

Flood Risk Management RD&T

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Coastal and Hydraulics Laboratory

July 22, 2014



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US Army Corps of Engineers
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Get Involved in R&D!

<http://operations.usace.army.mil/flood.cfm>

Operations & Regulatory: Flood Risk Management Gateway

operations.usace.army.mil/flood.cfm

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Flood Risk Management Gateway

US Army Corps of Engineers

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 - Hydropower
 - Inland Navigation Infrastructure
 - Natural Resources Management
 - Navigation
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 - Regulatory
 - Safety
 - Civil Works Environment

Business Processes

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Flood Risk Management Notes

Welcome to the Flood Risk Management Business Line

Formerly Flood & Coastal Storm Damage Reduction Business Line

- **FRM R&D Statements of Need**

Quick Links

- Civil Works Engineering and Construction
- Corps Guidance on Flood Control
- Flood Damage Reduction PCX
- Flood Risk Management - Planning CoP
- FY06 Civil Works Watershed Assessments
- Glossary of terms
- Hurricane and Coastal Storm PCX
- National Flood Proofing Committee
- National Flood Risk Management Program (NFRMP)

FRM Newsletter (Formerly FCSDR)

- About the FRM Newsletter
- 10 December 2013
- 4 November 2013
- 16 July 2013
- All FRM Issues
- Subscribe to FRM

Contacts

- Flood Risk Management SmartBook
- Field Office Directory

Display a menu for "http://operations.usace.army.mil/ideas/index.cfm?CoP=Flood"

R&D Statements of Need

<http://operations.usace.army.mil/flood.cfm>


Statements of Need

https://www.wes.army.mil/ops/ideas/son.cfm?CoP=Flood&Option=Submit&Step=2

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Operations & Regulatory: Statements of Need

Statements of Need

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US Army Corps of Engineers »

Statements of Need

Using the boxes below, you may submit needs and requirements for R&D. We want to know what you need to more effectively and efficiently address your organization's challenges. Based on your "need", we want to know the requirements for R&D that you think will satisfy that need either in part or in full. We understand that sometimes you will not have answers for all of the questions below, so please provide as much information as possible.

Title

Need that Drives Requirement
(We want to know what you need to more effectively or efficiently address your organization's challenges.)

Extent of Need Across USACE
(Identify other district offices or partners across the country that may have the same need.)

Requirement
(Identify the aspects of your stated need that R&D should address.)

Consequences if Requirement Not Met
(We want you to quantify the "consequences" when possible, otherwise qualitatively describe them. This information will be used to state the "value" to the Corps and the Nation of any research undertaken and to help prioritize needs.)

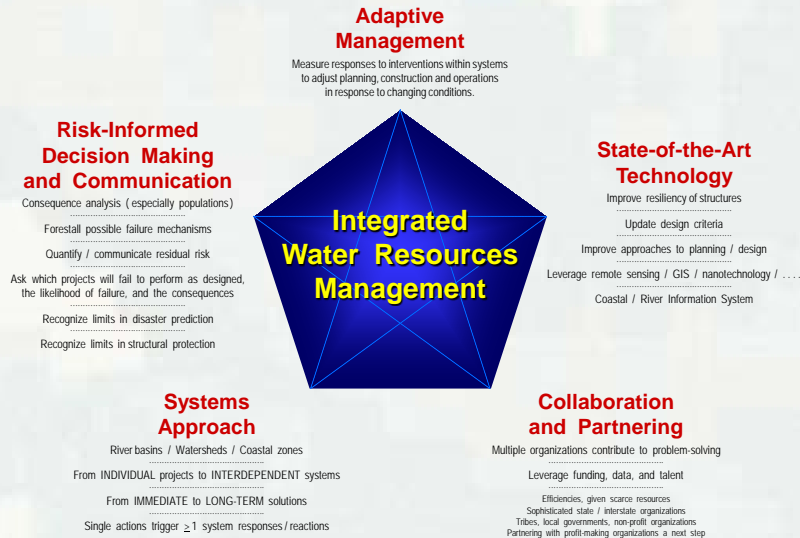
Product Recommendation
(If you have a good idea about what the product might be, let us know. When the R&D is finished, what is the best way to deliver the knowledge and capabilities to you?)

