

National Center for Foreign Animal and Zoonotic Disease Defense

FAZD CENTER

NATIONAL CENTER FOR FOREIGN ANIMAL
AND ZOONOTIC DISEASE DEFENSE

Research Needs of the Chemical and Biological Defense Division

CORE PARTNERS



Texas A&M University



ASSOCIATE PARTNERS

UNIVERSITY
OF MINNESOTA

FAZD CENTER

NATIONAL PARTNERS

Plum Island Animal
Disease Center

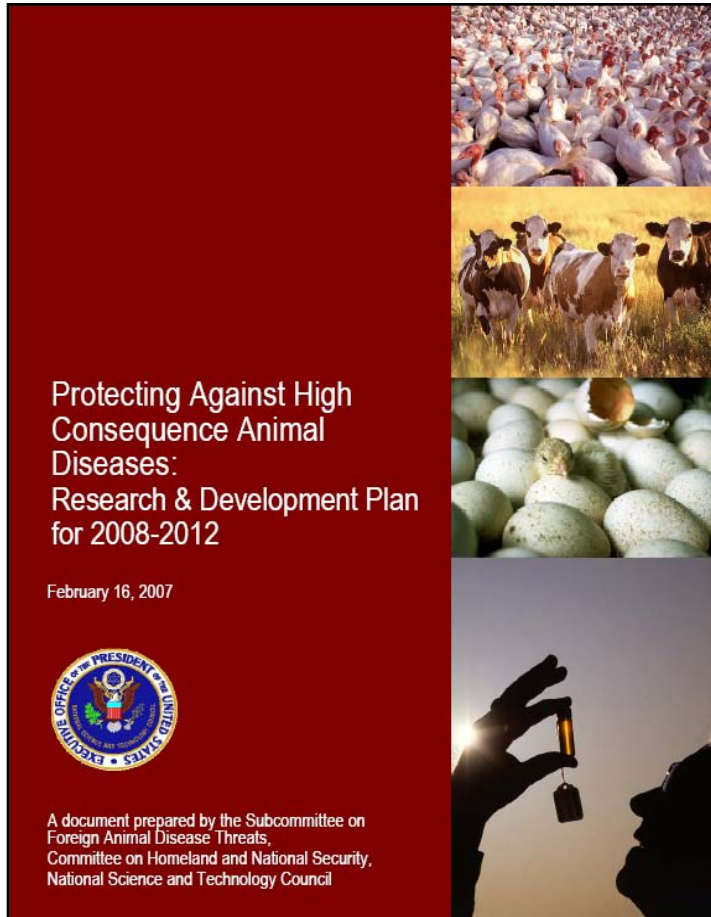
STATE PARTNERS

CENTERS OF
EXCELLENCENATIONAL CENTER FOR
FOOD PROTECTION AND DEFENSE
A HOMELAND SECURITY CENTER OF EXCELLENCE



FADT Subcommittee

Program Areas



FADT Subcommittee Program Elements

1. Modeling
 - Intervention strategies;
 - Countermeasure requirements
2. Veterinary Countermeasures
 - Vaccines & immunomodulators;
 - Diagnostics
3. Decontamination and Disposal
 - Agent fate & transport data;
 - Disposal technologies
4. Basic Research
 - Host-pathogen interactions;
 - How a pathogen exists in nature and in wildlife reservoirs

FAZD Center themes align with national requirements and priorities

Key Documents	Vaccines & Immunomodulators	Diagnostics & Detection Systems	Modeling & Related Analysis
National Science and Technology Council – Subcommittee on Foreign Animal Disease Threats	Veterinary Countermeasures • Vaccines, • Immunomodulators Basic Research • Host-pathogen interactions, • Pathogens in nature and wildlife	Veterinary Countermeasures • Diagnostics	Modeling • Intervention strategies and countermeasures
Homeland Security Presidential Directive 9 – Defense of U.S. Agriculture and Food	Mitigation Strategies	Awareness and Warning	Vulnerability Assessments Response Planning and Recovery
S&T Directorate High Priority Science and Technology Needs, Chemical/Bio Defense	Detect and Mitigate Animal Disease Outbreaks Detection Paradigms for Emerging and Novel Biological Threats	Chem Bio Forensic Analysis Handheld Rapid Biological and Chemical Detection	Tools for Integrated CBRN Risk Assessment
Chemical and Biological Defense – Capstone Integrated Product Team (IPT)	Animal Disease Mitigation • Characterize current vaccines • New vaccines with DIVA • Increase speed of onset of immunity	Animal Disease Detection • Rapid detection of outbreaks • High throughput • Mitigation of food chain contamination	Policy, Risk, Consequence Assessments • Inform decisions on national infrastructure protection • Improved tools for risk assessment • FMD decision support software
FAZD Center Work Plan Years 4-5	Biological Systems • Vaccines for RVF and AI • Antiviral protection against FMD • Commercialization of RVF vaccine – MP-12	Biological Systems • Rapid detection field tests for FMD, avian influenza and Rift Valley fever	Information Analysis Systems • Dynamic Preparedness Simulator to support overall emergency response cycle • Integrated system to support threat assessment and evaluation of options

