The Evolving Landscape of MCMD Information Flow
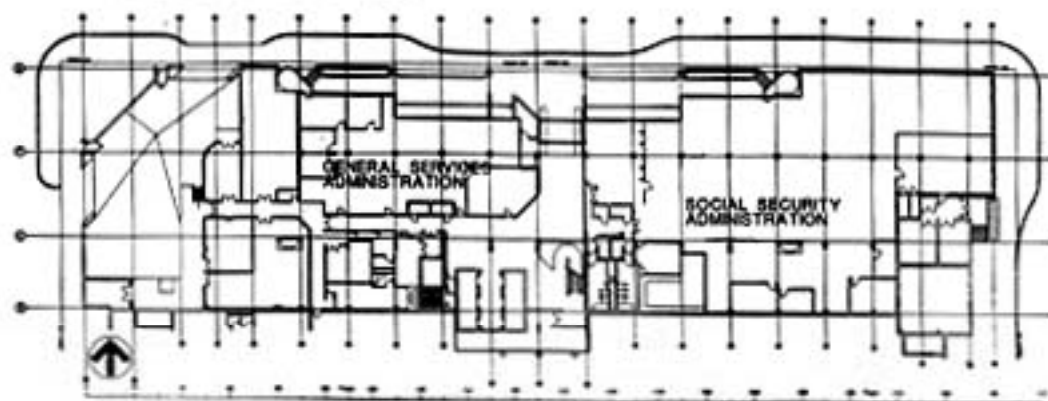
Michael F. Goodchild

University of California

Santa Barbara
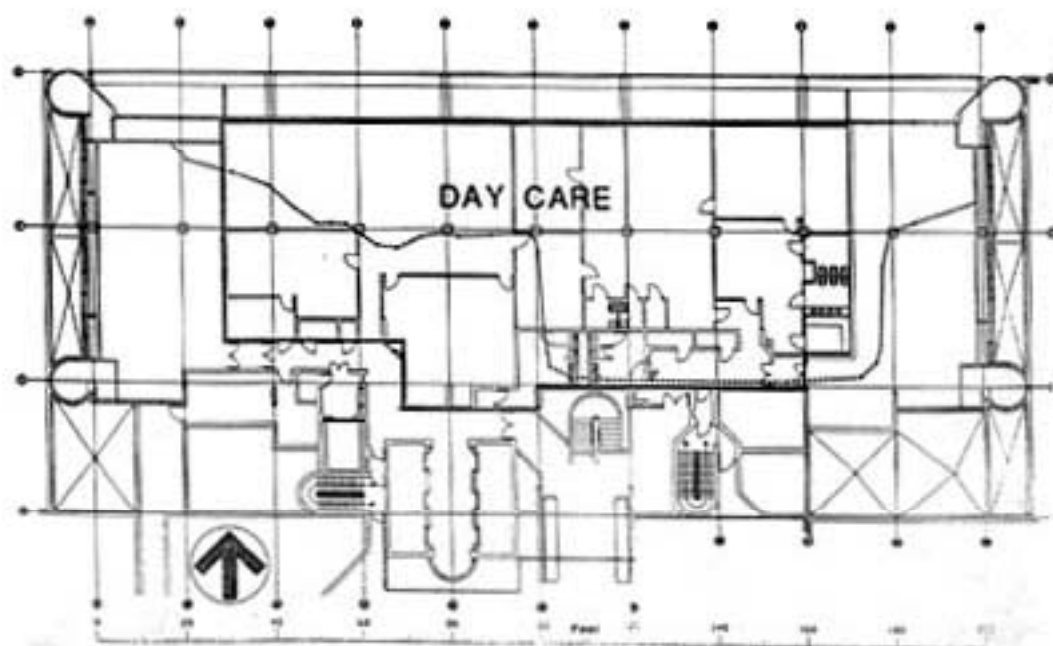
ALFRED P. MURRAH BUILDING FLOOR PLAN