Originator

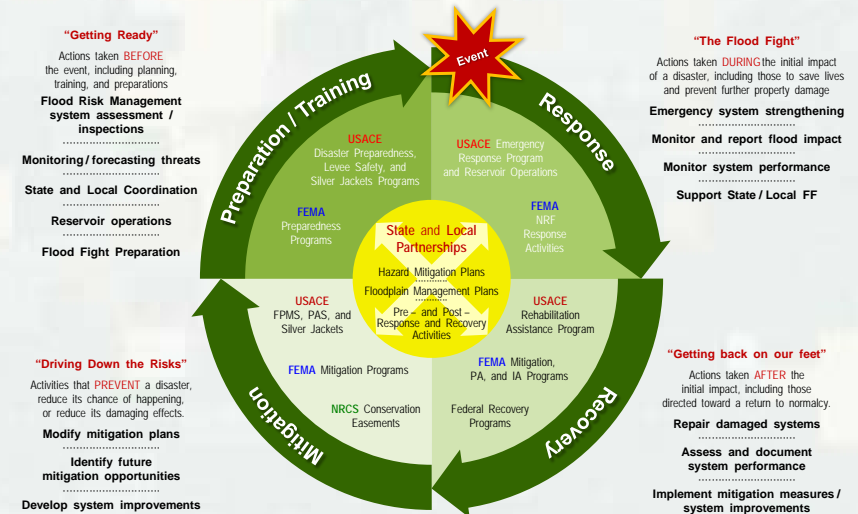
Display a menu

Flood Risk Management Doctrine

Overarching Approach

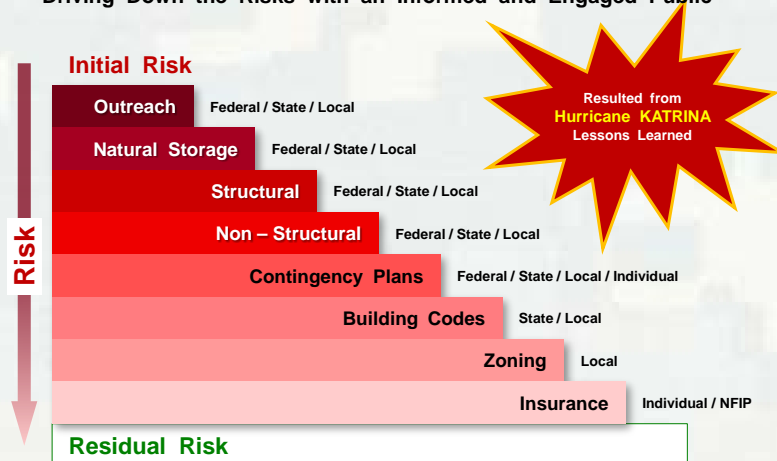


Life-Cycle Risk Management



Shared Disaster Risk Management

“Driving Down the Risks with an Informed and Engaged Public “



All Stakeholders contribute to reducing risk !

Risk-Informed Decisionmaking

RISK = expected value of an unwanted event which may or may not occur

$$\text{Consequences} \times \text{Vulnerability} \times \text{Threat}$$

(“Threat – Agnostic”) (Internal) (External)

A rigorous process of:

“Threat-Agnostic” Consequences Prioritization

“Threat-informed” Vulnerability Assessment

Probabilistic Prioritization of Investments

Consistent Analysis of Alternatives

Common Operating Picture

Systems / Portfolio “Mastery”

		Relative Risk Value Matrix (1-5 Matrix)				
		Overall Project Condition Classification				
Consequence Category	Condition	F (1)	D (2)	C (3)	B (4)	A (5)
	Consequence	Failed	Inadequate	Probably Inadequate	Probably Adequate	Adequate
1	High	1	1	2	2	3
2	Medium High	1	2	2	3	4
3	Medium	2	2	3	4	4
4	Low	2	3	4	4	5
5	Minimal	3	4	4	5	5

Value to the Nation

USACE Flood Risk Management

Operates 707 dams, 383 major lakes and reservoirs

- ▶ 376M visitors/yr, \$15B in economic activity, 500,000 jobs
- ▶ 24% US hydropower capacity, 3% of US electricity, \$500M in sales

25,000+ km of levees (some coastal)

100 coastal storm damage reduction and related projects including 650 km of shore protection

Water Supply from 153 projects for cities including Washington, DC

~12 Emergency responses per year

(Electricity, debris removal water/ice distribution, temporary roofing, flood fight...)



National Challenge: Flood-Prone Areas

- Development continues to increase
- Rapid growth in at-risk coastal areas
- Investments decreased by ~70% in real terms over past 3 decades.
- Over \$15 billion awaiting construction

Greenville, MS, Matfield



Bolivar Peninsula, TX

National Challenge: Aging Water Infrastructure

- Many infrastructure projects 50+ years old
- Investments in water resources infrastructure declining in real terms
- Result: more frequent closures for repairs, decreased performance & costly delays

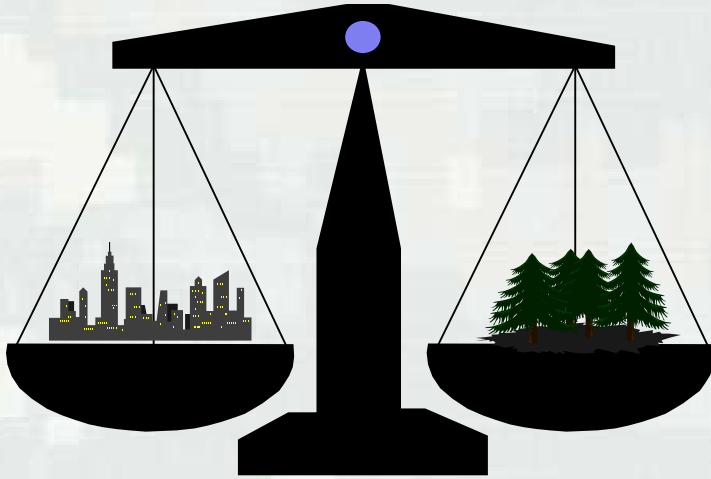


National Challenge: Asset Management & Infrastructure Recapitalization

- Deliver reliable infrastructure through use of risk-based assessments
- Risk-informed strategy applied to budget process
- Optimize use of limited resources across multiple business lines



National Challenge: Environmental Sustainability



- Balance between economic development, environmental stewardship
- Water quality threatened on 8% of nation's rivers and streams
- Corps has authority and programs for ecosystem restoration.



