ImageCat, Ltd.

Inventors of Risk Management Technologies

Virtual Disaster Viewer: Understanding Disasters through Shared Knowledge

Third United Nations International UN-SPIDER Bonn Workshop:
Disaster Management and Space Technology – From Concepts to Application
21-23 October 2009

John Bevington
Senior Project Scientist, **ImageCat (R&D), UK**

www.virtualdisasterviewer.com

EPICentre MCEER EERI EEFIT EPSRC

ImageCat, Ltd.

Inventors of Risk Management Technologies

Virtual Disaster Viewer

- Background: The Problem
- Introduction to VDV
- VDV Interface
- The Evolution of VDV
- The VDV Community & Events
- Summary

Problem Statement

There is a post-disaster need…

… for expert analysis to provide rapid and accurate commentary after significant events

… to harness the skills of experts from a wide variety of industries, affiliations, and locations

… for a central repository for experts' interpretations to improve dissemination and discussion of data from current and past disasters

- After major disasters, it is not always feasible to deploy field teams due to damage and/or access restrictions
- Multiple field deployments can result in duplication of effort and costs
- Data is not commonly shared between multiple field teams

Get the right information to the right people at the right time

ImageCat, Ltd.

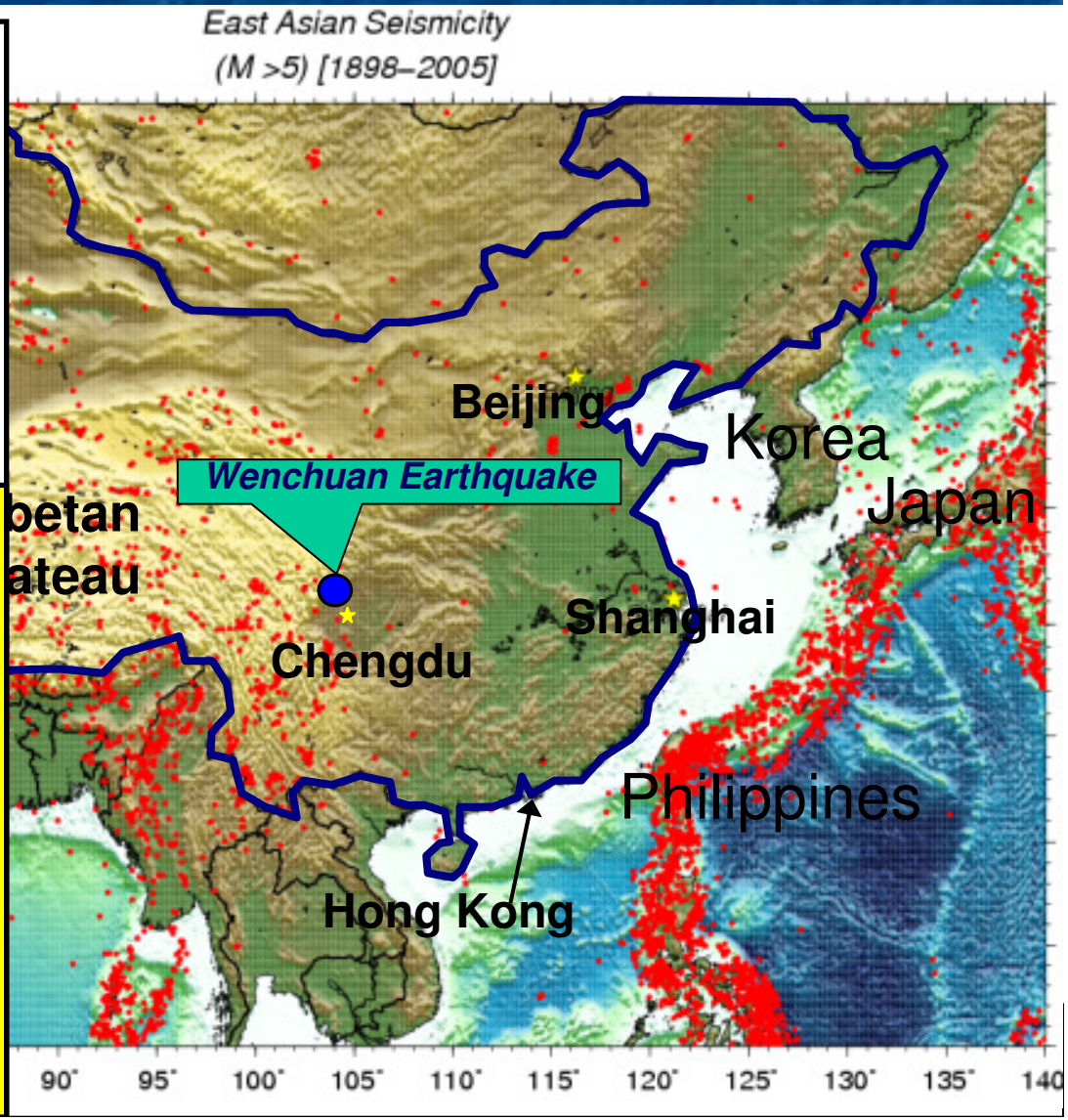
Inventors of Risk Management Technologies