FIRST FLOOR
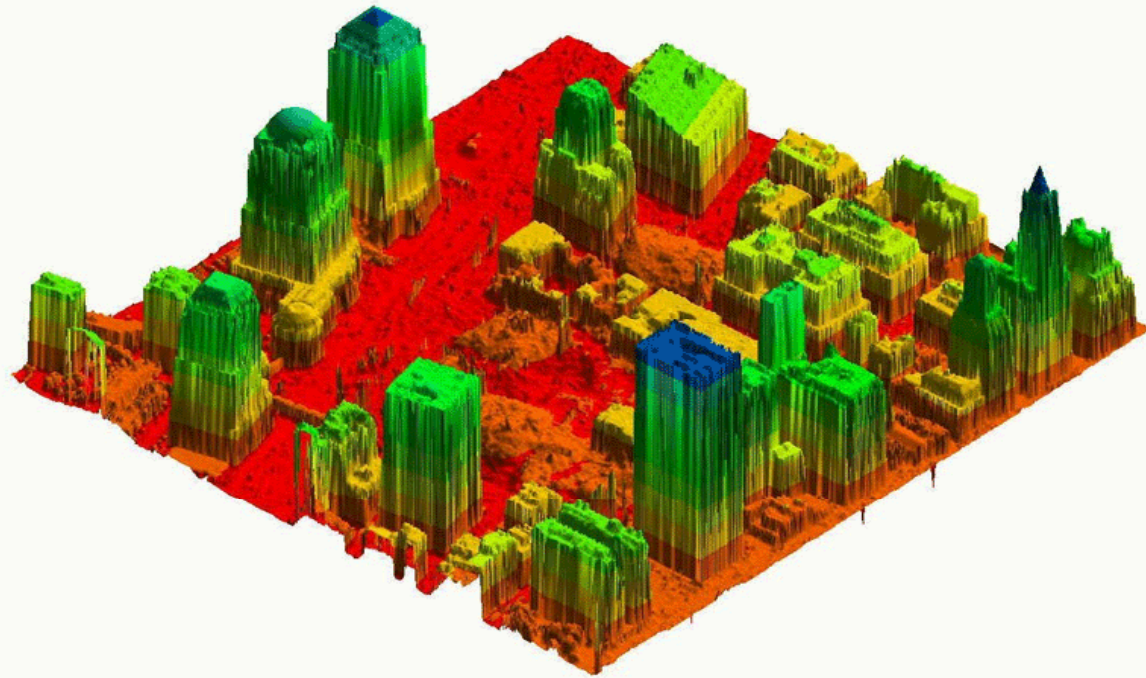

GENERAL SERVICES ADMINISTRATION

SOCIAL SECURITY ADMINISTRATION

SECOND FLOOR

DAY CARE
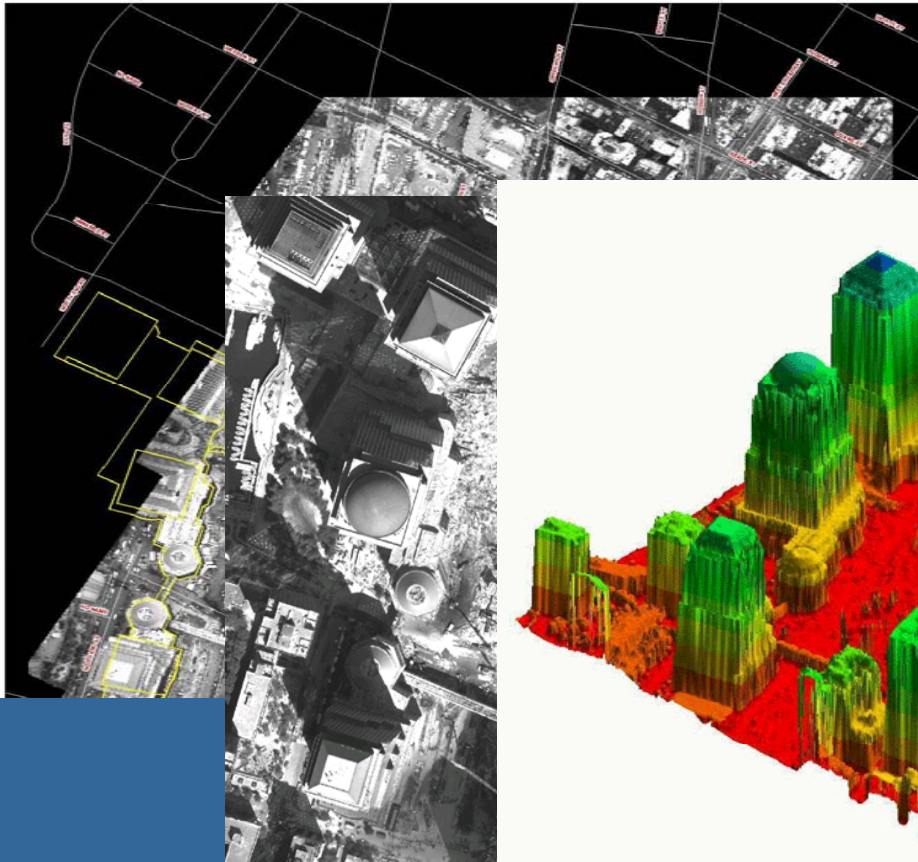
NYC Office of Emergency Management and NY Office of Cyber Security and Critical Infrastructure Coordination