National Challenge: Integrated Water Resources Management

- Planning based on watershed/
regional approach
- Ecosystem restoration
- Environmental sustainability
- Interagency coordination
- Involve all stakeholders



Severe Weather –
Midwest
Mar 2012

Key 2011/2012 Responses

Japan EQ & Tsunami –
Mar 2011



FEST Deployments
Jan – Mar 2011 &
OEF/OND



Queensland, Australia
Flood - Jan 2011



Christchurch, New Zealand
Earthquake - Feb 2011



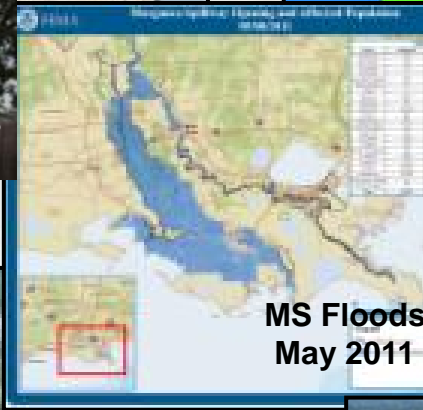
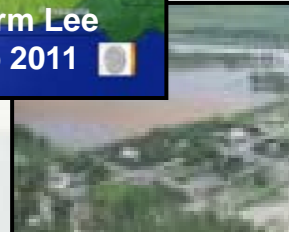
Northeast Snow Storm
Oct 2011



Derecho Storms
JUN-JUL 12



Tropical
Storm Lee
Sep 11

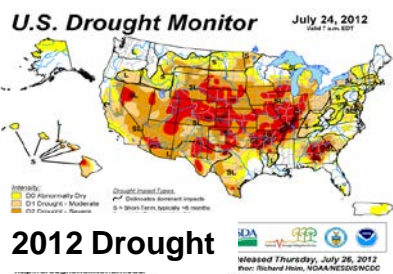


MS Floods
May 2011

Kootenai River Basin
2012

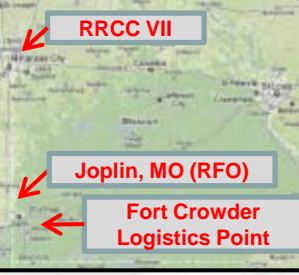


Hurricane
Irene
Aug 2011

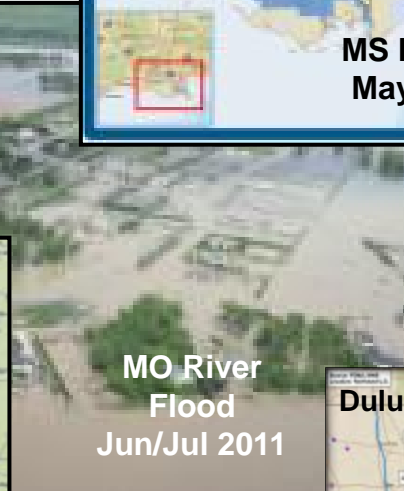


2012 Drought

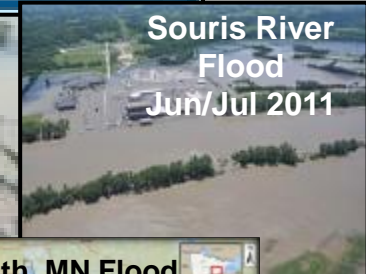
Joplin, MO
Tornado - June
2011



MO River
Flood
Jun/Jul 2011



Souris River
Flood
Jun/Jul 2011



Duluth, MN Flood



Pakistan Siachen
Glacier SME
Support
April 2012



Thailand Flood - Nov 2011



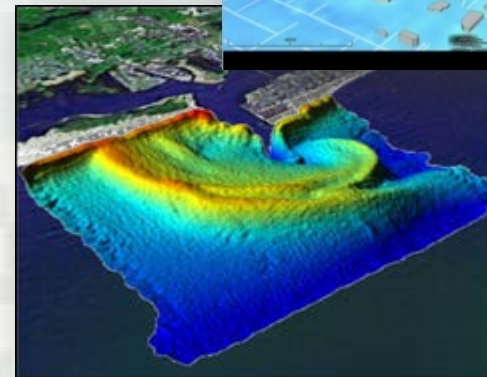
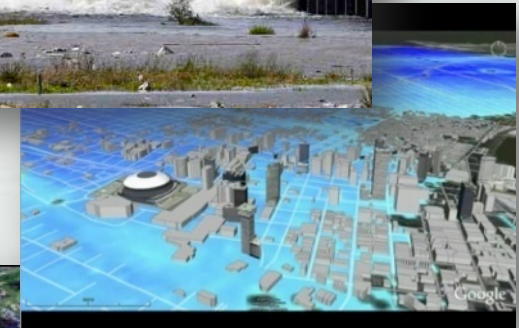
AL & MS Tornadoes
Apr 2011



