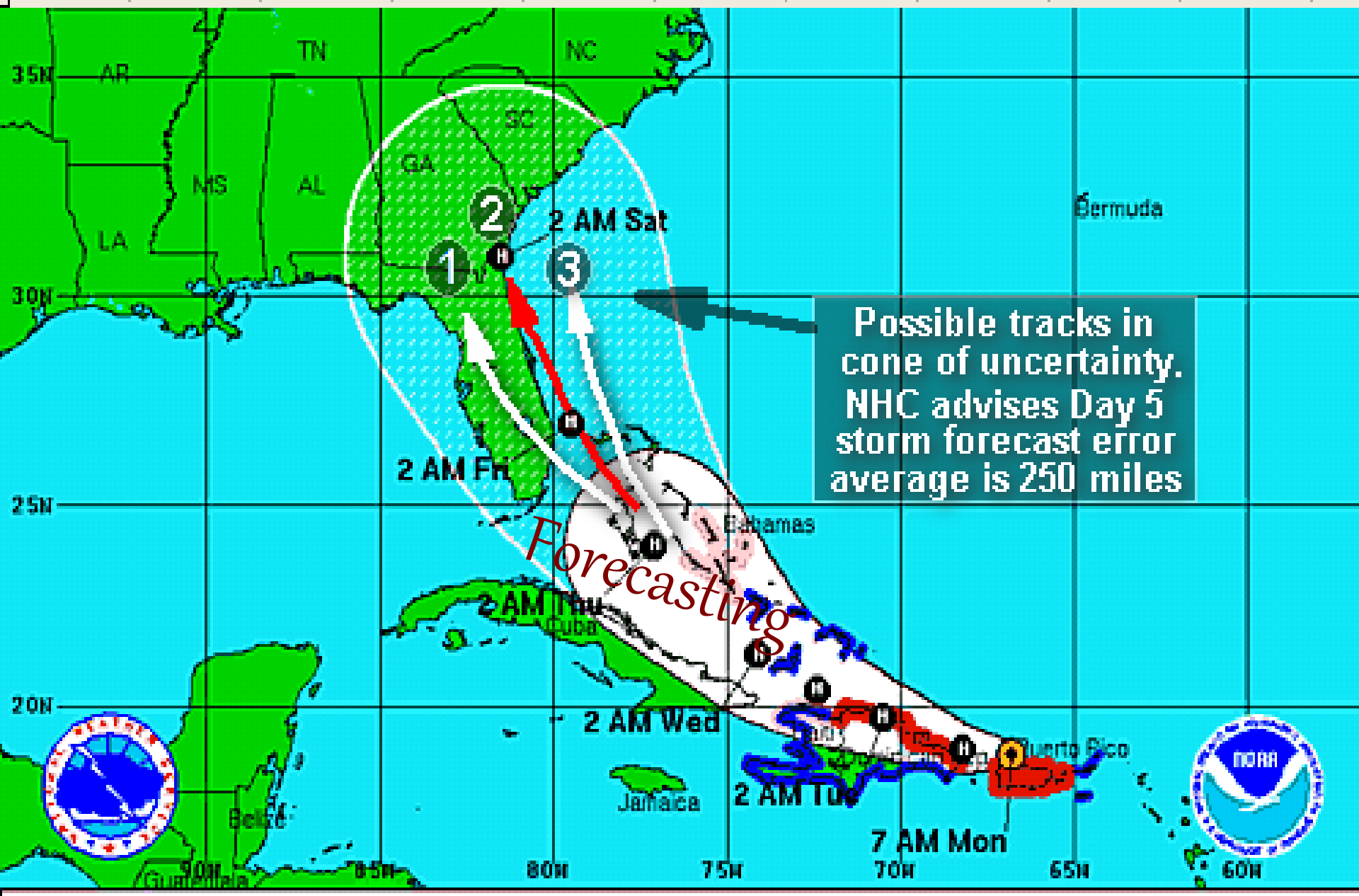
Diagnostics, Detection and Disease Surveillance Division (CBA)
Defense Threat Reduction Agency
Research & Development Chem-Bio Technologies

PROBLEM

DoD biosurveillance systems do not provide us with early warning….

we only learn about what happened after it is too late.


