



# “Field Reconnaissance Techniques during Emergencies”

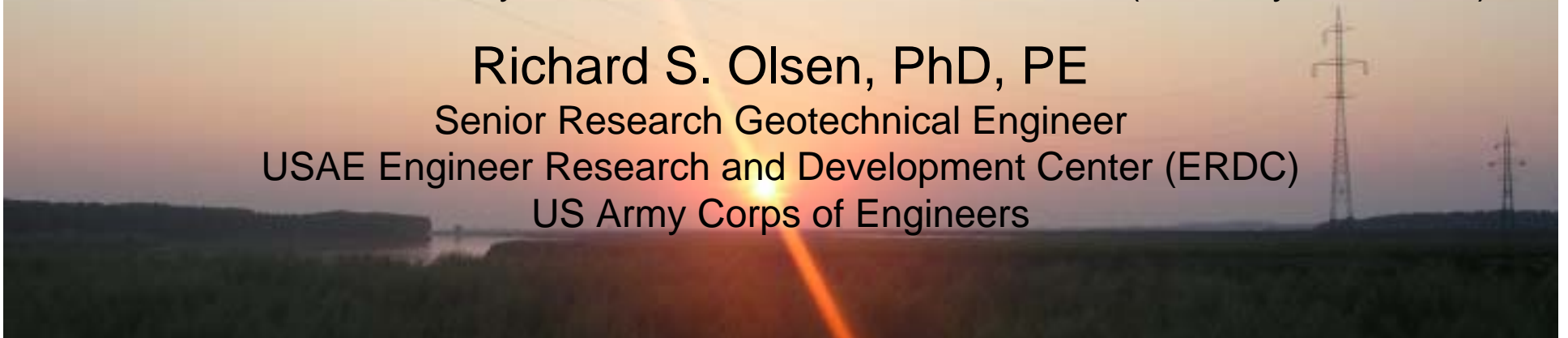
GEER Presentation - May 18, 2009 - Richmond Field Station (Berkeley, California)

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USAE Engineer Research and Development Center (ERDC)

US Army Corps of Engineers



# USACE Emergency Response: Flood Control & Coastal Emergencies (Public Laws 84-99, 93-288 {Stafford Act} & NEPP)

## Standard emergency objectives of USACE

- Blue roof missions
- Water missions
- Debris removal mission
- Electric power generators
- Real estate needs for emergencies
- etc as requested by FEMA
- Post emergency evaluations
- Reconstruction
  
- *Emergency reconnaissance is a small but important part of USACE historical efforts*

## Additional USACE Emergency Support Functions:

- Transportation (DOT)
- Firefighting (DOA)
- Information and Planning (FEMA)
- Mass Care (Red Cross)
- Health and Medical Services (DHHS)
- Urban Search and Rescue (FEMA)
- Energy (DOE)
- Flood Fight Support to FEMA



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**Disaster  
Preparation**



**Emergency  
Operations**

**Hazard  
Mitigation  
Management**

**USACE  
Emergency  
Response**

**Emergency  
Water  
Assistance**



**Rehabilitation  
of Damaged  
Projects**

**Advance  
Measures**



US Army Corps of Engineers (USACE ) and  
USACE Engineer Research Development Center (ERDC)

## ***primary objectives for rapid reconnaissance during natural disaster emergencies***

(Subject Matter Expert (SME) deployments)

### ***What is performed (and documented for non engineers);***

- Determine mode(s) of failure
- Determine all contributing factors that triggered the failure
- Determine if sequencing of failure is an issue
- Interview people & examine the site looking for non normal issues

### **a) Failure evaluation of water control structures;**

- 1) Rapidly provide cost effective repair methods for recovery
- 2) R&D; to change design and evaluation procedures in the future

### **b) Disaster site safety** (providing real-time advise to field command);

- 1) For safety of emergency workers
- 2) To determine when normal community activity can resume



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# Major initiatives that ERDC sees as important for reconnaissance efforts

## 1) HERO merge with air ARRK

- Helicopter Emergency Reconnaissance Observer (HERO) system  
(this is last year of development)
- Automatic Road Reconnaissance Kit (ARRK) (a military recon system)

## 2) Improvements in understanding of how water control structures fail

- Concentrating on marginal failures
- Interviewing people is critical
- Importance of soil modulus differences, cascading failures, human factors, etc

## 3) Improved field recon methods

- Better selection, use, and transport of basic field equipment
- Better field procedures for documenting observations
- Minimal use of paper in field using “photo signing” methods
- Requirement that all field data is computerized before start of next day
- Pre training in terms of GPS, cameras, procedures, & post processing



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## Continuation of **Major initiatives**

### **4) Near real-time rapid reporting to headquarters in Washington DC and local emergency field stations**

- Nightly two-level rapid Google Earth presentation of field observations
- Nightly web page publishing
- Better use of E-mail and Contacts in field using BlackBerrys for situation awareness
- Better use of satellite communications (data, voice, SPOT, etc.)