2008 Wenchuan, China Earthquake

2008 Wenchuan Earthquake

Details (known):
May 12, 2008, 2:28pm (Local time)
Magnitude: 7.9 (USGS)
Location: 30.986° N, 103.364° E
Depth: 19km
Fault length: approx. 250km

Damage Estimates:
69,200 dead (20,000 missing)
374,200 injured
5.4 million buildings collapsed
21 million buildings damaged
5 million homeless
15 million evacuated
46 million people affected
Economic loss US$80 billion?
UNDMT Situation Report No. 8, 14 June 2008

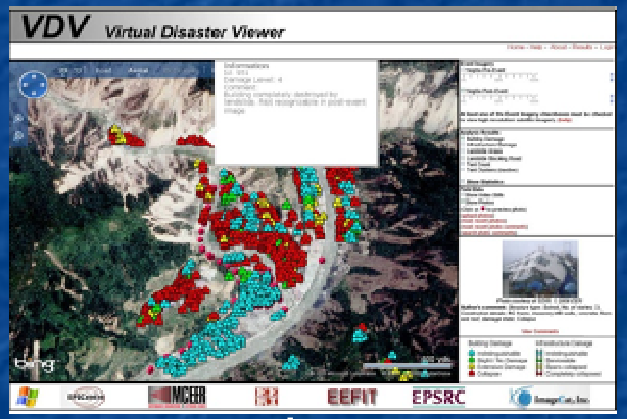


ImageCat, Ltd.

Inventors of Risk Management Technologies

Virtual Disaster Viewer

Online *Social Networking* - style tool for:



- Expert analysis and mapping of:
  - per-building and infrastructure damage assessment
  - landslide distribution and extent
  - location and extent of relief activities
- Visual Change Detection analysis by engineers, remote sensing experts and scientific community
- Amalgamation of geo-located field data in conjunction with fine spatial resolution RS imagery, provides a holistic remote view of disaster area