Water Depth	Color
15	
14	
13	
12	
11	
10	
9	
8	
7	
6	
5	
4	
3	
2	
1	

Original
OEM in
WTC
Complex
Bldg 7
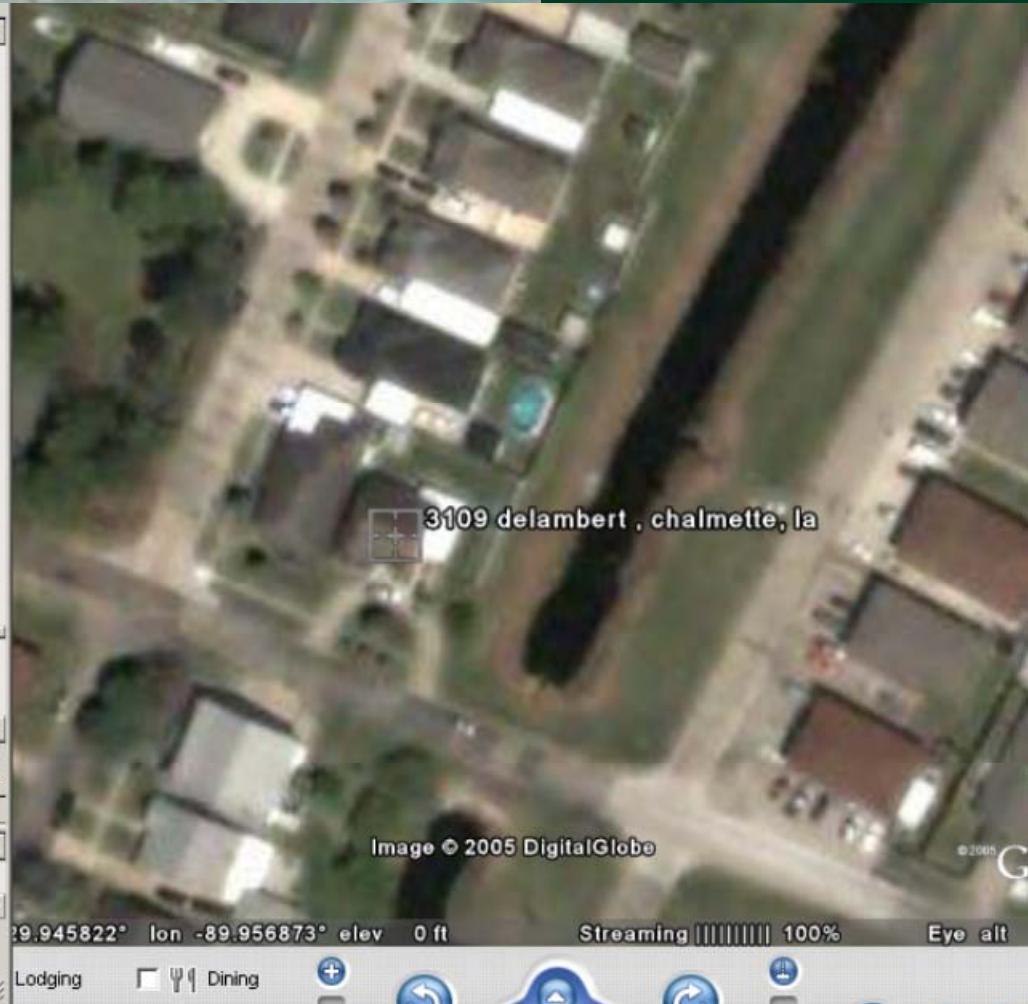