### **5) Team forming**

- USACE Forward Engineer Support Teams (FEST) during emergencies
- Foreign Ministry based government-to-government partnerships in the field
- GEER partnerships with Universities, groups, and other US government agencies

### **6) USACE/ERDC Changes/Challenges**

- USACE ERDC Subject Matter Experts (SME) are now better defined
- ACE-IT is a challenge for USACE (centralized control of computer systems)
- USACE Reach Operations Center (UROC) is providing civil emergency reach back



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Keypad for 4 second data entry

Pan-tilt-bearing sensor (georo stabilized)

GPS on dashboard  
(with barometric sensor)

Firewire camera

“Camera Pod”  
containing 3-axis  
sensor, firewire  
camera, high  
resolution camera,  
GPS unit (in  
background), and  
keypad

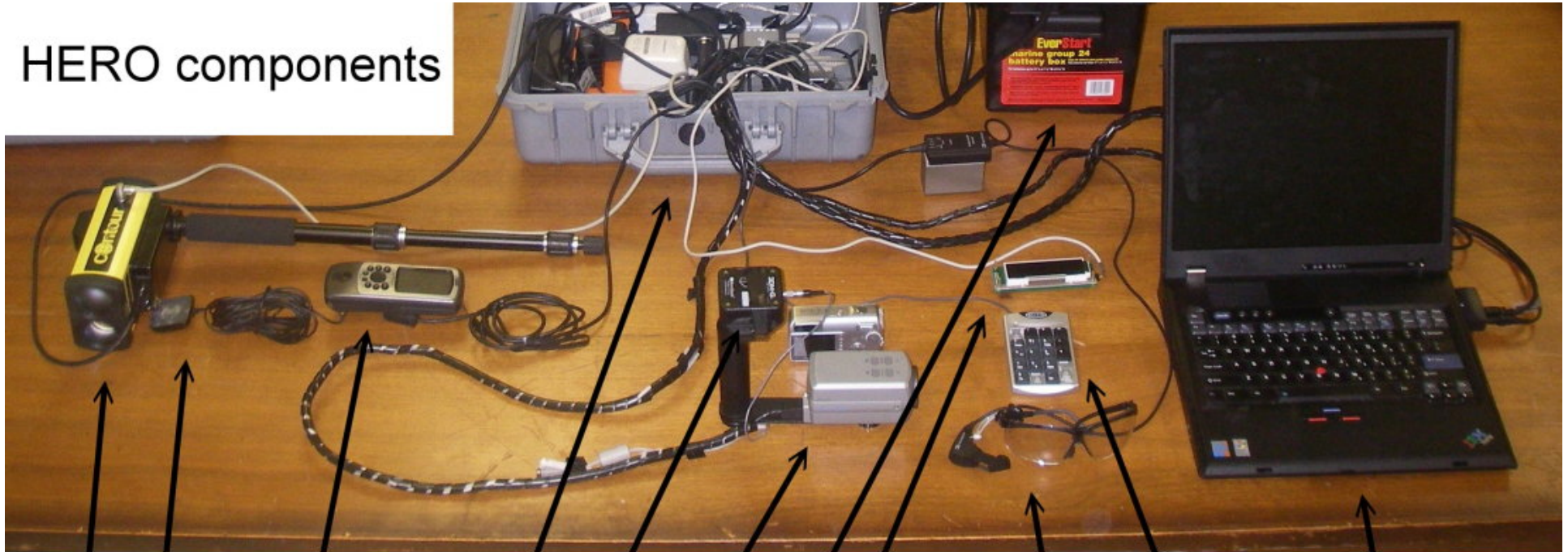
# Helicopter Emergency Reconnaissance Observer (HERO) system



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# 2007 version of the HERO system hardware

HERO components



Laser distance device

Remote GPS antenna

GPS device

Pan/Tilt sensor

Firewire camera

12 volt power supply (5 hrs)

Display for helicopter pilot

Observer eye display

observer key pad

HERO computer (1.8 Ghz)

Power supplies and communication ports (RS-232 and USB)