FRM and R&D Nexus

Strategic Needs & Priorities

- Determine Risk & Uncertainty for Project Alternatives Evaluation & Performance
- Optimize Design & Management of Resilient Coastal & Estuarine Resources
- Assess Comprehensive & Multidisciplinary Management of Watersheds
- Improve Flood Risk Management & Water Control Infrastructure Resiliency & Reliability
- Enable effective disaster preparation, response & recovery
- *Engineering with nature to enhance ecosystem and processes, benefits and services*
- *Deliver sound engineering and scientific solutions that meet Planning Modernization guidelines*



Risk and Uncertainty Frameworks for Project Alternatives Analysis

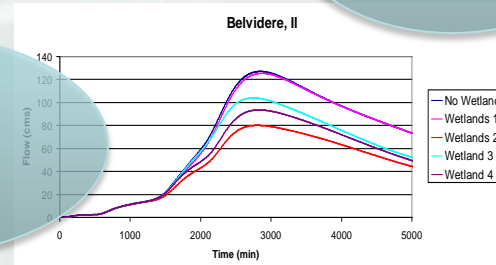
**HEC-
WAT/HEC-
FRA**

**HEC-
FIA**

**H&H
Models**

**CSTORM-
DB**

**Beach-
fx**



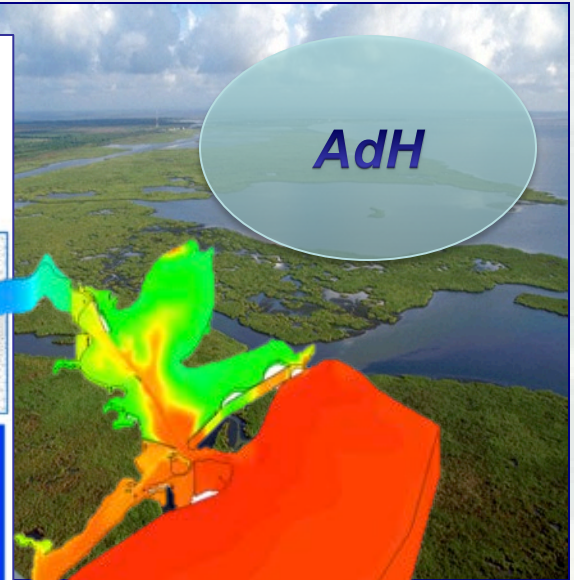
Improve Corps' planning, design and formulation capability through advanced software that integrates engineering computations with FRM analysis tools. Software is designed to enhance evaluation and comparison of project alternatives in a risk and uncertainty framework

Coastal Systems

CDIP

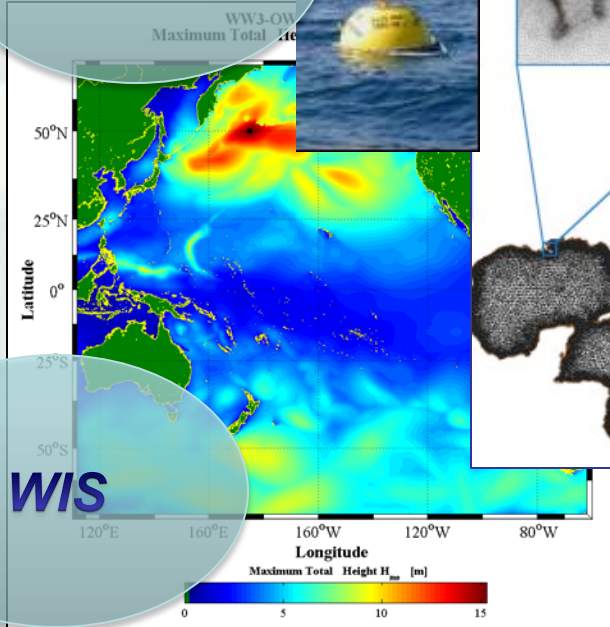
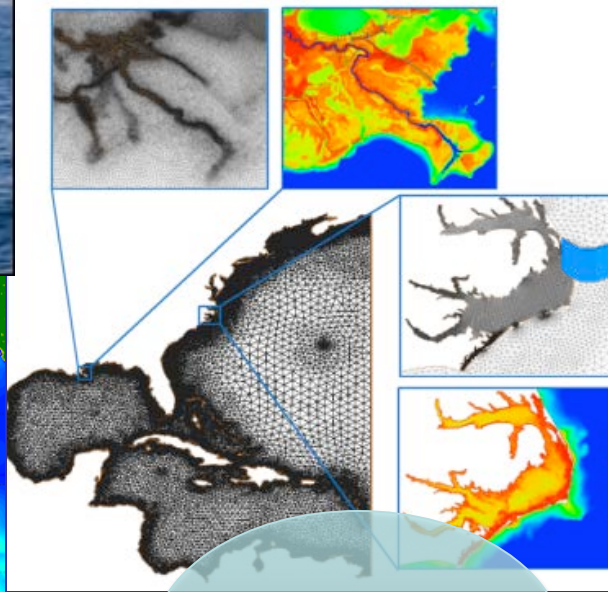