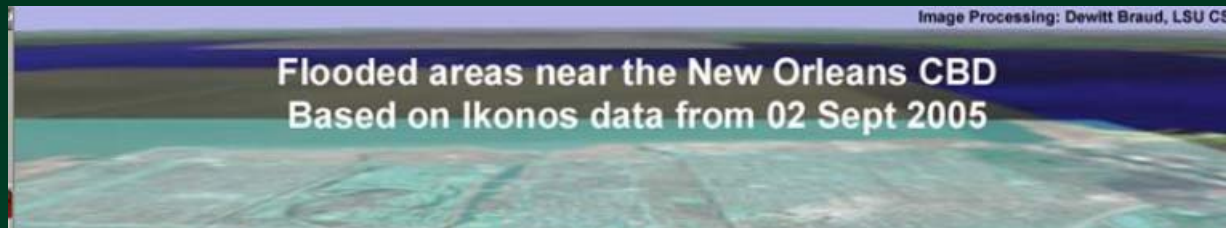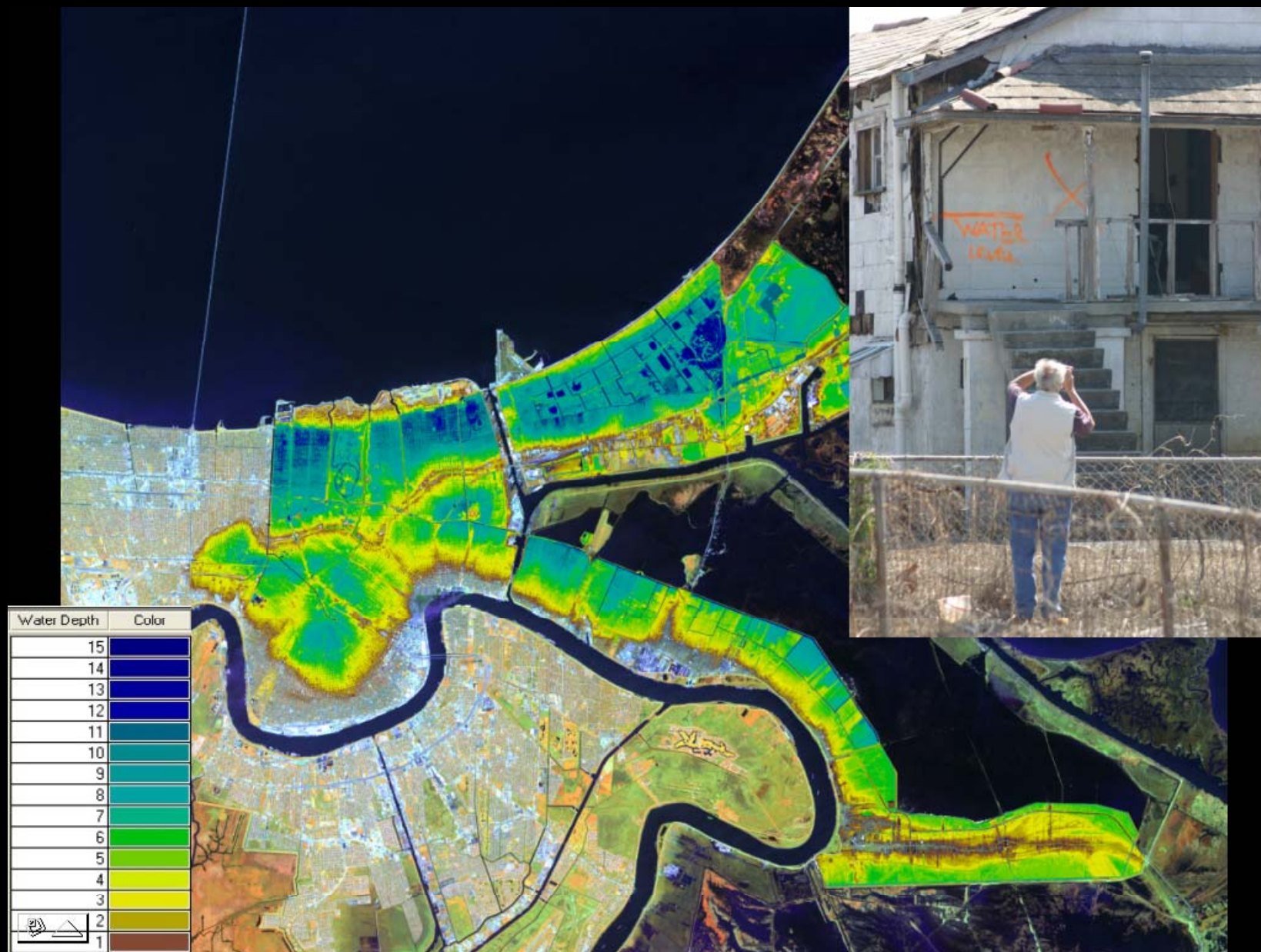
For free PDF version of final report,
Google "Successful Response"

