

# DHS SCIENCE AND TECHNOLOGY

## Flood APEX Program Overview

**Sept 7, 2017**

**National Geospatial Advisory Committee Meeting**



**Homeland  
Security**

Science and Technology

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Chief Geospatial Scientist

First Responders Group

Science and Technology Directorate

# Flood APEX Program Charter

- The Department of Homeland Security's Flood Apex Program was created at the request of the Administrator of the Federal Emergency Management Agency (FEMA) to bring together new and emerging technologies designed to increase communities' resilience to flood disasters and provide flood predictive analytic tools to FEMA, state and local governments, and other stakeholders.
- Program Sponsors
  - Federal Emergency Management Agency
    - Roy Wright, Assistant Administrator, Flood Insurance & Mitigation Agency
    - Ted Okada, Chief Technology Officer, Federal Emergency Management Agency
  - Department of Homeland Security Science and Technology Directorate
    - Dan Cotter, Director, First Responders Group

# U.S. FLOOD RISK TODAY

Floods are the **#1 Natural Disaster** in the U.S.

Flash Flooding Causes the Most Weather-Related Fatalities **200 Lives per year — More than Tornadoes**

About 9 Million People Live in Flood Hazard Areas, 50% are Uninsured or Under-Insured

More than **500,000 Bridges** in the U.S. Cross Water. **9% are Structurally** Deficient and Subject to Increased Flood Damage

Flood Damages Average **\$7.9 Billion Annually**, Rising Almost **2% per year**

On average, nearly 6,000 people are killed and over 445,000 people are injured in weather-related crashes each year. Approximately 22% annual crashes - nearly 1,259,000 - are weather-related. The vast majority of most weather-related crashes happen on wet pavement and during rainfall: 73% on wet pavement and 46% during rainfall.

All **50 States** have Experienced Floods or Flash Floods **in the Past 5 Years**

Other Types of Floods Claim **80 Lives per year — 50% Vehicle-Related**

More than 53% of U.S. Voters have been Personally Impacted by Floods

**More than 27,000 U.S. Dams** are “high-hazard” (dam failure would cause deaths or serious economic loss) . **>14% of these are “deficient” and in need of repairs**

More than **20% of Flood Claims** are for Properties **Outside of known High-Risk Flood Areas**

# Scope of the Problem

## Visionary Goal

### Key Challenges

1. **AVOIDABLE FATALITIES:**
2. **UNINSURED LOSSES**
3. **INADEQUATE MITIGATION INVESTMENTS**
4. **INSUFFICIENT COMMUNITY RESILIENCE**
5. **BLOCKED ACCESS TO NEEDED INFORMATION**
6. **OUTDATED ANALYTICS**

### —S&T Visionary Goal— Resilient Communities: Disaster-Proofing Society

Critical Infrastructure of the future will be designed, built and maintained to withstand naturally occurring and man-made disasters. Decision makers will know when a disaster is coming, anticipate the effect and use already-in-place or rapidly deployed countermeasures to shield communities from negative consequences. Resilient communities struck by disasters will not only bounce back, but bounce forward.

# Research & Development Tracks

## 1. NEW FLOOD SENSORS & ALERTING FOR THE INTERNET OF THINGS:

Small Business Innovation Research (SBIR) for low cost, rising water sensors  
Smart alerts testbed for Geo-targeted alerts and rules engine  
Storm water management innovation  
Flood Response testbed

## 2. SMARTER REMOTE SENSING AND SITUATIONAL AWARENESS:

Dam safety and monitoring integrating RS, UAS and smart sensor technologies  
CRADA on civil use of UAS with Property Drone Consortium (PDC)  
Rapid monitoring and detection using small sats pilot  
Core Information Requirements project for first responders  
Longitudinal analysis of flood inundation and landuse change using LandSAT

## 3. HIGH PERFORMANCE COMPUTING/ARTIFICIAL INTELLIGENCE

- Deep learning and artificial intelligence for rapid, wide area detection and extraction of building outlines
- Next generation flood modeling and analytics
- National Water Center Summer institute partnership with NWS, etc.