AdH



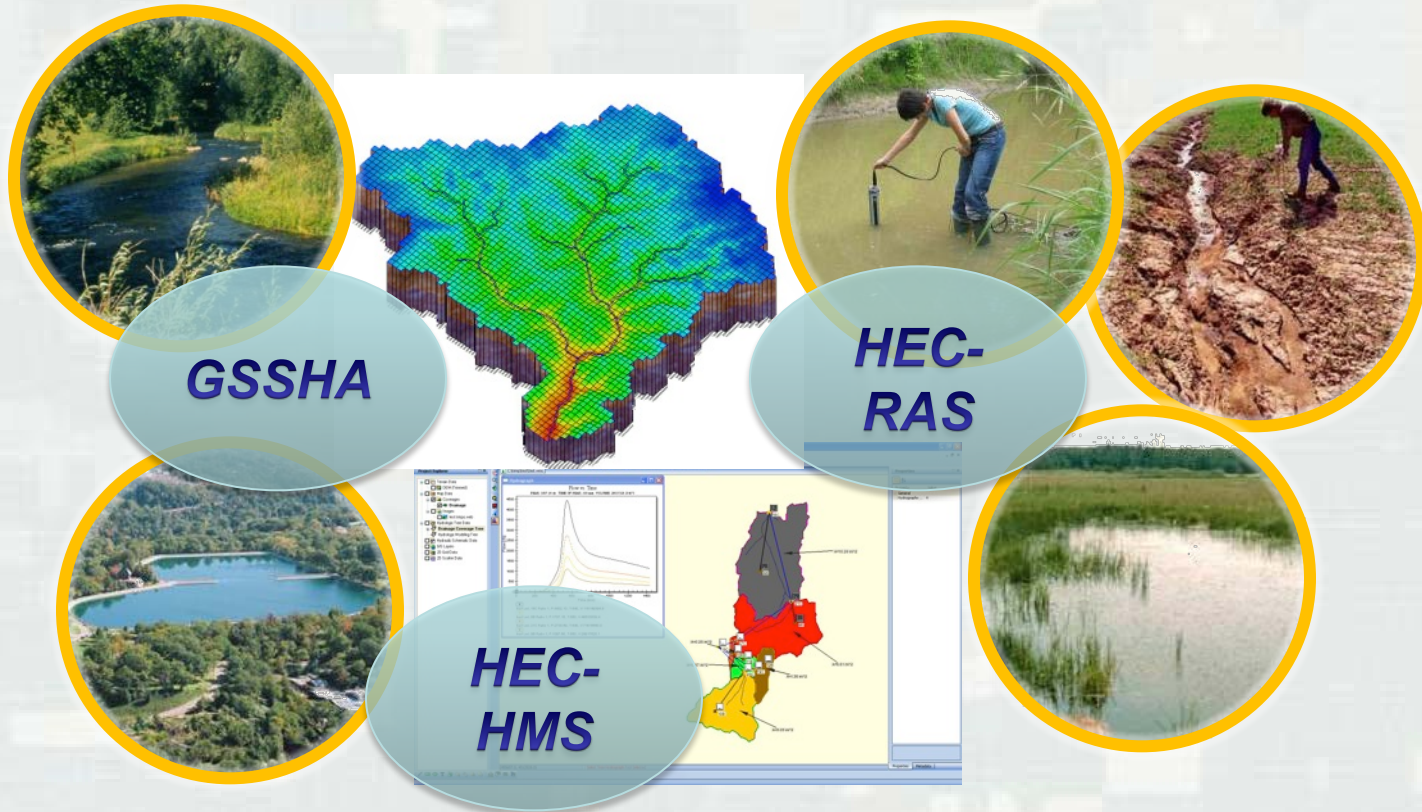
**FRF &
CLARIS**

**CSTORM-
MS**



Provide USACE and its partners and stakeholders the framework and analytical tools to balance human development activities with natural system requirements in a sustainable manner through regional management of coastal and estuarine water and sediment resources

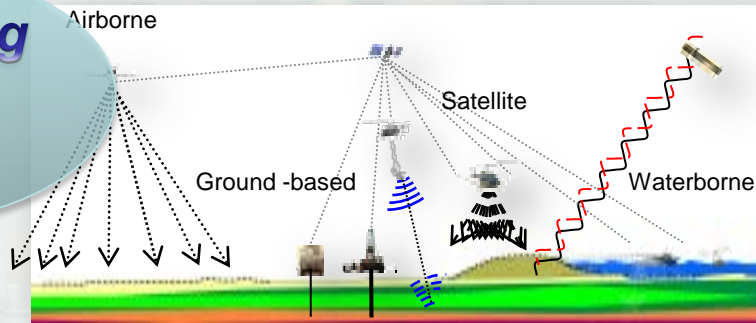
Watershed Systems



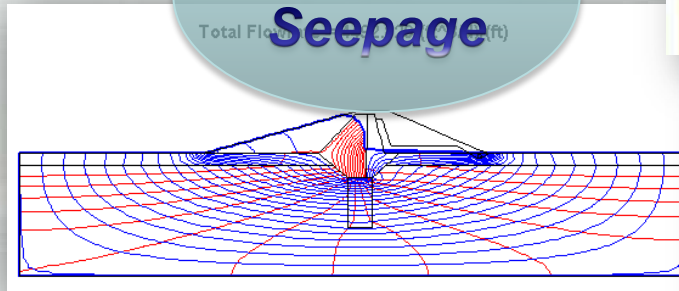
Provide capability to Districts and stakeholders to conduct holistic studies on watersheds, rivers, reservoirs and estuaries for multidisciplinary water resources management. Capability includes interoperable hydrology, hydraulics, sediment and material transport and ecologic processes