Mapping Science Committee

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

SUCCESSFUL RESPONSE STARTS WITH A MAP
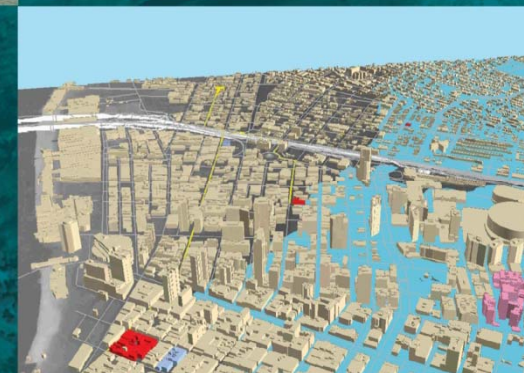
Improving Geospatial Support for Disaster Management

NATIONAL RESEARCH COUNCIL
OF THE NATIONAL ACADEMIES

Geospatial information is central in all aspects of emergency management

Mitigation for future events

Planning for future events

Response and recovery

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

- Maps are essential in the earliest stages of search and rescue

- Overhead images provide the best early source of information on damage

- Importance of evacuation planning

Image credits: *top*, courtesy Schad Meldrum, City of Oklahoma City; *middle*, courtesy NOAA; *bottom*, courtesy Richard Church, University of California, Santa Barbara

Geospatial data and tools have the potential to contribute to the saving of lives, the limitation of damage, and reduction in the costs to society of dealing with emergencies
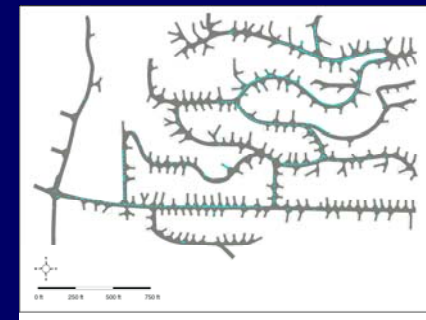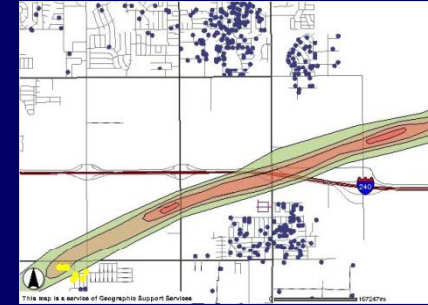
Special Needs of Geospatial for EM

- Past few decades have seen massive investments in geospatial data and tools
- But specific requirements of EM rarely addressed
  - Rapid operational capability & access to data
  - Extensive planning
  - Training of first responders
  - Tools that work under difficult circumstances of search & rescue