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# HERO Output to GOOGLE EARTH

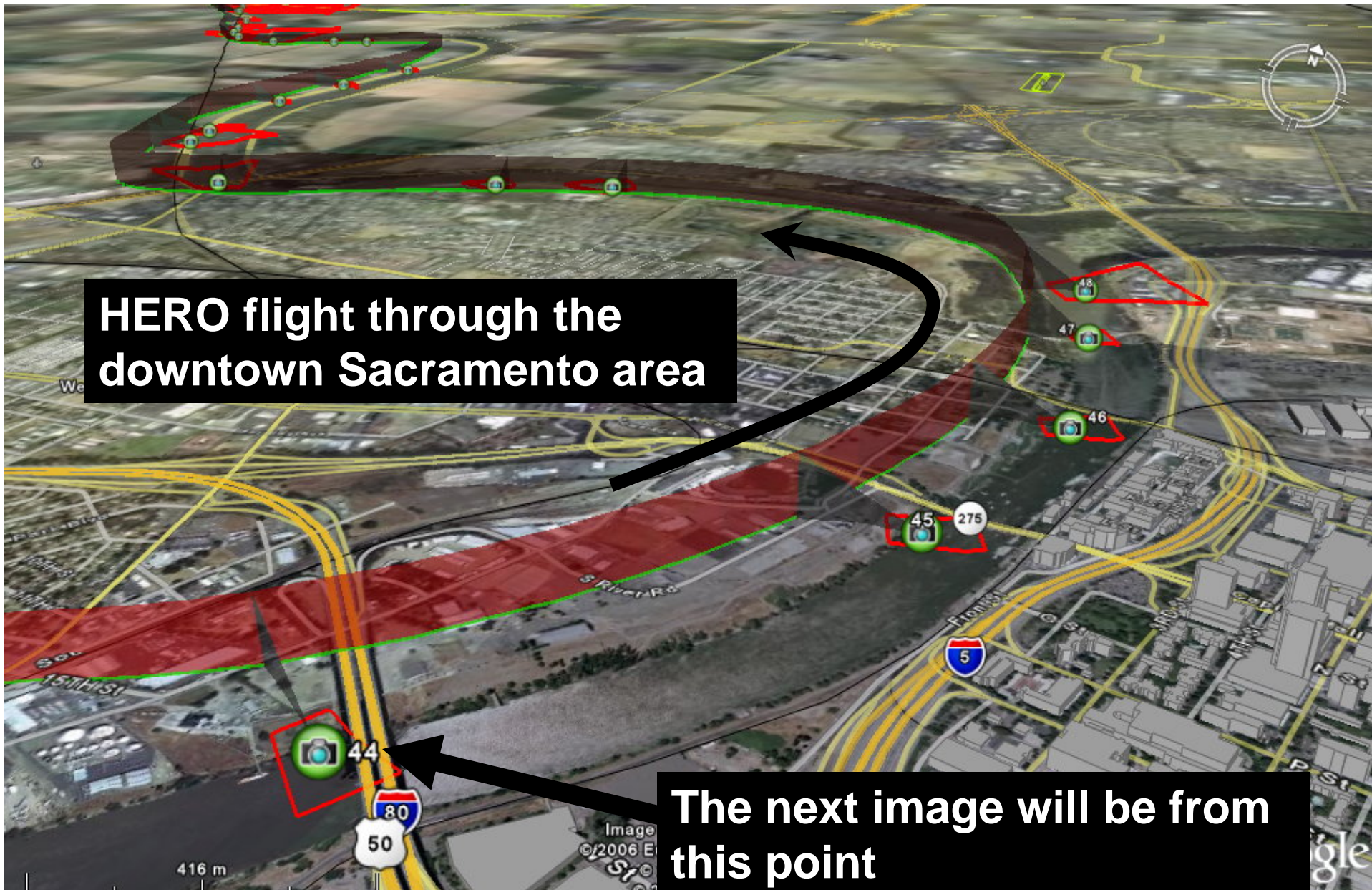
**Summary of damage index**

**Helicopter flight path (and height)**

**The user clicks on this icon to see the photo**

**Real-time projected photo footprint on the ground**

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Sacramento demo of HERO in 2007

44

**Hardware Health: Problem !**

**Helicopter**

Vel: 73 kts  
move Bear: -0- (?)  
Elev vSat: 159 m  
Elev vAirP: 137 m  
Height Laser: 0 m