Infrastructure Resiliency & Reliability

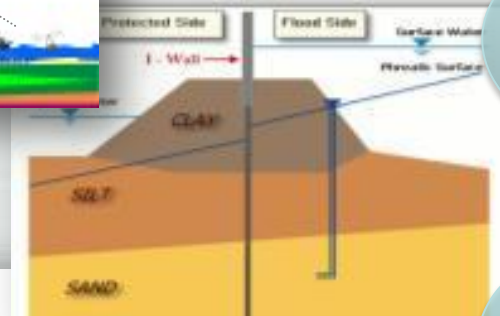
Monitoring and Sensing



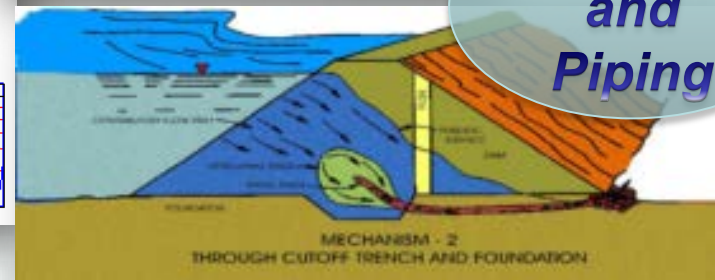
Transient Seepage



Corps I-Wall

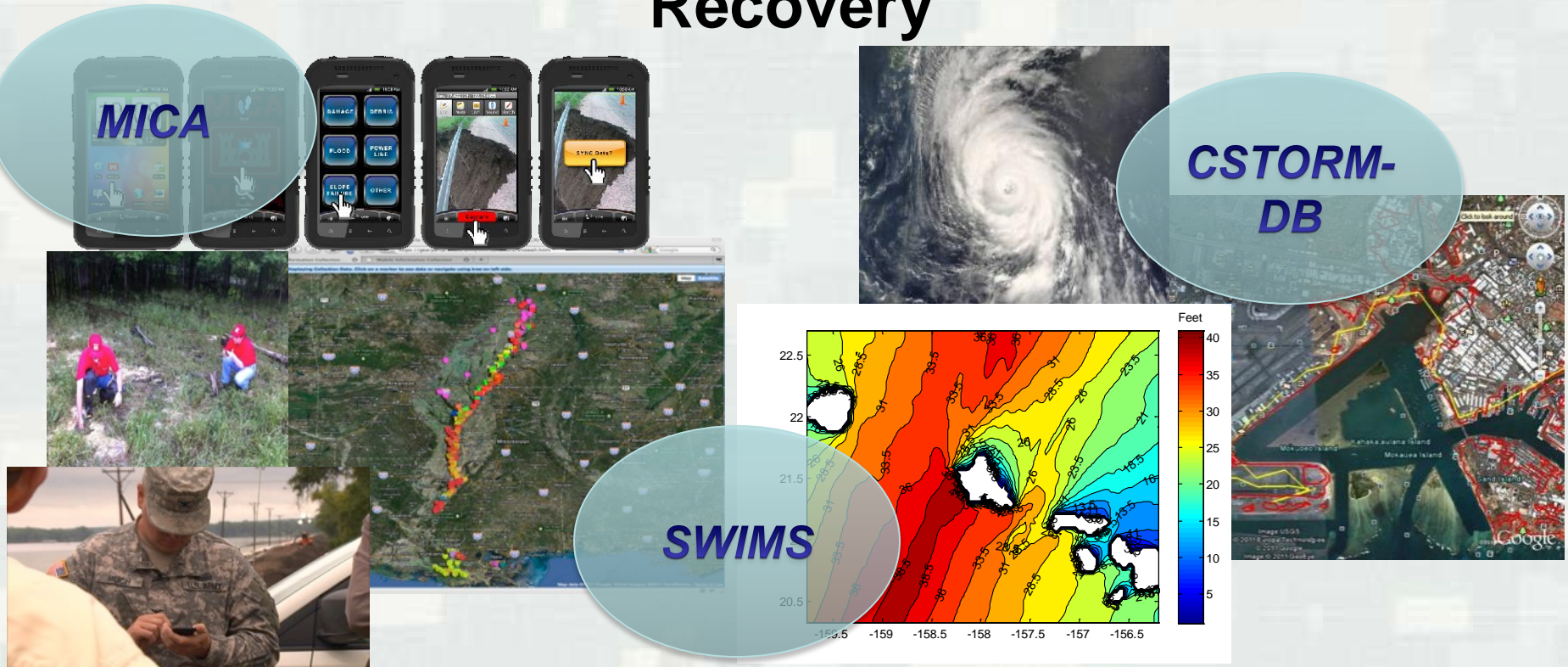


Seepage and Piping



Identify near term opportunities for gaining new capability and longer term science-based initiatives to make greater strides in improving the condition and functioning of infrastructure.

Effective Disaster Preparation, Response & Recovery



Enable expedient, efficient, and effective data acquisition, data management and information dissemination for life-cycle public safety and all hazard risk mitigation. Capability includes rapidly deployed models and reliable damage assessment technologies

<https://technology.erdcdren.mil>

US Army Engineer Research and Development Center

TECHNOLOGY TRANSFER & INFUSION INITIATIVE

Search below to connect with ERDC experts, products, and capabilities.