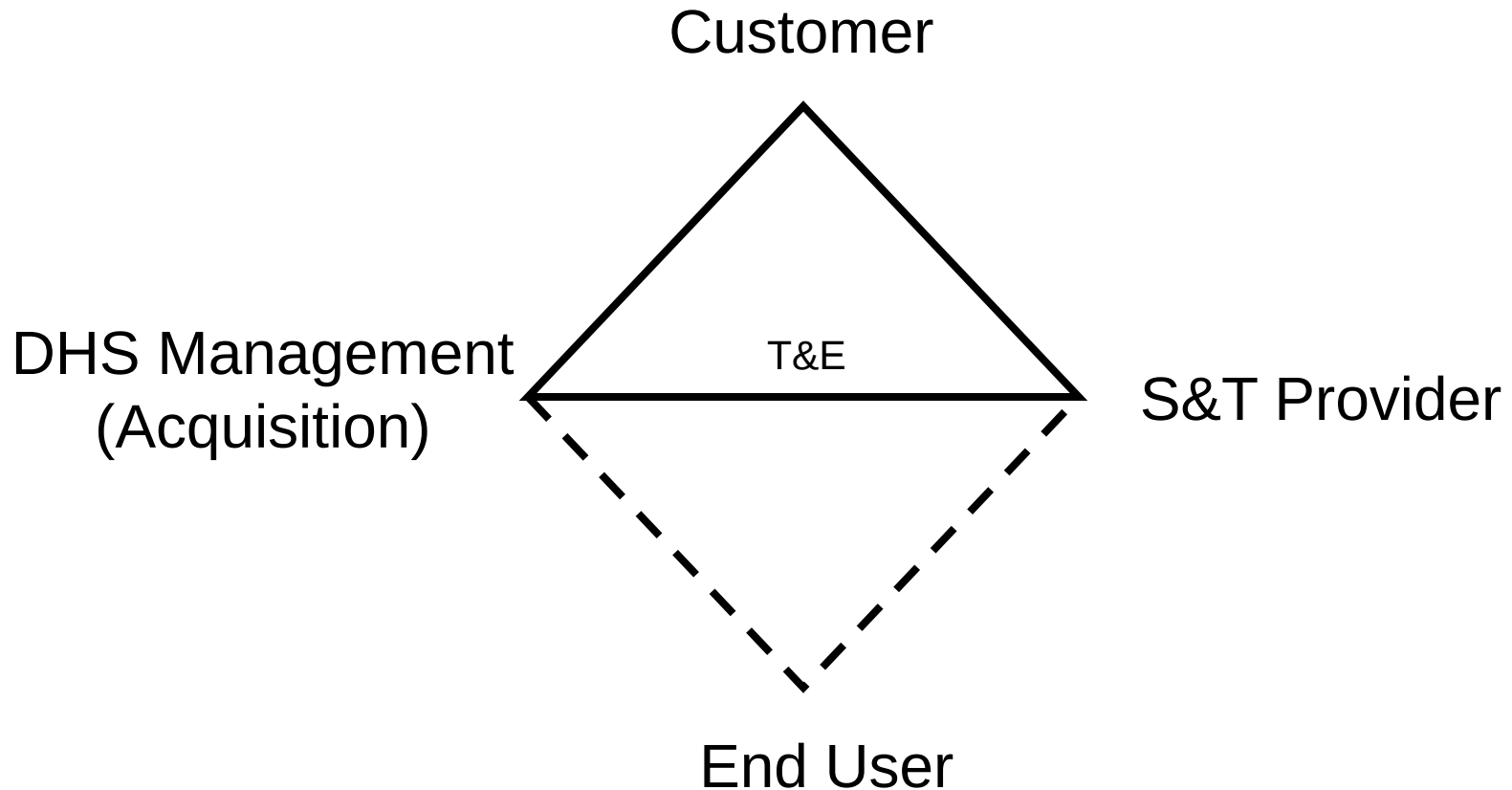


FAZD Center products are in alignment with Homeland Security Presidential Directive 9

Summary of research and education accomplishments is organized under roles and responsibilities defined in HSPD-9 — Defense of United States Food and Agriculture

Awareness and Warning • Integrated system to support threat assessment and evaluation of options • Interstate transportation model for cattle and swine (with NCFPD) • System to send state outbreak alerts to non-commercial owners of livestock/poultry • Risk assessment for FAZDs (with NCFPD)		Vulnerability Assessments • Criticality tools to enable states to identify critical food and agriculture system components • Assessment of impact of FMD outbreak in feedlots – Texas • National model of FMD and other diseases • RVF Epidemiologic and Economic Impact Assessment for NBACC
Mitigation Strategies (Prevention) • Vaccines for RVF and AI • Antiviral protection against FMD (with PIADC) • Commercialization of RVF Vaccine – MP-12 • Integrated platforms for unknown or attenuated disease agent characterization (agent characterization)	Response Planning and Recovery (Detection) • Dynamic Preparedness Simulator to support overall emergency response cycle • Rapid detection field tests for FMD, avian influenza and Rift Valley fever • Models and databases to assess consequences of prevention and intervention	Outreach & Professional Development • Avian influenza training for early responders • National FAZD curriculum for early responders with handbooks/online course • Awards and recognition for FAZD Center’s DHS Scholars and Fellows • Stakeholder workshops on mass animal mortality

HS Capability IPTs





Alignment of FAZD Products/Projects with DHS Chem/Bio IPT Representative Technology Needs

Chem/Bio requirements derived from Capstone Integrated Product Team:

- Co-chair: Office of Health Affairs – CMO Jeff Runge, M.D.
- Co-chair: Infrastructure Protection – Assistant Secretary Robert B. Stephan