EPICentre MCEER EEFIT EPSRC

VDV Interface

www.virtualdisasterviewer.com

User comments

Map window

Field data locations

Damage assessment

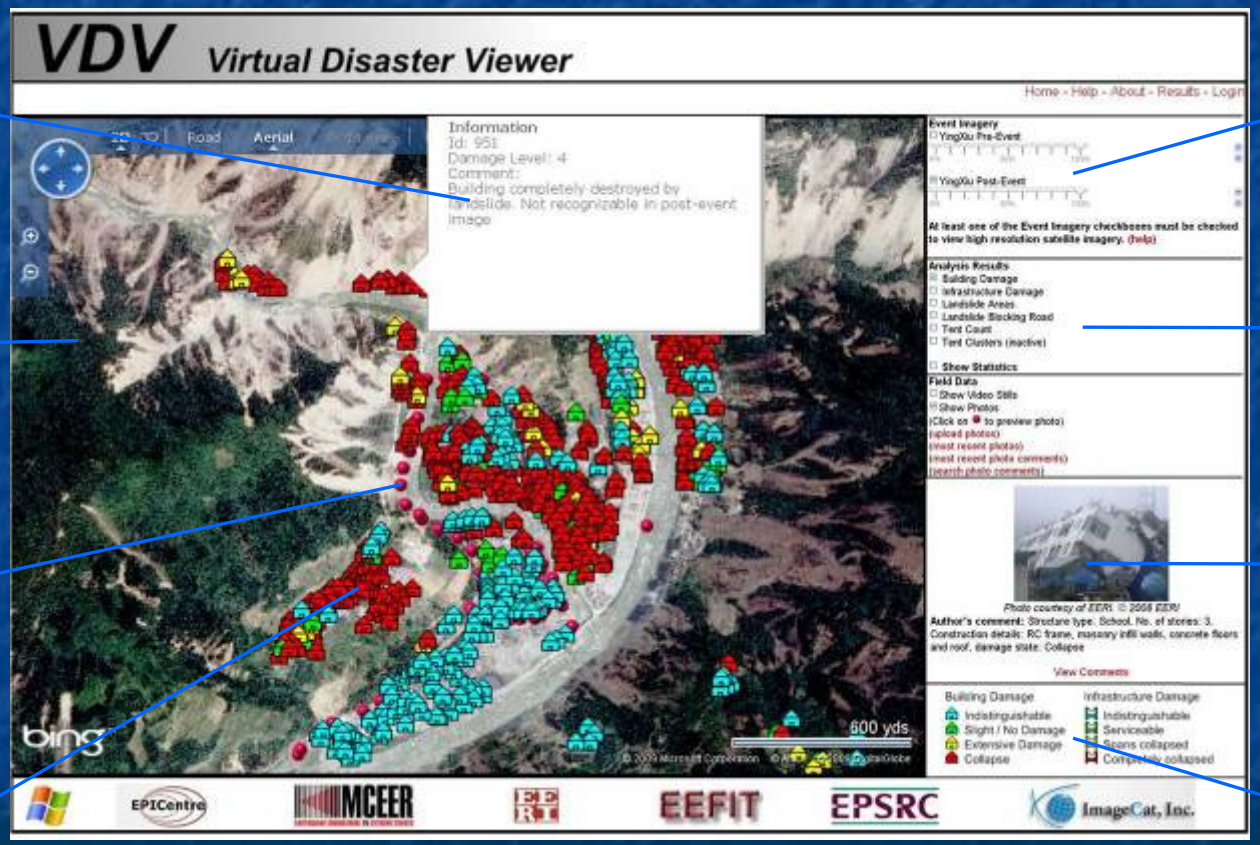


Image control

Layer control

Field photos

Damage scales

EPICentre MCEER EEFIT EPSRC

Evolution of VDV

VDV China: Damage Assessment

VDV Italy: Field Team Support

VDV Charley: Video Functionality

VDV Turkey: Data Repository

VDV Future...?

Evolution of VDV

VDV China: Damage Assessment

VDV Italy: Field Team Support

VDV Charley: Video Functionality

VDV Turkey: Data Repository

VDV Future...?

Functionality: Damage Assessment

Wenchuan, China (2008)

- High-resolution data purchased and loaded into VDV
- Damage assessment provided by team of expert volunteers using pre- and post-event data
- Geo-referenced field data available to aid analysis
- Grid system used to allocate

VDV Virtual Disaster Viewer

Viewing event **2008 Wenchuan Earthquake**

Event Imagery

YingXiu Pre-Event

0% 50% 100%

YingXiu Post-Event

0% 50% 100%

At least one of the Event Imagery checkboxes must be checked to view high resolution satellite imagery. (help)

Analysis Results

- Building Damage
- Infrastructure Damage
- Landslide Areas
- Landslide Blocking Road
- Tent Count
- Tent Clusters

Field Data

- Show Video Stills
- Show Photos

VHR Satellite imagery – Pre-event

VDV Virtual Disaster Viewer

Viewing event: **2008 Wenchuan Earthquake**

Event Imagery

YingXiu Pre-Event

0% 50% 100%

YingXiu Post-Event

0% 50% 100%

At least one of the Event Imagery checkboxes must be checked to view high resolution satellite imagery. (help)

Analysis Results

- Building Damage
- Infrastructure Damage
- Landslide Areas
- Landslide Blocking Road
- Tent Count
- Tent Clusters

Field Data

- Show Video Stills
- Show Photos

Building Damage	Infrastructure Damage	Humanitarian Response	Landslide
Indistinguishable	Indistinguishable	Tent	Landslide Area (area)
Slight / No Damage	Serviceable	Tent Cluster (area)	Landslide Blocking Road (line)
Extensive Damage	Spans collapsed		
Collapse	Completely collapsed		