Human Systems

- Effectiveness of geospatial data and tools dependent on
  - Training
  - Coordination among agencies
  - Sharing of data and tools
  - Planning and preparedness
  - Attention/resources invested in technology
- These are the critical factors that must be addressed if future responses are to be more effective

Data

- Data frequently scattered among multiple jurisdictions
- Data often in disparate, incompatible formats
- Lack of data interoperability at many levels
- Lack of knowledge about what data exist & where
- Restrictions on use of data, concerns about data security
- Lack of training of data users
- Lack of operational infrastructure in immediate aftermath of disaster

Planning

- **The role of geospatial data and tools should be addressed explicitly by the responsible agency in strategic planning documents at all levels**

- **Geospatial procedures and plans developed for all but the smallest of emergencies should be multiagency**

Governance

- **The current system of governance of the NSDI should be strengthened**
  - **Should include full range of agencies, governments, and sectors that share geospatial data and tools**

- **DHS should play a leading role in ensuring that the special needs of emergency management for effective data sharing and collaboration are recognized as important in this new governance structure**

THE NATIONAL ACADEMIES
Advisers to the Nation on Science, Engineering, and Medicine

Data Sharing

- **A new effort should be established to develop policies and guidelines that address the sharing of geospatial data in support of all phases of emergency management**
  - led by DHS
  - within the framework and governance structure of NSDI

- **These policies and guidelines should define:**
  - the conditions under which each type of data should be shared
  - roles and responsibilities of each participating organization
  - data quality requirements
  - interoperability requirements that should be implemented to facilitate sharing

Standing Contracts

- **Standing contracts and other procurement mechanisms should be put in place to permit emergency managers to acquire overhead imagery and other types of event-related geospatial data rapidly during disasters**

Photos courtesy of Paul Greenfield & Dale Dague, USDA FS

Preparedness Exercises

- **Address communication problems that currently inhibit communication between first responders and coordinating centers through intensive preparedness exercises**

- **These exercises should:**
  - **Focus on clear objectives with respect to use of geospatial data and assets**
  - **Involve decision-making representatives from all levels of government, as well as other relevant organizations and institutions**
  - **Be coordinated nationally so that common problems can be identified**
  - **Be realistic in their complexity**
  - **Allow participants to work carefully through the geospatial challenges posed by disasters**

Backup and Archiving

- **DHS should revise Emergency Support Function 5 of the National Response Plan to include backup and archiving of geospatial data, tools, and procedures developed as part of disaster response and recovery**

- **DHS should assign responsibility and necessary funds to FEMA for archiving and backup in the Joint Field Offices during an incident**

Research

- **NSF and federal agencies with responsibility for funding research on emergency management should support the adaptation, development, and improvement of geospatial tools for emergency management**
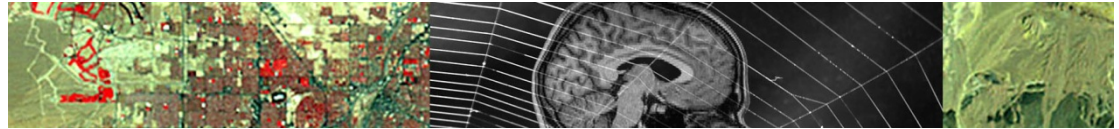
Training

- **Academic emergency management curricula should increase the emphasis given to geospatial data and tools**

- **Geospatial professionals who are likely to be involved in emergency response should receive increased training in emergency management business processes and practices**
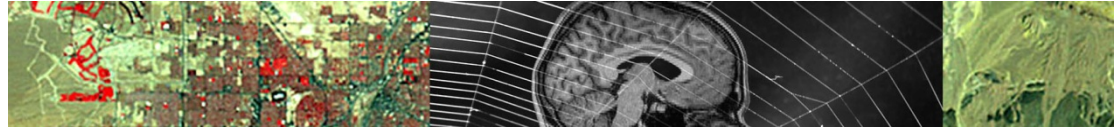
How is geographic information created?