Component Participation: CBP, I&A, PLCY, USCG, USSS

Outcome: Resource-constrained, prioritized list of proposed programs (FY09-FY13)

Technology Needs

- **Animal Disease Detection and Mitigation**
- **Detection Paradigms and Systems**
- **Improved ChemBio Forensic Analysis**
- **Infrastructure Protection IPT**

Animal Disease Detection and Mitigation

Technology Shortfall

- Multiple vaccines required to protect animals against different serotypes
- Current vaccines use the “one bug, one drug” approach and assays can not distinguish infected animals from vaccinated ones
- Current vaccines have adverse trade implications

Future Anticipated Deployments

- Characterization of the effectiveness of current vaccines
- New vaccines that can speed the onset of immunity and distinguish infected from vaccinated animals (DIVA)
- FMD outbreak decision support software
- High-throughput assays for detection of high consequence animal diseases

Cross-functional Values of Technology

- Primary Customers – OHA, IP
- Technologies anticipated from this effort will have direct benefit to:
HSC, USDA, DOI
Federal, state and local decision makers

Relevant FAZD Projects / Products

- Next generation vaccines with DIVA properties and associated diagnostics for RVF, AI
- Immunomodulatory / antiviral vaccine technology to shorten time from immunization to immunity and prevent disease transmission
- Decision support and training systems for animal disease outbreaks, disease specific epidemiologic and economic models (FMD, RVF, AI)
- Science based modern diagnostics including high-throughput, surge capacity robotic assays (FMD)

Broad Representative Technology Needs

- Policy net assessments to provide fresh perspectives on fundamental elements of the national biodefense strategy
- Improved tools for integrated CBRN risk assessment
- Consequence assessment of attacks on chemical facilities and ChemBio attacks on other critical infrastructure
- Detection paradigms and systems for enhanced, emerging and novel biological threats
- Tools to detect and mitigate animal disease breakouts
- Handheld rapid biological and chemical detection systems
- Integrated CBRNE Sensor reporting capability
- Incident characterization capability for response and restoration
- Improved ChemBio Forensic Analysis capability
- National-scale detection architectures and strategies to address outdoor, indoor (e.g., highly trafficked transportation hubs) and critical infrastructure

FAZD Alignment with Representative Technology Needs of other IPTs

Border Security:

Improve detection, tracking, and identification of all threats along the terrestrial and maritime border (Borders/Maritime Division)

Cargo Security:

Detect and identify WMD materials and contraband (Borders/Maritime Division)

Incident Management:

Integrated modeling, mapping and simulation capability (IP/Geophysical Division)

Logistics management tools (IP/Geophysical Division)

Infrastructure Protection:

Analytical tools to quantify interdependencies and cascading consequences as disruptions occur across critical infrastructure sectors (IP/Geophysical Division)

Advanced, automated and affordable monitoring and surveillance technologies (C2I Division)

Evolution of Priorities

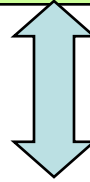
- Key documents

- o Subcommittee on Foreign Animal Disease Threats
- o HSPD-9
- o DHS S&T Directorate High Priority Science and Technology Needs
- o Chemical and Biological Defense, DHS S&T
- o CBD Division Year 5 Deliverables
- o The FAZD Center Work Plan, Years 4-5

- Transcending priorities across these documents
 - o Modeling for intervention strategies and countermeasures
 - o Development of vaccines and immunomodulators
 - o Development of diagnostic/detection systems for FAD
 - o Outreach and professional development

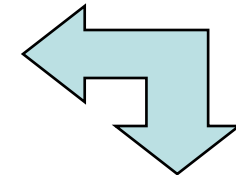
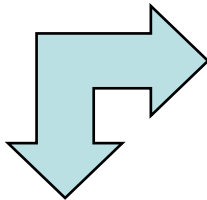
Private Sector

- Livestock Commodity
- Biologics Manufacture
- Related Food Producers.



FAZD CENTER

NATIONAL CENTER FOR FOREIGN ANIMAL
AND ZOO NOTIC DISEASE DEFENSE



Chem-Bio Division
DHS
Science and Technology
Directorate

DHS

- S&T
- OHA
- FASCC/GCC
- Intell Office
- Human Factors
- Other S&T Divisions

USDA

- USDA Office of Homeland Security
- Research, Education, Extension, Economics, Markets and Regulatory (APHIS)

HHS

- CDC
- NIH
- FDA



Biological Systems BioSys

Foot & Mouth Disease



Peter Mason
Mark Estes
Tilahun Yilma
Jim Womack

Avian Influenza



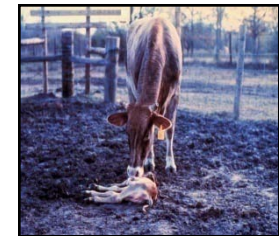
Carol Cardona
Blanca Lupiani
Sanjay Reddy