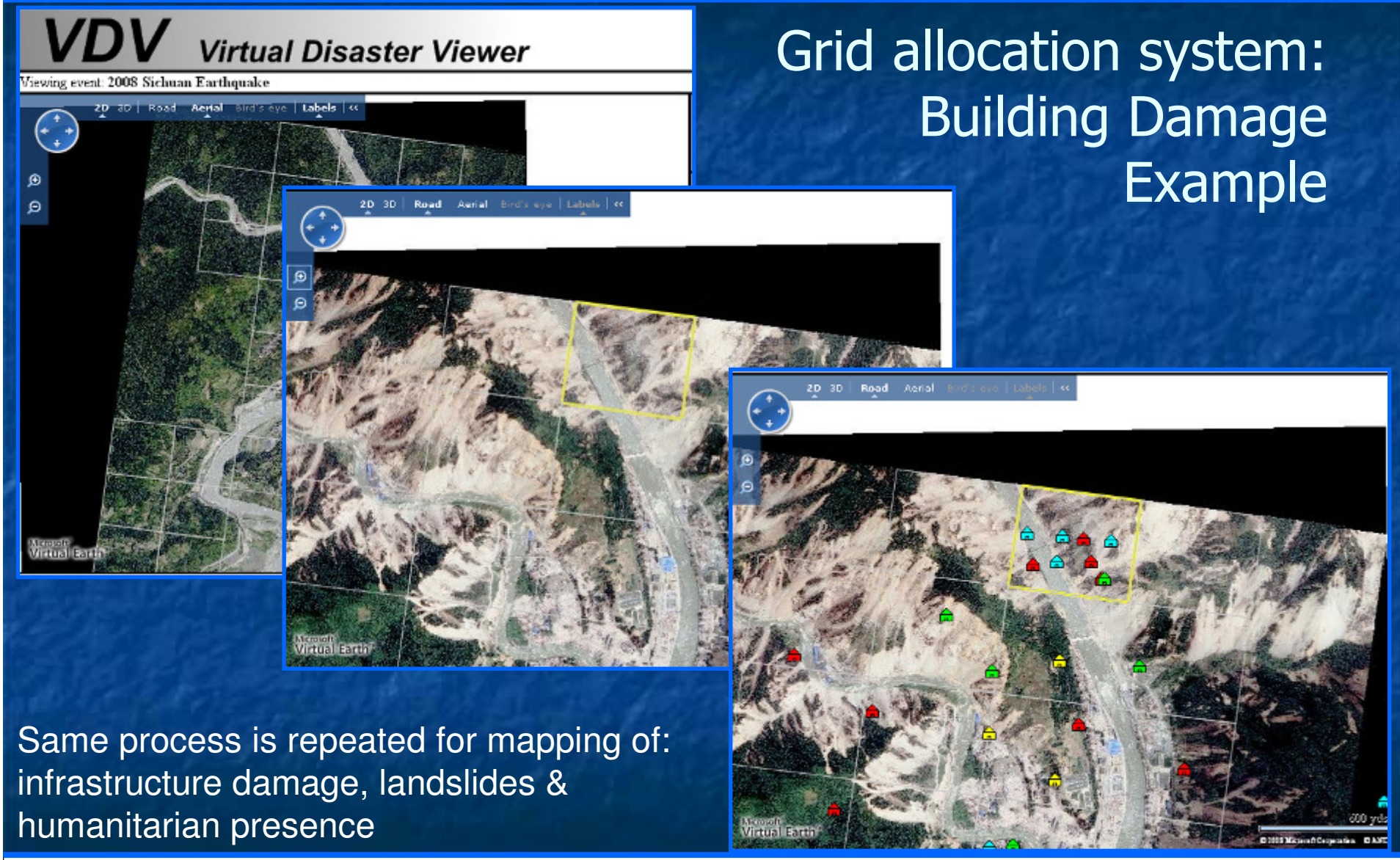
Interaction point for areas or lines

VHR Satellite imagery – Post-event

ImageCat, Ltd.