# Research & Development Tracks

## 3. REALIGNED ECONOMIC INCENTIVES & RISK ANALYSIS:

- Flood proofing standards and innovation
- Hazus Tsunami module
- Hurrevac-X evacuation software
- Hurricane Floyd-Matthew study
- Commercial Flood Insurance market study
- Reimaging flood risk and ratings
- State of GeoINT for Community Resiliency
- Resilient America partnership with National Academy of Sciences
- flood risk and resilience operating procedures
- Review of existing practice and research; “Landscape Study” (RAND)
- National Natural Hazards Vulnerability and Community Resilience Indices
  - Analysis of flood risk indicators and metrics
  - FEMA Regional extracts of social vulnerability indices (SoVI)
- FEMA MDWG and the FEMA Response Geospatial Group support
- National Geospatial Preparedness Summit partnership with NAPSG, etc.
- National Conversation on Flood Disasters: series of roundtables
- International Coordination with NATO, CANADA, etc.

# Stakeholder Engagements & Partnerships

- **FEMA:** Sponsor of the Flood Apex
- **National Weather Service:** National Water Model and National Water Center (NWC) initiative, Partnership to reduce flood fatalities and improve flood warnings, Coordination NWC with partners including the United States Geological Survey, the U.S. Army Corps of Engineers and FEMA
- **NOAA Office of Coastal Management:** Partnership with NOAA Coastal Services Center on understanding future conditions related to sea level rise and coordination on practitioner tools.
- **National Academy of Sciences (NAS):** Collaboration with the Resilient America Roundtable community pilots and Urban/Flashing flooding research with FEMA
- **Greater New Orleans:** Partnership Intermediary Agreement to perform research on flood resiliency issues
- **Flood Apex Research Review Board:** Provide recommendations and subject matter expert insights in partnership with UNC & Jacksonville State through S&T University programs
- **Association of State Floodplain Managers:** Provide focal point for collaboration with state floodplain managers
- **National Dam Safety Program:** Collaboration on risk perception and warning systems
- **National Alliance of Public Safety GIS Professionals;** First responder collaboration on use of spatial analytics to reduce flood fatalities and damages
- **National Emergency Management Association:** Collaboration on community resilience and information requirements
- **Central United States Earthquake Consortium:** Decision support analytics and regional information sharing / interoperability
- **First Responder Network Authority:** Collaboration on joint efforts to support next generation technology and information requirements
- **Housing and Urban Development:** Flood Disaster Resilience Grant Programs
- **Rockefeller Foundation:** Chief Resiliency Officers
- **Zurich Insurance:** Resilience indicators and metrics
- **Resource for the Future: Economics of** disaster insurance and financing.
- **Commonwealth of Kentucky:** Post Disaster Mitigation grant decision support tools
- **Commonwealth of Virginia:** Partnership to explore causes and solutions for lack of insurance coverage
- **National Institute for Hometown Security:** Private sector – government information sharing
- **Private Sector (ongoing):** Long Range Broad Agency Announcement / Broad Agency Announcement and Small Business Innovation Research Act Awardees; Realtors, bankers, insurance, builders and renters trade associations; Technology transition partnerships

# Research Review Board Members

Greg Baecher

Doug Bellomo

Chad Berginnis

Sam Brody

Dave Canaan

Stephen Cauffman

Jeffrey Czajkowski

Joshua Dozor

Joseph Fiksel

Sandra Knight  
(Chair)

Terry Lunn

Scott McAfee

John Pine

David Maidment

Maria Honeycutt

Mary Mullusky/Ernie Wells

Gavin Smith

Tom Richardson

Paul Huang

University of Maryland

U.S. Army Corps of Engineers

Association of State Flood Plain Managers (ASFPM)

Texas A&M University at Galveston

Charlotte Mecklenburg Storm Water Services

National Institute of Standards and Technology (NIST)

Wharton Risk Management and Decision Processes Center

Federal Emergency Management Agency (FEMA)

Ohio State University

WaterWonks LLC

Georgia Emergency Management Agency/Homeland Security  
(GEMA/HS)

Federal Emergency Management Agency (FEMA)

Appalachian State University

University of Texas-Austin

NOAA

NWS

University of North Carolina

Jacksonville State University

FEMA\FIMA



## Flood Apex – Rethinking America's costliest disaster