Rift Valley Fever

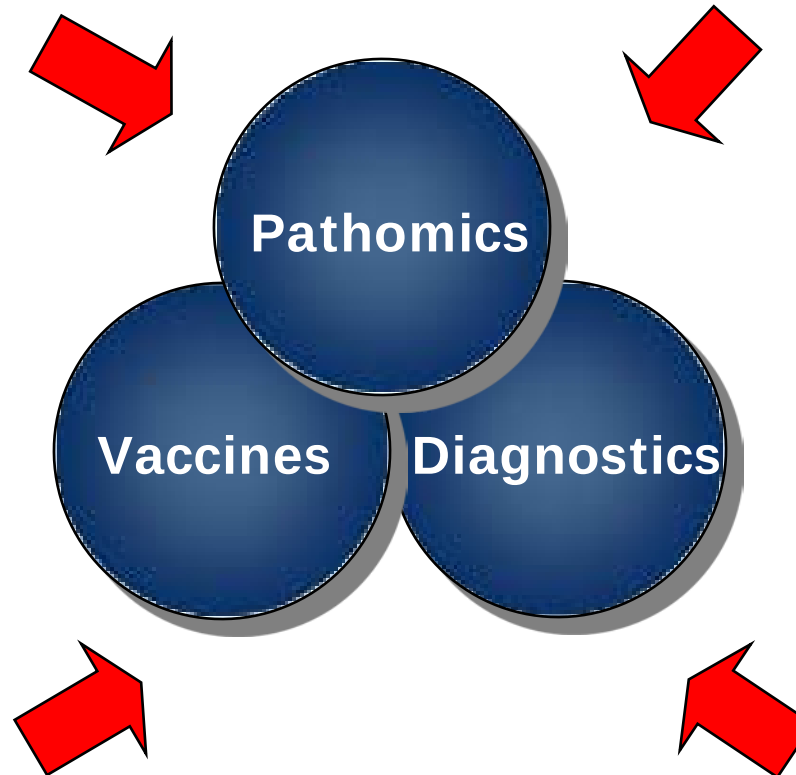


C.J. Peters
Tilahun Yilma
Jim Womack

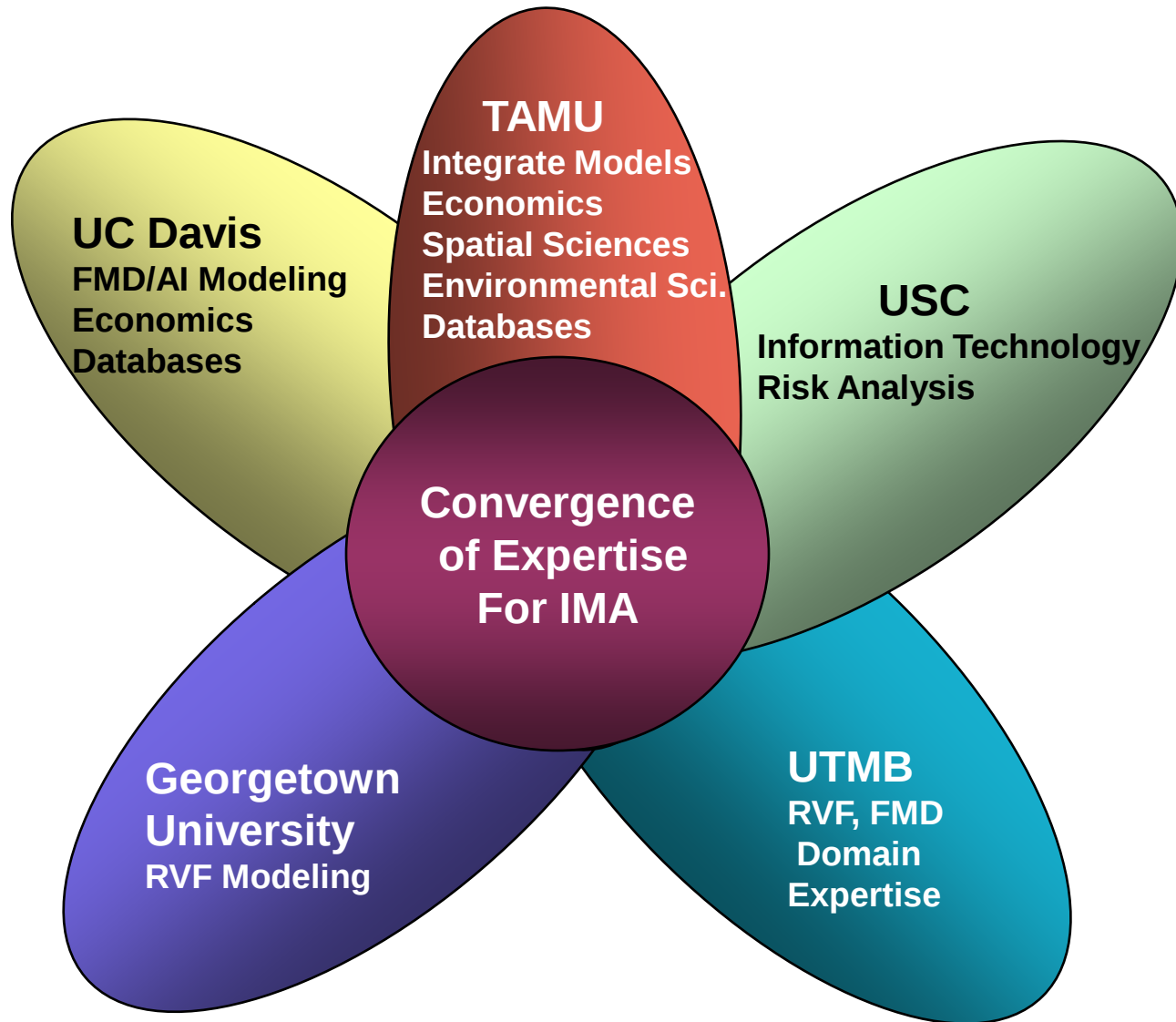
Pathomics Platform



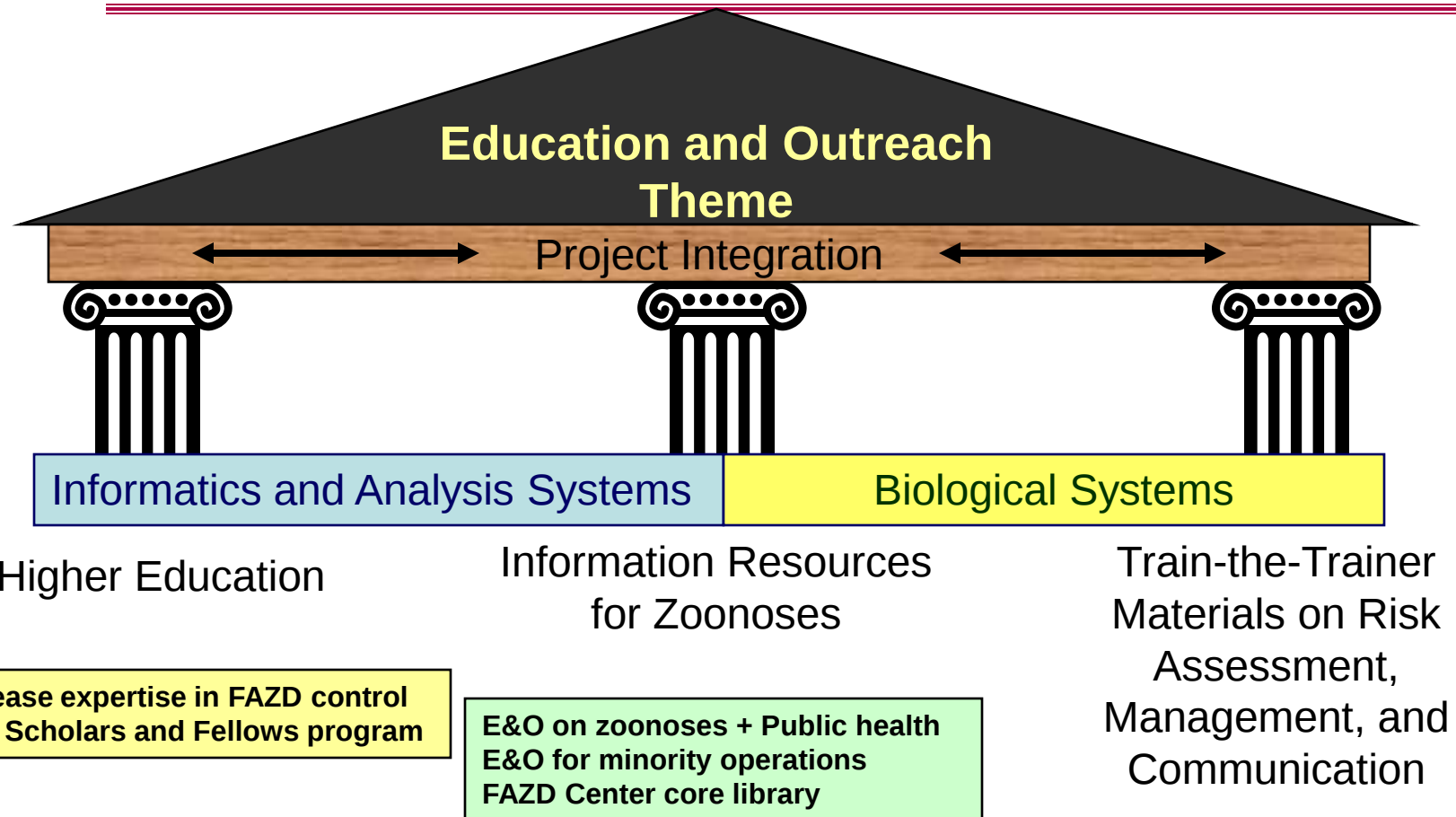
Skip Warner
Garry Adams
Mary Lipton



Information Analysis Systems **IAS**



Structure of Education-Outreach Theme



FAZD CENTER VACCINE DEVELOPMENT

FAZD CENTER

NATIONAL CENTER FOR FOREIGN ANIMAL

To Security

State/ Federal Regulatory Agencies – Animal Owners

Production and Stockpile
Industry & Government

Validation

USDA – FDA, CDC
Regulatory Agencies

Field Testing Demo Efficacy

Industrial
Partner,
Biopharma

Manufacturing Methods, GLP

Laboratory Demonstration

High level
Containment Labs
Including PIADC

Discovery of biological
Reagents or new approaches

National Lab &
Other Collaborators

Avian influenza
Rift Valley Fever
Brucellosis

9

8

7

6

5

4

3

2

1

TRL

From Science

Customers and Products

Customer	Product
Food and Agriculture Industries	Protection, planning, education, response
Policy/Decision Makers	Quantitative decision tools at multiple levels
DHS- OHA	Vaccines, diagnostics, models, UK –FMD lessons learned
DHS – IP	Threat and vulnerability assessments NIPP, criticality criteria
DHS – NBACC	Threat assessment
DHS - CBP	Surveillance and detection for FAZD
APHIS	Databases, models, decision support system support and consequence management
CDC	Zoonoses- vulnerability assessment and consequence management
Intelligence Community	Assessments, requirements, analysis
Economic Research Service	Databases and GIS based animal transportation models
NBACC	Economic Impact Assessment – Rift Valley Fever, analysis methods
State Emergency Planning and Response	Engagement at state levels in California and Texas – models for other states