- By authorities and their experts
  - USGS
  - NGA
  - Ordnance Survey
  - military in many countries
  - state and local governments

- Disseminated to non-expert users
  - with restrictions
  - at cost of production or reproduction?
  - restrictions since 9/11

Volunteered geographic information (VGI)

- A phenomenon of the 21st Century
  - recent months
- *User-generated content*
- *Collective intelligence*
- *Crowdsourcing*
- *Asserted information*
- The empowerment of millions of private citizens
  - largely untrained
  - no obvious reward
  - no guarantee of truth
  - no authority

http://www.directrelief.org/Flash/HaitiShipments/Index.html
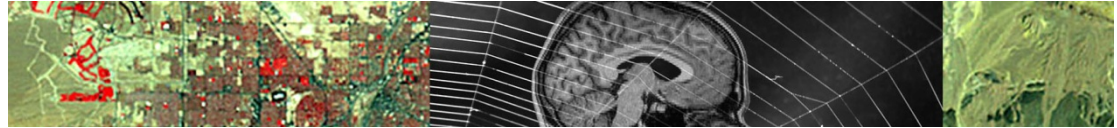
Emergency management

- **Recent fires in Santa Barbara**
  - Zaca Fire (July 07)
    - burned for 2 months
    - no houses lost
  - Gap Fire (July 08)
    - burned for 7 days
    - no houses lost
  - Tea Fire (November 08)
    - burned for 2 days
    - 230 houses lost
  - Jesusita Fire (May 09)
    - burned for 2 days
    - 75 houses lost

Tea Fire

Legend

- 🟠 Debris Basin
- 🔴 Debris Basin to be Cleaned
- 🟪 Self-Recording Station
- 🟩 Alert Station
- 🟦 Observer Station
- ▪▪▪ Channel Clearing
- ◇ Sand Bags - 401 E. Yanonali St.
- ▭ Tea Fire Perimeter

Watersheds	Acres Burned	% of Watershed
🟩 Mission Canyon	183	2%
🟨 Laguna	8	1%
🟦 Sycamore Canyon	1,686	67%
🟥 Montecito Creek	64	1%

- ▭ City Boundary
- ▬ 100 year flood plain

SANTA BARBARA

0 0.25 0.5 1 Miles

N

Follow

FEMA: California Tea Fire
Nov 13, 2008

tea fire santa barbara | VPNewsLog
Nov 13, 2008 7:48 PM

The Tea Fire
Nov 13, 2008 11:24 PM

Fire destroys 80+ houses in Montecito, Santa ...
Nov 13, 2008

Santa Barbara "Tea" Fire
Nov 13, 2008 9:44 PM

Canned Spam in high demand - Crime Scene
Nov 13, 2008

Las Alturas Fire Montecito 2008 Tea Fire
Nov 13, 2008 8:42 PM

Wildfire Today: Update on Tea fire near Monte...
Nov 13, 2008

Lal Masjid of Bradistan « Pak Tea House
Nov 13, 2008 9:50 PM

Tea Fire Westmont College
Nov 14, 2008 3:11 AM

Tea Fire (Santa Barbara & Mon...
Nov 14, 2008 7:39 AM

Tea Fire SB fr
Nov 14, 2008

Oprah's house Montecito: Oprah's house fire '...
Nov 13, 2008

Tea Fire Montecito/Santa Barbara pt. 1
Nov 14, 2008 12:00 AM

Santa Barbara Tea Fire Time Lapse
Nov 14, 2008 5:46 AM

Water Fill Up Helicopter Tea Fire Santa Barb...
Nov 14, 2008 10:51 AM

Montecito Fire (See Pic and Video Footage) - ...
Nov 13, 2008

Tea Fire Santa Barbara Helicopter Water Drop
Nov 14, 2008 1:55 AM

365 days: Abwarten und Tee trinken
Nov 13, 2008

Santa Barbara "Tea Fire" Helicopter
Nov 14, 2008 2:00 AM

3 pm | 4 pm | 5 pm | 6 pm | 7 pm | 8 pm | 9 pm | 10 pm | 11 pm | **Nov 14, 2008** | 2 am | 3 am | 4 am | 5 am | 6 am | 7 am | 8 am | 9 am | 10 am | 11 am | 12 pm | 1 pm | 2 pm