These tools are used for ERDC Technology Transfer & Infusion. Click on each to access directly.



Discover everything
about ERDC



Collaborate easily with ERDC
researchers and developers.



Explore ERDC's wiki for the
latest in USACE R&D.

Modular Protective System

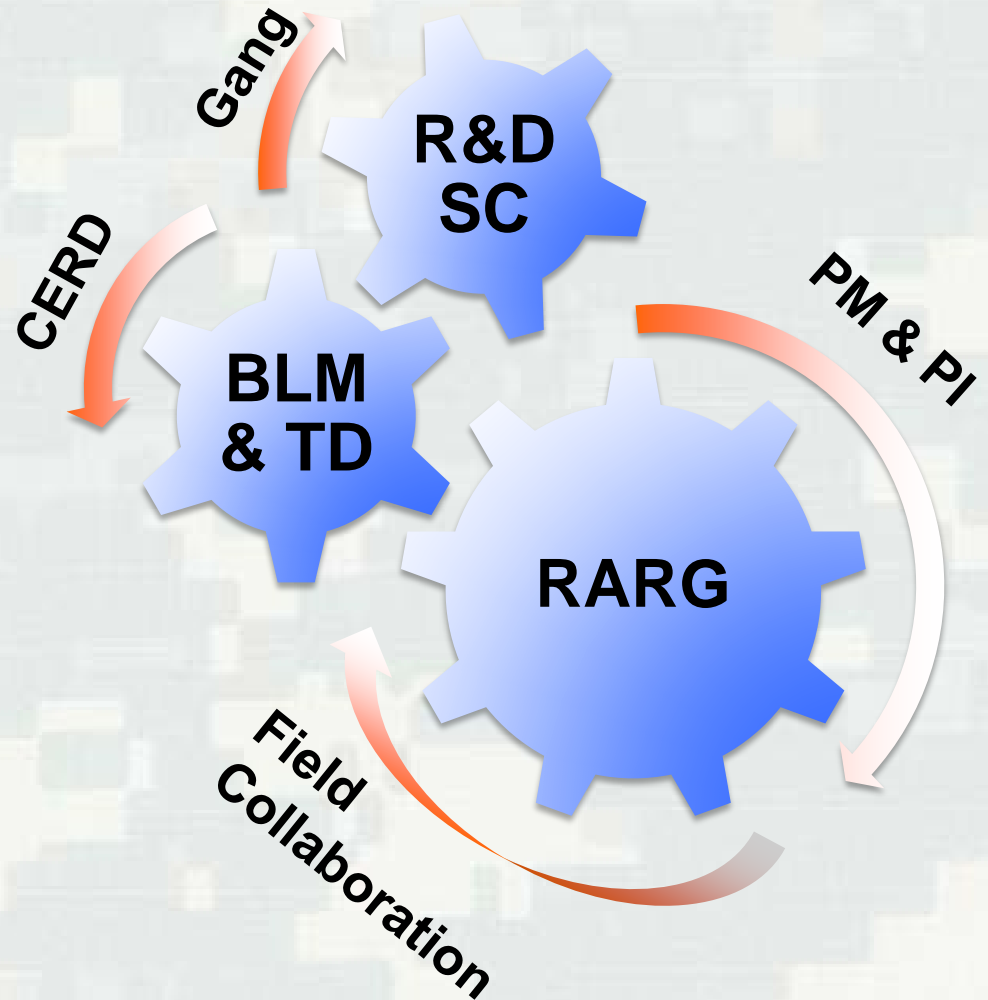
Objective: Evaluate integrity of structure against worst case
scenarios, attacks including suicide bombs.
Devin Shain, Don Nelson, and Nick Boone