FAZD CENTER

NATIONAL CENTER FOR FOREIGN ANIMAL
AND ZOONOTIC DISEASE DEFENSE



Detection Paradigms and Systems

Technology Shortfall

- Highly sensitive, highly specific and robust detectors with the ability to characterize agents for clinical intervention
- Reliable discrimination against background
- Event reconstruction

Cross-functional Values of Technology

- Primary Customers – OHA, IP
- Technologies anticipated from this effort will have direct benefit to:
HHS, CDC, EPA, DoD, USDA, FBI, USPS, USSS
Federal, state and local decision makers

Future Anticipated Deployments

- Fully autonomous detection systems
- Detection system to detect and identify agents in minutes, not hours
- Food monitoring systems compatible with industry practices
- Ultra-high sensitivity, ultra-low false response assays
- Portable surface contamination monitor
- Handheld technologies

Relevant FAZD Projects / Products

- Rapid, accurate and inexpensive field diagnostics for Rift Valley Fever (RVF)
- High-throughput, surge capacity, robotic assays for Foot and Mouth Disease (FMD)
- Rapid and accurate chute-side field tests for FMD
- Multiplex fluorescent microsphere diagnostics for Avian Influenza (AI)
- Rapid and accurate pen-side assays for AI
- Integrated/universal biosignature array platforms

Improved ChemBio Forensic Analysis

Technology Shortfall

- Validated forensic assays for top agents
- Highly efficient extraction methodologies
- Characterization of sampling matrix interferences and contaminants

Future Anticipated Deployments

- NBFAC fully operational as ISO 17025 certified bioforensics analysis laboratory
- Validated forensics assays for top Chem, Bio, and animal disease threats
- Fully operational National Bioforensics Repository Collection for strain comparison
- Research strategy for addressing chemical and biological forensics implications

Cross-functional Values of Technology

- Primary Customers – OHA
- Technologies anticipated from this effort will have direct benefit to:
FBI, I&A, USPS, USSS
Intelligence community
Other Federal, state and local law enforcement

Relevant FAZD Projects / Products

- Science-based diagnostic technologies for RVF, FMD and AI as mentioned
- Integrated sequence-dependent biosignature array platforms and associated biosignature archives
- Universal sequence-independent array platform technology and associated biosignature archives
- Host response biomarker profiling for specific pathogens (e.g., AI in poultry) - Pathomics

Infrastructure Protection IPT

Analytical Tools to Quantify Interdependencies and Cascading Consequences as Disruptions Occur Across Critical Infrastructure Sectors

FAZD CENTER

NATIONAL CENTER FOR FOREIGN ANIMAL
AND ZOONOTIC DISEASE DEFENSE

Technology Shortfall

- Integrated risk modeling in protection planning and decision support systems
- Prioritized protection of Critical Infrastructures and Key Resources (CI/KR)
- Risk informed policy and investment strategy development

Future Anticipated Deployments

- Real-time decision support technologies that integrate dynamic updates from sensor networks and databases

Cross-functional Values of Technology

- Primary Customer – DHS, Office of Infrastructure Protection
- Technologies anticipated from this effort will have direct benefit to:
 - CI/KR owner operators
 - Sector Specific Agencies (SSAs)
 - Sector Coordinating Councils (SSCs)
 - Government Coordinating Councils (GCCs)