EARLY WARNING



Hurricane Irene

Monday August 22, 2011

7 AM EDT Intermediate Advisory 7A

NWS National Hurricane Center

Current Information:

Center Location 18.8 N 66.8 W

Max Sustained Wind 75 mph

Movement WNW at 14 mph

Forecast Positions:

● Tropical Cyclone ○ Post-Tropical

Sustained Winds: D < 39 mph

S 39-73 mph H 74-110 mph M > 110mph

OUR "HURRICANE"

S&T S

- Identify a
  sources'
  "slow, tru
- Create a
  data sou
  need an
- Enable i
  impact f
- Collabor
  environn

NATIONAL STRATEGY FOR BIOSURVEILLANCE

Biosurveillance Goal: achieve a well-integrated national biosurveillance enterprise that saves lives by providing essential information for better decision making at all levels through four core functions:

1. *Scan and discern the environment*
2. *Identify and Integrate Essential Information*
3. *Alert and Inform Decision Makers*
4. *Forecast and Advise Impacts*

Number of Cases

2 months and 1 week later… WHO CONFIRMS

12-Apr

Clinic Record

imeline: Social Media,
Records,
egators, Laboratory

USER/ANALYST COMMUNITY

- Workshop
  - Involved S&T, Requirements, Users, Industry, Acquisition
- Interviews
  - Established baseline and elicited workflow activities
    - ✓ NCMI – Intelligence Community Lead for Disease Surveillance
    - ✓ NORTHCOM – Pandemic Influenza Lead
    - ✓ HHS – Civilian Lead for Disease Surveillance
    - ✓ Boston Public Health Command
    - ✓ COCOMs
    - ✓ Naval Health Research Center
    - ✓ Naval and Marine Corps Public Health Center
    - ✓ NEPMU-2
- KEY OUTCOME: Current Public Health (ESSENCE), DoD (Health Affairs), Interagency (BioSense 2.0) Surveillance Systems are…
  - EVENT-based, stove-piped based on organizational mission
  - Reliant upon traditional (clinical) data sources; lab results take weeks to provide actionable information
  - **Surveying only human (sometimes just military) populations will not provide early warning**

HOW IT'S DONE NOW: *BSV DYSFUNCTION*

Analyst scans multiple, various data sources for signals
Hunts/gathers data manually

Analyst interprets data for importance, analytics not connected to data

Analyst collaborates with other analysts

Analyst confirms/denies signal

Analyst produces report

Analyst pushes out product

Connections present, but not made

Manual, laborious

Iterative process

No knowledge management

Constant repetition

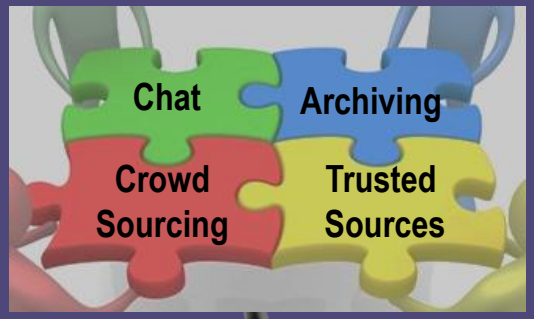
No archiving/sharing

Decision maker gets information too late to make a difference

A NEW APPROACH IS NEEDED: BIOSURVEILLANCE ECOSYSTEM (BSVE)