**--Camera--**

Height: 132 m (AIR)  
To CamGrCt: 235 m  
Cam Tilt: 29 deg dwn  
Cam Roll: 3 deg L/R  
Cam Bearing: 122.0 (SE)  
ZoomDegs(horz): 22 deg  
Expo: 1/128 sec

**--Location Error--**

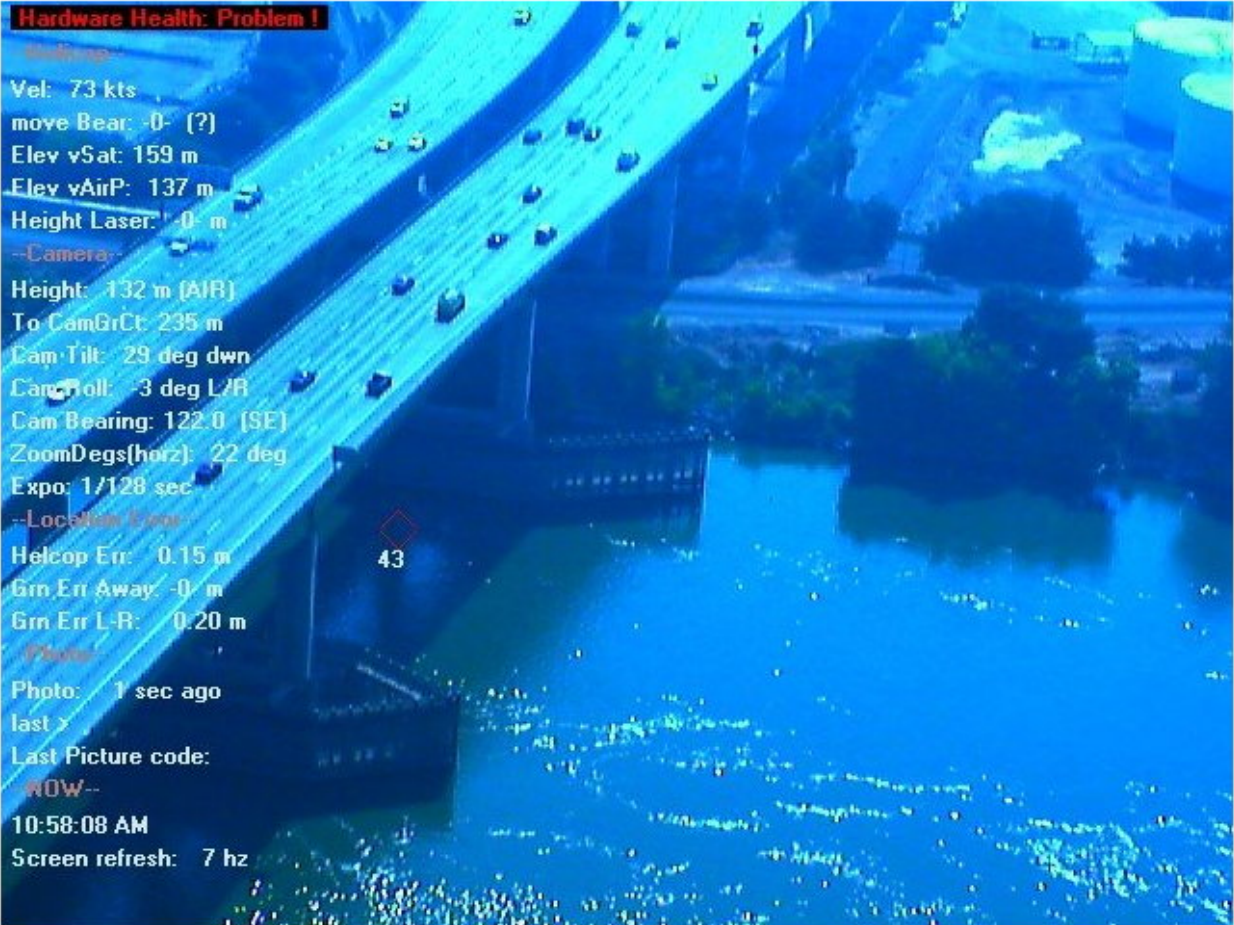
Helcop Err: 0.15 m  
Grn Err Away: -0 m  
Grn Err L-R: 0.20 m

**Photo**

Photo: 1 sec ago  
last  
Last Picture code:

**NOW--**

10:58:08 AM  
Screen refresh: 7 hz



Directions: [To here](#) - [From here](#)



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# Using two-level Google Earth reporting