MILITARY ENGINEERING

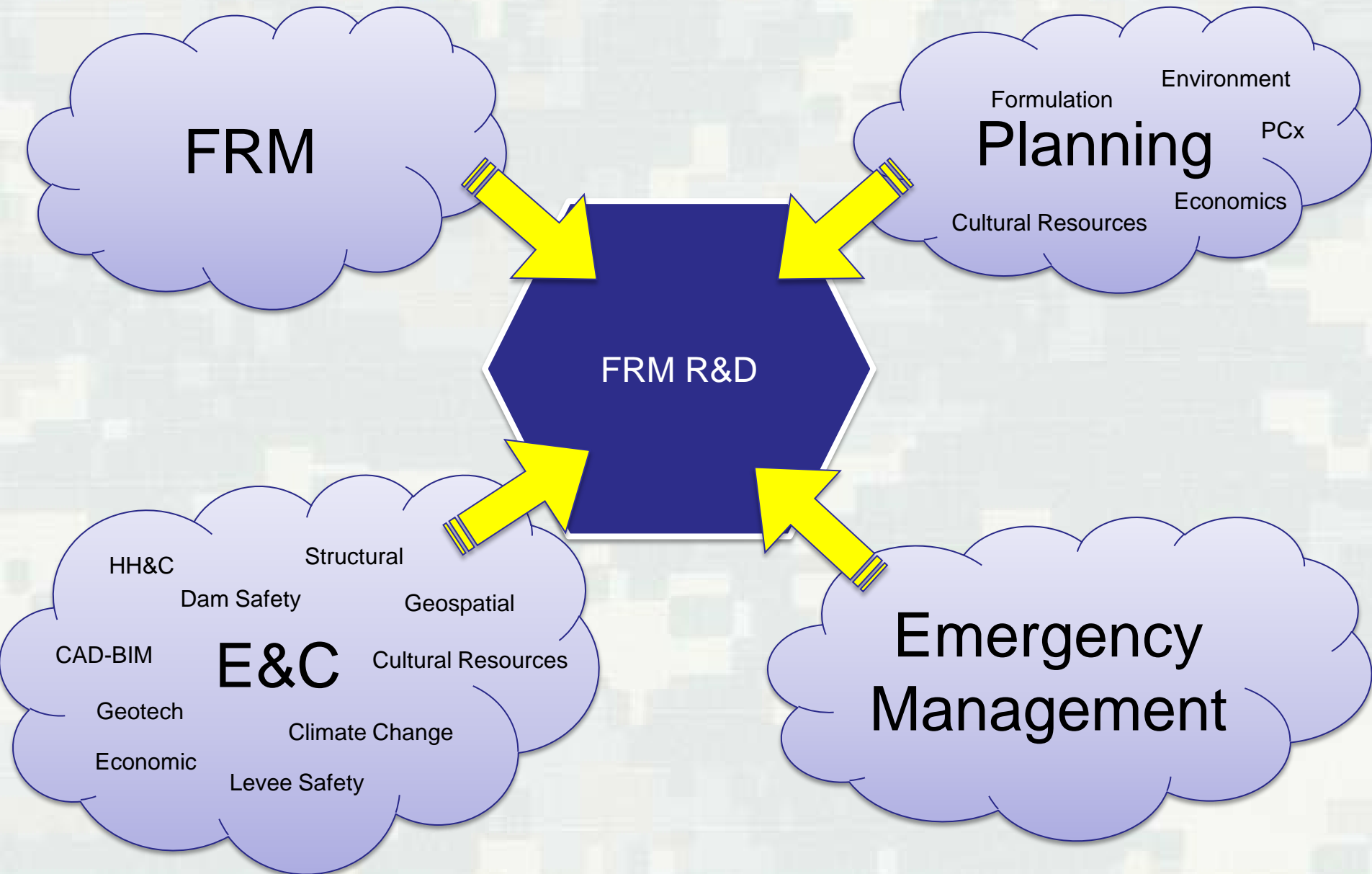
ERDC provides innovative technologies and capabilities to the soldier in
order to enable force protection and maneuver.

Civil Works R&D Process

- Produces requirement-driven program
- Short-term requirements
- Strategic requirements
- Leverages other Corps programs
- Collaborate with field and others
- Documentation: SOP



FRM RARG (CoP Input)



2014 RARG Preliminary Ranking

Title	Weighted Avg
Evaluation and Comparison of the Grouting Effectiveness of Conventional Cement Grouts and Balanced Stable Grouts for use in Grouting Rock Foundations of Dam Safety Projects	4.3
High velocity stage-damage curves	3.8
The Impact of Vegetative Roots on Seepage and Piping in Levees	3.8
Methods for Determining Drought Recurrence Intervals	3.4
Load and Resistance Factor Design for Flood & Retaining Structures	3.4
Physics based atmospheric models for probable maximum precipitation estimation	3.4
Quantification of Nearshore Transient Water Level Induced by Storm Wave Action	3.3
Geotechnical site characterization of complex foundations under extremely long levees	3.2
Hydraulic Model Workflow Improvements - Topographic/Geometry Data Management, Streamlining of Editing Capabilities, Automation of Repetitive Analyses, and Improvement in Model Runtime Capabilities	3.0
Rapid Pre-Storm Coastal Survey Ability for Improved Storm Impact Assessment and Prediction at USACE Coastal Storm Damage Reduction (CSDR) Projects	3.0
Short-term forecasting and project risk tradeoffs	3.0
Need for GIS-Based Meteorologic Modeling Tool	3.0

Title	Weighted Avg
Accretion rate of coastal wetlands experiencing relative sea level rise	2.8
Repair/Replacement of failed in-service water stops for Civil Works structures	2.8
Mold Flood Damage Functions	2.8
Evaluation of Fully Grouted Piezometer Installations	2.8
Alternative Methods for Apportioning Sediment Transport Capacity	2.7
Development of tools to improve efficiency of hydraulic analysis and mapping for large areas	2.6
Multi-dimensional Numerical Hydraulic Modeling of Bridges	2.4
Ice Engineering Tool Development	2.3
Erosion and Mass-Wasting Failure of Cohesive Sediment	2.2
Integrating Non-Monetary and Life Cycle Risks for Improved FRM Decision Making	2.1
Improved instream structures for vertical stability, energy dissipation, floodplain function, and ecological connectivity	2.0
National Emergency Costs—Quantification and depth damage curves	2.0
Sediment Impact Assessment for Dam Removal Activities	1.6
Quantifying Effects of Ice-Jam Flooding	1.3
Estimating impacts of small water withdrawals at reservoir projects	1.3
Urban watershed application of systems approach developed for Demonstration Erosion Control (DEC) watersheds	1.2
Applications for a Catastrophic Impact Model (CIM)	1.0
Climate change induced increases in bank erosion impacts to archaeological sites	1.0

Thank you

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