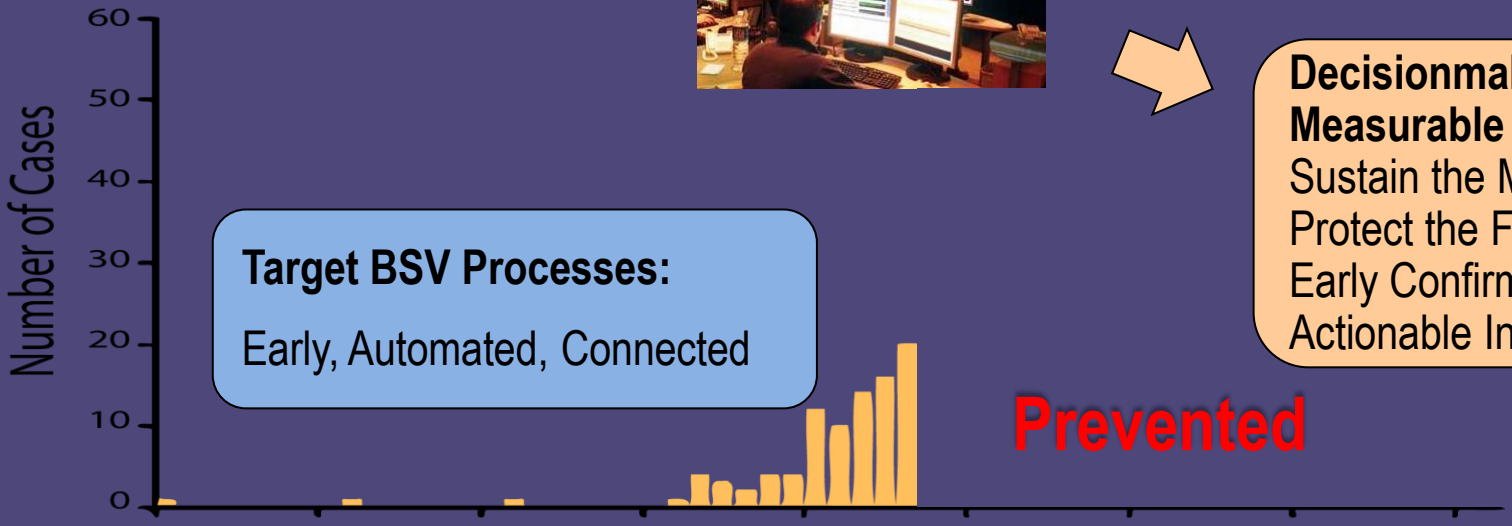
Integrated Relevant Data

Collaboration



Accessible Analytics

BSVE User Workbench



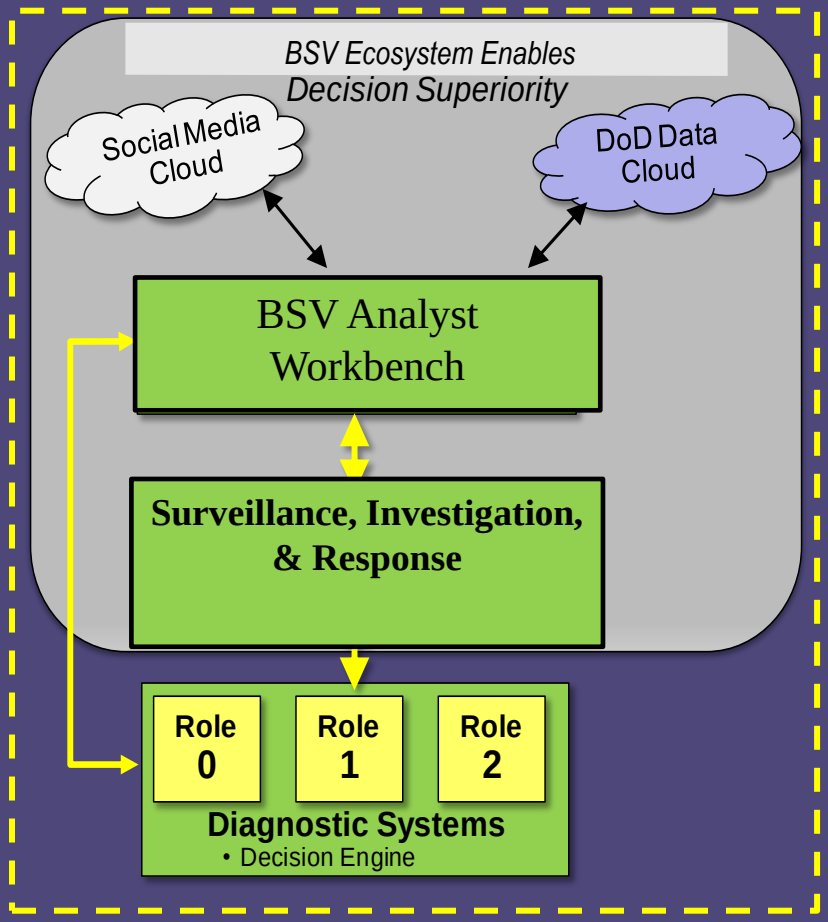
Target BSV Processes:

Early, Automated, Connected

Decisionmaker Achieves Measurable Results:

Sustain the Mission
Protect the Force
Early Confirmation
Actionable Information

24-MONTH CHALLENGE OBJECTIVE



24-Month Challenge will demonstrate linking: "a well-integrated BSV Ecosystem that saves lives by providing PON diagnostics for better decision making at all levels"

HARNESS INDUSTRY TO CHANGE THE GAME

- Exploit the industry framework that has evolved to warn, forecast, and proactively respond to disasters

- Research, develop, and demonstrate − to the public and to industry − a commercially viable early warning/response system for outbreaks

DESIGNED FOR:

  - Mutually positive private sector and government impact

  - Widespread sustainment (by the private sector) and use well beyond the initial government investment

A TRANSFORMATION FOR HEALTHCARE AND BIOSURVEILLANCE

Government/Ministry of Health Data

Open Source Information

Point-of-Need Diagnostic Results

Self-Administered Diagnostic Systems to Drive Treatment Earlier, With Results Informing BSV

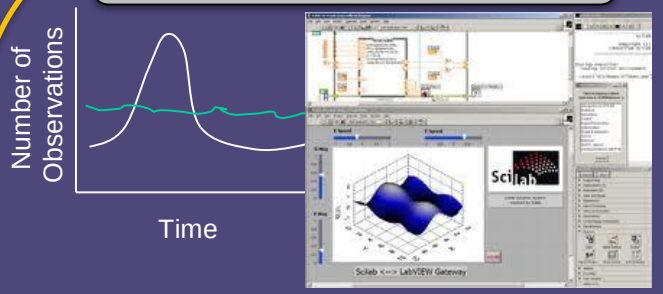
Environmental Observations

Zoonotic Testing

Veterinary Health Observations

Convert Silos to Direct Data Linkages

Customizable Analyst Workbench



Immediate Diagnostic Results Driving Treatment, Informing Health Reporting Systems

CVS/pharmacy
Expect something extra

DETAILED DISEASE CANDIDATES FOR DEMONSTRATION

- Syndromically-targeted, multiplexed diagnostic system considered most useful for purposes of 24 Month Challenge Demo, according to CBA external medical focus group:

Severe acute systemic febrile illness (SASFI)

Priority α
- *Malaria* (*P. falciparum*)
- Dengue
- Melioidosis (*Burkholderia pseudomallei*)

Priority β
- Lassa Fever
- *B. anthracis* (anthrax)
- *Y. pestis* (plague)

POINT-OF- NEED DIAGNOSTIC SYSTEMS

- **Role 0:** very simple and rugged devices suitable for self-use and use by non-medically trained service members
- **Role 1:** handheld electronic systems for use in forward (medical level 1 care) environments

Role 0

HOME /SELF USE [1]

- Akin to paper-based platforms
- Capable of 3-5 tests on one sample

Role 1

MEDICAL PROVIDER

- Increased functionality
- Higher plexity (10-100 simultaneous tests)

- Fast, easy to use, sample-to-answer systems
- Compatible with existing communications infrastructure[2]
- At clinical research stage in 24 months
- Suitable for eventual FDA clearance and CLIA waiver (monthly meetings with FDA scheduled; concept fits with FDA paradigm shift to separate results interpretation from device/user)

1. Also includes uses with non-human samples (e.g. insect vectors, livestock, food, environment), which would be performed by technical operators
2. With use of external reader for Role 0 systems

DEVICE CANDIDATES

Role 0	Role 1
Rapid Pathogen Screening	BD Veritor
FIO *	Epistem GeneDrive
Diagnostics for All	Quidel Sophia
SD Bioline	MesoScale Diagnostics
	Mesa Tech (In Negotiations for Contract)
	Phillips Royal Electronics
	Multiplex PCR Device (In Negotiations for Contract)
	Luminex (Miniature PCR/Immuno)
	Wave 80

- **DTRA has funded 3 Evaluation Labs to develop and test Point-of-Need diagnostic devices (NRL, JHU/APL, LLNL)**