**Places**

- RO\_tailings\_06-v7.kmz
  - Site Flags
  - Problem Flags
  - Car Travel to Sites
  - Site Photos
    - Baisoara\_(BR)
    - Bozanta\_(BOWBZ)
    - Bozanta\_(BZ)
    - Bloaja\_(BL)
    - Colbu\_1\_(C1)
    - Fagetul\_Ierii\_(FL)
    - GM-mod
    - Gura\_Rosia\_(GR)
    - Harapeia\_(HA)
    - Lunca\_Muresului\_(LM)
    - Malini\_(ML)
    - Novat\_(NV)
    - OM-mod
    - OP-mod
    - Patranjeni\_(PT)
    - Plopis-Rachitele\_(PR)
    - Ribita\_Curteni\_(RC)
    - RLS-mod
    - Rovina\_(RO)
    - Sfarcu\_(SF)
    - Tailings\_Dam\_D2\_(D2)
    - Photos D2
      - D2-714.JPG
      - D2-728.JPG
      - D2-745.JPG

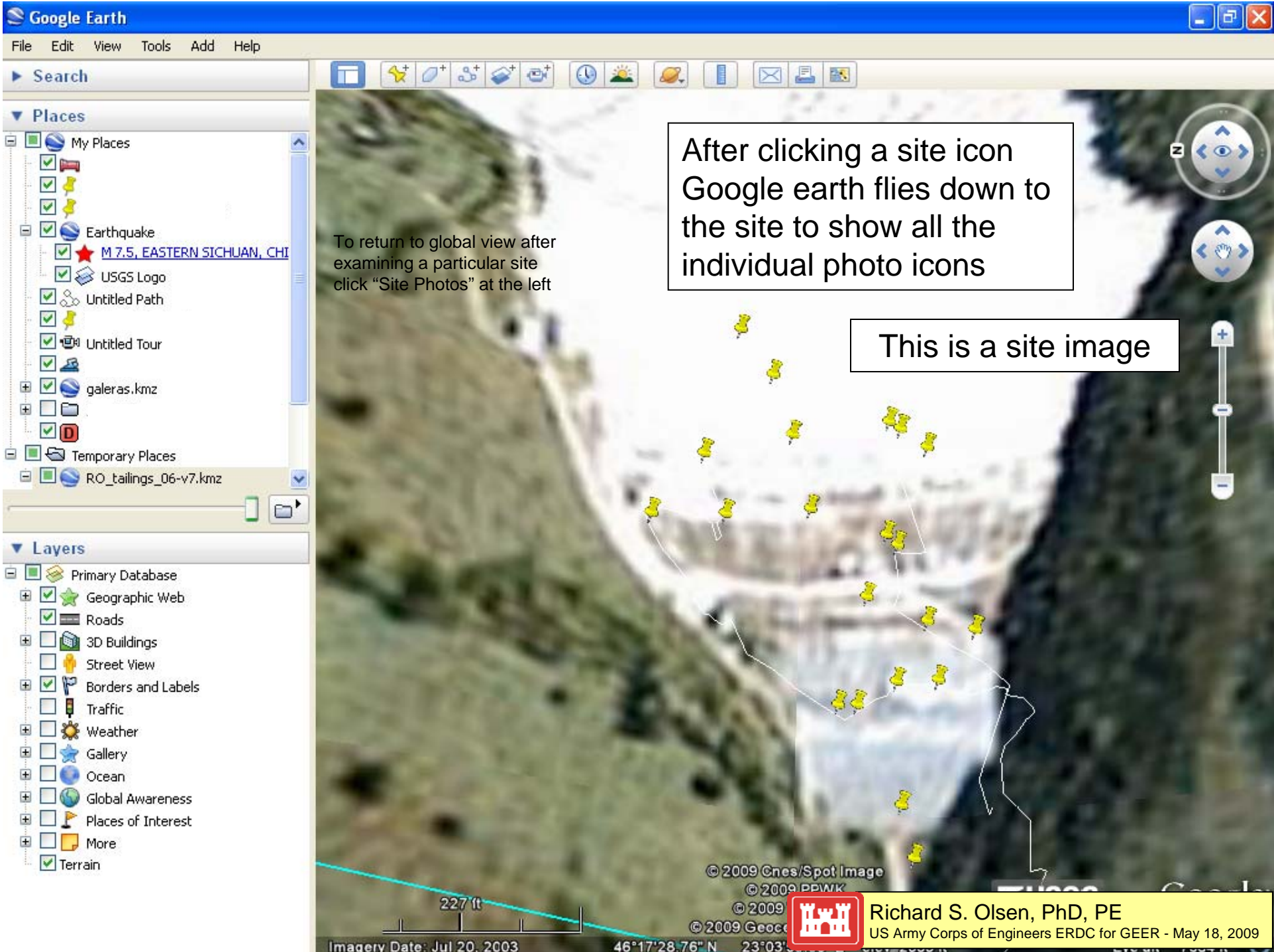
**Map Labels:** Valea Stei, Valea Selistei, Valea Sesei, Valea Miresului, Valea Devei, Harapeia, Lunca Muresului, Ribita Curteni, Rovina, Patranjeni, Gura Rosia, Deva, Alba.