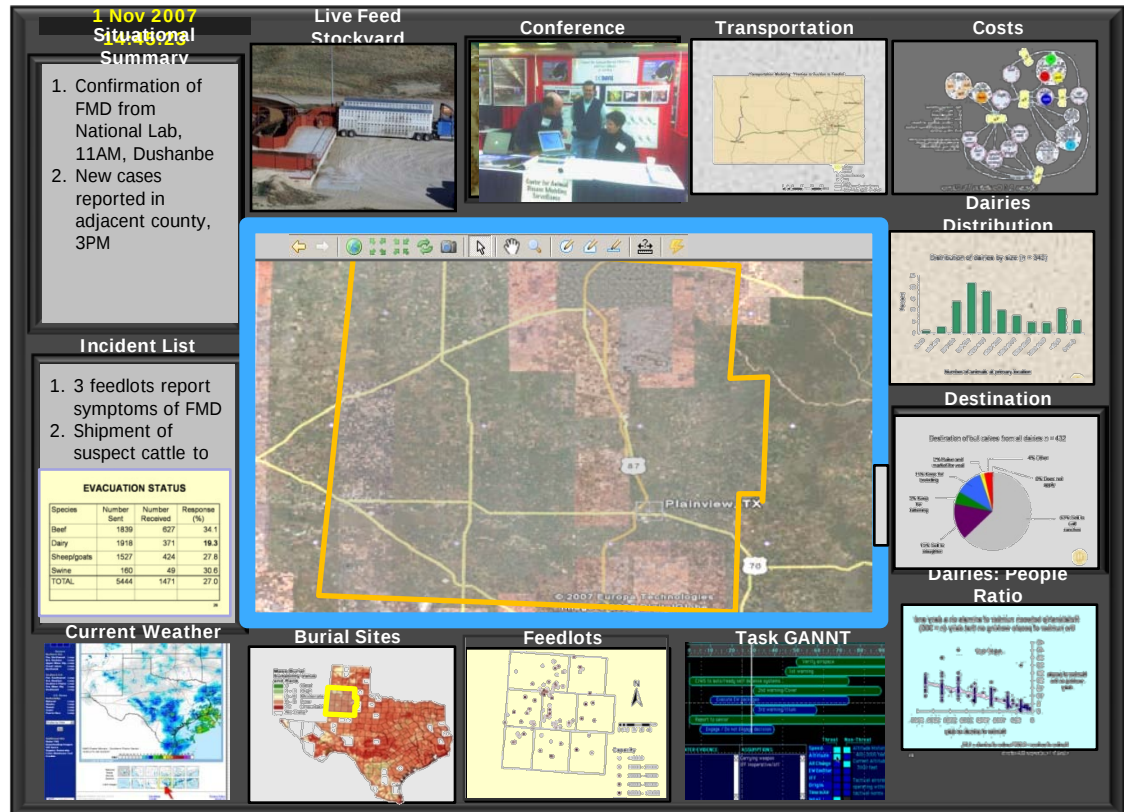
Relevant FAZD Projects / Products

- Decision support and training systems for animal disease outbreaks
- Disease specific epidemiologic, economic and transportation models and associated databases (e.g. FMD, RVF, AI)

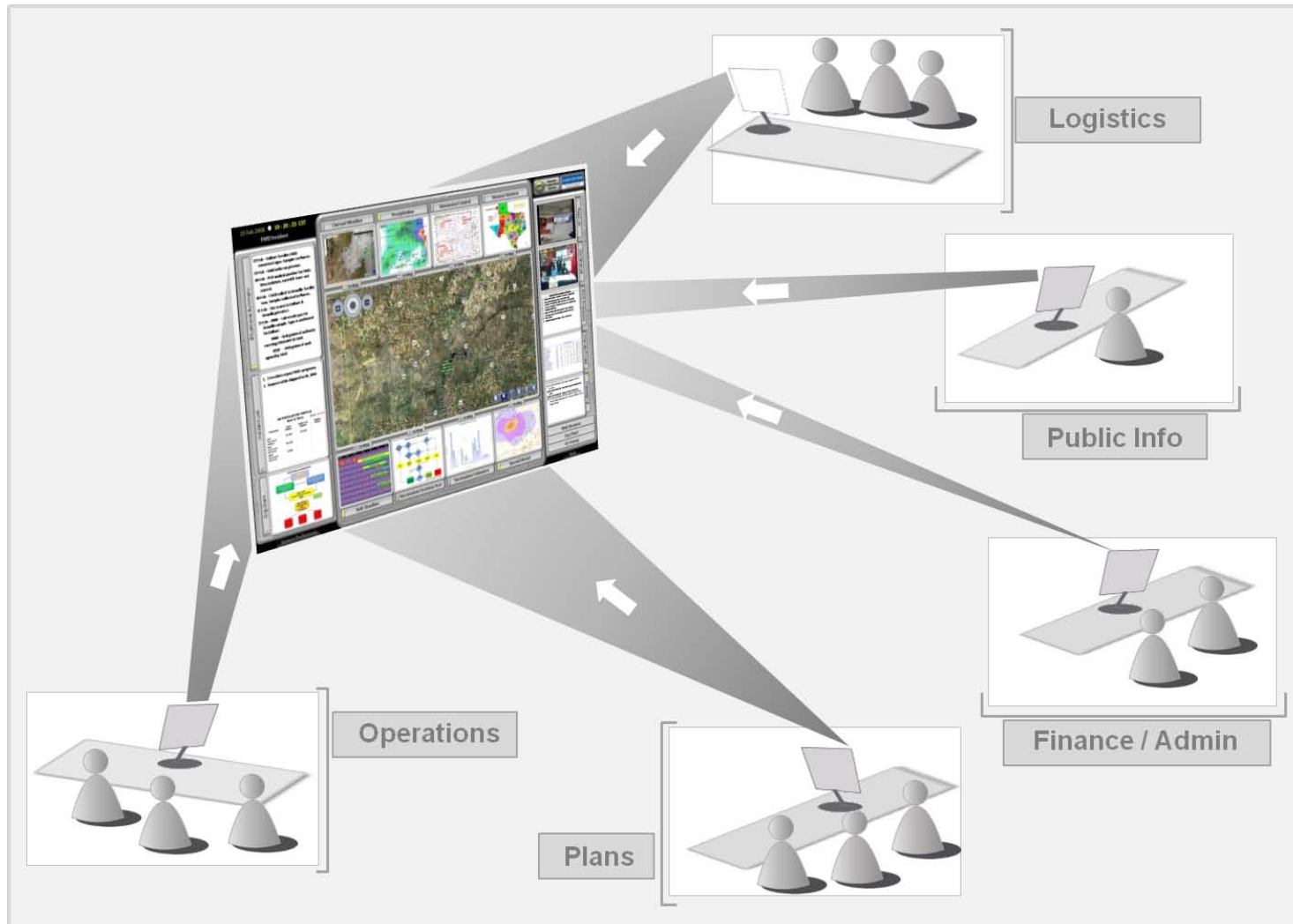
Model-driven Training and Vulnerability Assessments

Develop second prototype of Dynamic Preparedness System (DPS)