* Not actual assay, just a reader

OCONUS CLINICAL SITES FOR 24 MONTH DEMONSTRATION

Base Site and Location	Number and Location of Cohort Sites	Prevalent Disease States for Study	Estimated Prevalence of Target Pathogen (%)[2,3,4]	# of Patients with Selected Pathogen Required for Testing Device Performance[5]	Sample Size Goal (# of acute febrile patients needed, based on estimated prevalence)	Past Number of Acute Febrile Patients per Year[2,3,4]
NAMRU-2[1] (SE Asia)	Will include sites in Cambodia (9), Thailand (2), and Northern Australia (1)	Dengue, Malaria (*P. falciparum*) and Melioidosis (*Burkholderia pseudomallei*)	Dengue: 8-10% Malaria: 2-5% Melioidosis: Pending	Dengue: 245 Malaria: 245 Melioidosis: 200	2450 4900 Pending	3325 3318 Pending[6]
NAMRU-6[2] (Peru)	Iquitos, Peru (~12)	Dengue	20-25%	245	980-1225	1345
USAMRU-K[3] (East Africa)	Will include sites in Kenya (~8) and Uganda (~2)	Malaria (*P. falciparum*) Plague (*Y. pestis*)	20-25% pending	245 200	980-1225 Pending	750[4] Pending

[1] Actual number of sites to be determined after site visit in September 2012.

[2] Data extrapolated from M. Kasper, *et al* (2012). *Am J Trop Med Hyg* 86(2): 246-253—reports confirmed dengue in 883/9975 and confirmed *P. falciparum* malaria in 216/9954 cases from surveillance data in Phnom Penh, Cambodia (9 clinical sites) from 2006 to 2009. Also, *P. vivax* seen in 481/9954 cases.

[3] Data extrapolated from B. Forshey (2010), et al. *PLoS NTD* 4(8): e787—reports confirmed dengue in 2482/10,739 from surveillance data in Iquitos from 2000 to 2007.

[4] Data extrapolated from unpublished archived sample data from Dr. John Waitumbi (USAMRU-K). Reports confirmed *P. falciparum* malaria in 599/2240 cases from 2009 to 2012 in their febrile surveillance cohort. Dr. Waitumbi states that absolute numbers can be increased at select sites in order to capture required samples at a quicker rate.

[5] In order to test performance characteristics of both role 0/1 device, calculation of pathogen amount needed for validation is based on tier 0 estimate of sensitivity and precision.

[6] Data to be collected in September, 2012 after face to face discussion with sites.

***Goal*−create signal over noise with near real-time uplink to BSV Ecosystem (Jan − Dec, 2014)**

PROGRESS TO DATE

BSVE

- Nov 2011: Biosurveillance Workshop
- Jan 2012: Industry Days (San Jose, CA and Chantilly, VA)
- Jan 2012: BAA/Service Call released
- Feb-Jul 2012: BSV Ecosystem Team Interviews with BSV Users
- July 2012: BAA Performers Selected
- Aug 2012: BSVE User Workflow Report Completed
- Aug 2012: BSVE User Group Forum
- Oct 2012: BSV Ecosystem Contracts Awarded, Kickoff, & JPEO Coordination

24 Month Challenge

- January 2012: 24 Month Challenge Starts
- March 2012: Industry Day and RFI Released
- May 2012: Device Evaluation Labs on Contract
- August 2012: Device Performers on Contract (12 Technologies)
- October 2012: Program Review & JPEO Coordination

24 MONTH CHALLENGE PROGRAM TIMELINE

January 2012	August 2012	February 2013	December 2013	January 2014	December 2014
24 Month Clock Starts	Device Performers on Contract 12 technologies 9 Role 1 3 Role 0	1st Device Down-select (3-5 technologies) Technical Demo of device-BSV Ecosystem Linkage	2nd Device Down-select (1-2 technologies) Ideally at least one Role 0 and one Role 1 move forward	Begin OCONUS Demo Continual clinical patient study Intermittent Month-long BSV Ecosystem/Device Linkage Demos	Finish OCONUS Demo

Out year work could include different syndrome panels, further development of technologies and integration of host response or novel assays into diagnostic platforms