**Photo Labels:** VM-23.JPG, VM-11.JPG, MIpan1.JPG, MI-2.JPG, 100\_1989.JPG, VD-10.JPG, HA-19.JPG, VD-05.JPG, -13.JPG.

**Text:** Inspection of tailing dams (and failure modes) in the mountains of Romania (5000 photos of 40 tailing dams in 2006 and reported using Google Earth)

To return to global view after examining a particular site click "Site Photos" at the left

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After clicking a site icon Google earth flies down to the site to show all the individual photo icons

To return to global view after examining a particular site click "Site Photos" at the left

This is a site image



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Google Earth

File Edit View Tools Add Help

Search

Places


- Earthquake
  - M 7.5, EASTERN SICHUAN, CHI
  - USGS Logo
  - Untitled Path
  - Untitled Tour
  - galeras.kmz
  - Temporary Places
    - RO\_tailings\_06-v7.kmz
      - Site Flags
      - Problem Flags
      - Car Travel to Sites
      - Site Photos

Layers

- Primary Database
  - Geographic Web
  - Roads
  - 3D Buildings
  - Street View
  - Borders and Labels
  - Traffic
  - Weather
  - Gallery
  - Ocean
  - Global Awareness
  - Places of Interest
  - More
  - Terrain

VLpan03.JPG

This is an example of a site photo



Directions: [To here](#) - [From here](#)

© 2009 PPWK  
 © 2009  
 © 2009 Geoc

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Imagery Date: Jul 20, 2003      227 ft      46°17'27.30" N      23°04'

# Google Earth icons related to earthquake damage



## Selection and organization of field equipment during reconnaissance efforts

**Car bag**



**Walking bag**





Pens and markers Pocket paper



Light  
(AA batteries)



Item flagging



Garmin 60xx



Mirror, level,  
tape, mag.,  
mirroe, ruler



Gloves, ear plugs, mask



Pocket  
pen and  
torvane



shovel



GPS antenna

# Inside the Walking Bag



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Dash board  
anti skid



Use  
flagging



USB cable



Water  
depth



Field medicine



Garmin  
GPS  
for car track



Felt cloth  
to reduce dash reflection



12 volt to  
110 volt



Bug repellent  
and  
suntan  
lotion

# Inside the Car Bag



AA battery charger



Blackberry charger



Camera battery charger



Extra blackberry as a battery charger



Item flag



Camera battery charger



Extension cord

4 outlet extension

Bag 2 not shown

# Inside the computer bag 1



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Field  
back pack  
having  
open net  
cloth



Walking  
stick (and  
camera mono  
pod)



Hat with pocket  
inside hood for  
GPS



## Field Items



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BB  
batteries



2 AA



Camera  
batteries



2 AA



back pocket (larger)  
for "Fresh" batteries



front pocket (smaller)  
for "used" batteries

# Single Battery Bag



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# Blackberry

(The group leaders and SMEs must have blackberries)

With installed software for field use

- Google maps
- weather web links
- NexRad web links
- 411 web link
- social networking software/links

Pre-establish contact lists and have methods for contact information exchange.

Have contacts for all field POCs, office POCs, support groups (i.e. motel, food, transportation, communications), medical POCs, other agencies, other groups...



Have international unlimited data option set before deployment

Users must have experience using the Blackberry



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Belt  
holder



Use an old  
blackberry  
as a battery  
charger  
(and backup list  
of contacts)



Extra SIM  
in case  
blackberry  
is lose or  
broken  
(required for  
some agencies)



Wired  
(and/or bluetooth)  
ear phone



## Blackberry items



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**I'm standing on a failed bridge in Taiwan  
caused by the 1999 Chi Chi earthquake  
(the waterfall was also generated by the fault displacement)**

# Thanks



This bridge was  
washed out a  
day later



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