SHOW SOURCES ⌄

Hits	Source
595673	Jesusita Fire (Ethan)
188308	SBC Jesusita Fire Santa Barbara, CA (Robert O'Connor - fire news blog)
89214	Jesusita Fire Map (Randy - Independent.com)
67525	Jesusita Fire in Santa Barbara - LA Times map (Los Angeles Times)
27777	Map of burned homes in Santa Barbara (Los Angeles Times)
26330	Jesusita Fire Evacuation Areas: Approximation (COSB)
25454	Santa Barbara 'Jesusita Fire' (ABC7 Eyewitness News)
19592	Jesusita Fire - Santa Barbara (lanewspace)
2446	Santa Barbara Damaged Homes 2008 (Los Angeles Times, note: mapped for comparison with Jesusita)
2048	Jesusita Fire (longhairedhippy)
1314	Santa Barbara Fire Evacuation (Gary);
962	Jesusita Fire in Santa Barbara (ABC30 Action News)
788	Wildfire ~ Santa Barbara (Buffalo)
505	Closure map - Jesusita Fire in Santa Barbara (Los Angeles Times)
461	Untitled (Matthew, note: discovered via google.com.mx);
396	Jesusita Fire Structure Damage (Paul Bartsch);

VGI

- Important in all four cases
  - first photographs of Tea Fire appeared on Flickr in minutes
  - first Twitters about Jesusita Fire in minutes
  - maps, text accounts
- Search engines (Google) take a finite time to catalog
  - too long for Tea and Jesusita Fires
- Flickr and other site-specific catalogs work much faster
  - after Zaca Fire people knew where to look for rapidly available information
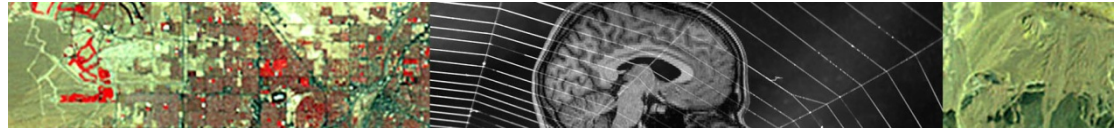
Lessons learned

- Authoritative information
  - must be verified by officials
  - too slow for the Tea and Jesusita Fires

- Asserted information
  - carries risk of false positives
    - false rumor of Tea Fire in Mission Canyon
    - some unnecessary evacuations
  - people are willing to accept false positives
  - lack of authoritative information amounts to false negatives
  - false negatives are far less acceptable than false positives
    - there were some posted false negatives

Luck, readiness pay off in Santa Barbara's Mission Canyon

Spencer Weiner / Los Angeles Times

Smoke from the Jesusita fire darkens the sky along Holly Road above Mission Canyon near Santa Barbara today.

LA Times May 8 2009

Hundreds of homes are set in a narrow canyon downwind from brush-covered wildlands, but evacuation drills, brush clearance and reverse 911 calls all help avert a major disaster.

By Bettina Boxall and Catherine Saillant
May 8, 2009

Reporting from Santa Barbara -- Everyone in Mission Canyon knew these days of flame and smoke would come. It was just a matter of when and how bad it would get.

They had staged evacuation drills, set up phone trees and put herds of brush-munching goats to work. They had cut down clusters of eucalyptus and bought metal shutters to protect against flying embers.
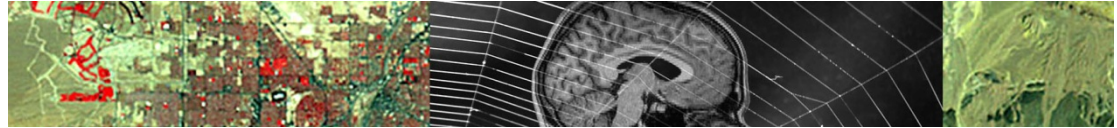
Summary points

- Importance of geospatial data in all phases of an emergency

- Major challenges
  - data sharing
  - training
  - time-critical application

- Web 2.0
  - community-sourced information
  - timeliness versus quality