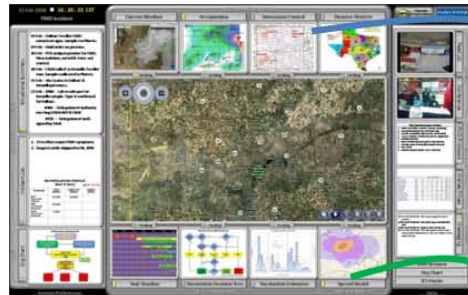
- FMD incursion training and event response
- Emergency management personnel at the multi-county level
- Based on feedback from stakeholders



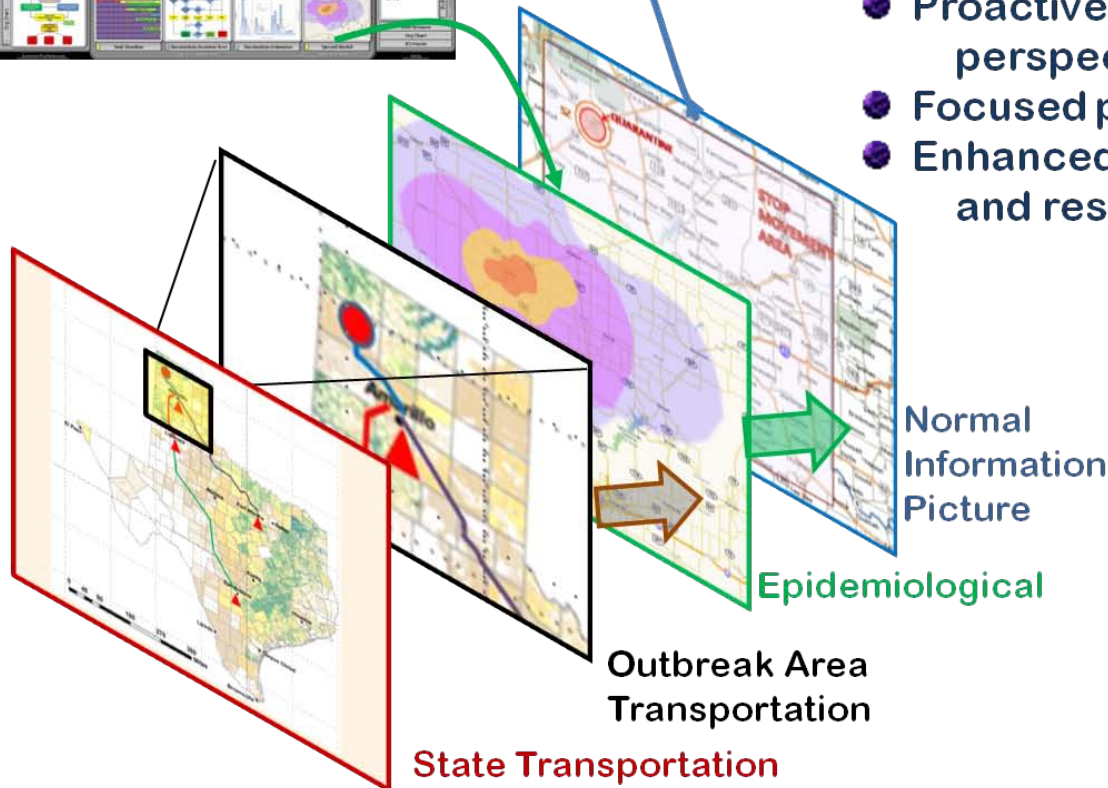
A Common Integrated Display



Model Integration – An Incident Response Multiplier



- Broaden use of the models
- “Push Down” distribution to responders
- Proactive operational perspective
- Focused planning parameters
- Enhanced economies of effort and resource allocation



FAZD Center Milestones FY07-10

Goals	Rapid and accurate detection and diagnosis of threat agents	Vaccines, antiviral agents, resistance against threat diseases	Decision systems to assess consequences of options to prevent/curtail disease	Education; Planning and training tools for private sector stakeholders
Outcomes FY 07	Laboratory validation of diagnostic tests for FMD, RVF, and AI	Immunogenicity tests of RVF and AI vaccines using lab animals Live-agent challenge tests at PIADC of antiviral agents for FMD	Prototype integrated Decision Support System National market and transportation model integrated into MESA Scenario and consequence models for 2d Bio-Threat Risk Assessment	National and international information/training modules for AI fielded
FY 08	Prototype chute-side test for FMD and pen-side test for AI	Live agent challenge tests of prototype DIVA vaccines for RVF, AI and brucellosis.	Risk reduction tool for enterprise/sub-sectors, and dynamic planning/ training simulator for regional/national planning-intervention Refine market/transportation and bio-threat risk assessment	Dynamic planning and training simulators for FAZD available to decision makers
FY 09	Prototype detection systems for new priority agents Host-pathogen markers for earlier detection of infection	RVF, AI vaccines validated and available for production	Second generation scenario & consequence models for developed and used for 3rd Bio-Threat Risk Assessment.	Web based training and education modules deployed into national network
FY 10	Rapid multi-agent field tests for exotic animal disease Prototype host-pathogens markers for field testing	Enhanced resistance to classes of exotic disease – host-pathogen-environmental relationships –molecular genetics approach	Expand decision systems to other livestock species and human-animal interface scenarios	Second generation information and training modules for priority human-animal diseases

FAZD CENTER

NATIONAL CENTER FOR FOREIGN ANIMAL
AND ZOONOTIC DISEASE DEFENSE