Inventors of Risk Management Technologies

Grid allocation system: Building Damage Example



Same process is repeated for mapping of: infrastructure damage, landslides & humanitarian presence

EPICentre MCEER EARTHQUAKE ENGINEERING TO EXTREME EVENTS EERI EEFIT EPSRC

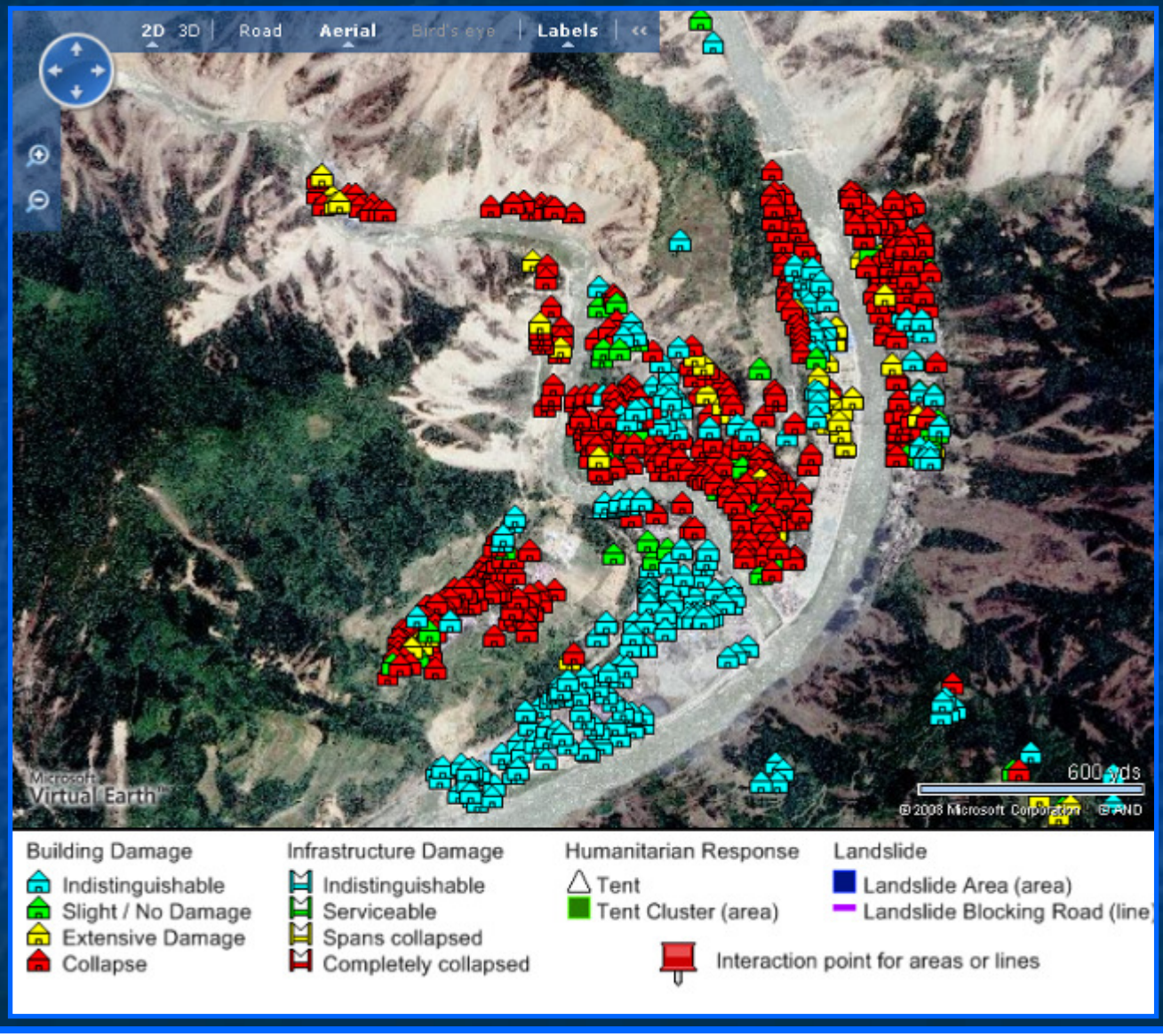

Landslides
Structural Failure
Temporary Shelters


Structural Failure


Landslides & Blocked roads

ImageCat, Ltd.

Inventors of Risk Management Technologies



Results

BUILDING DAMAGE

EPICentre MCEER EERI EEFIT EPSRC

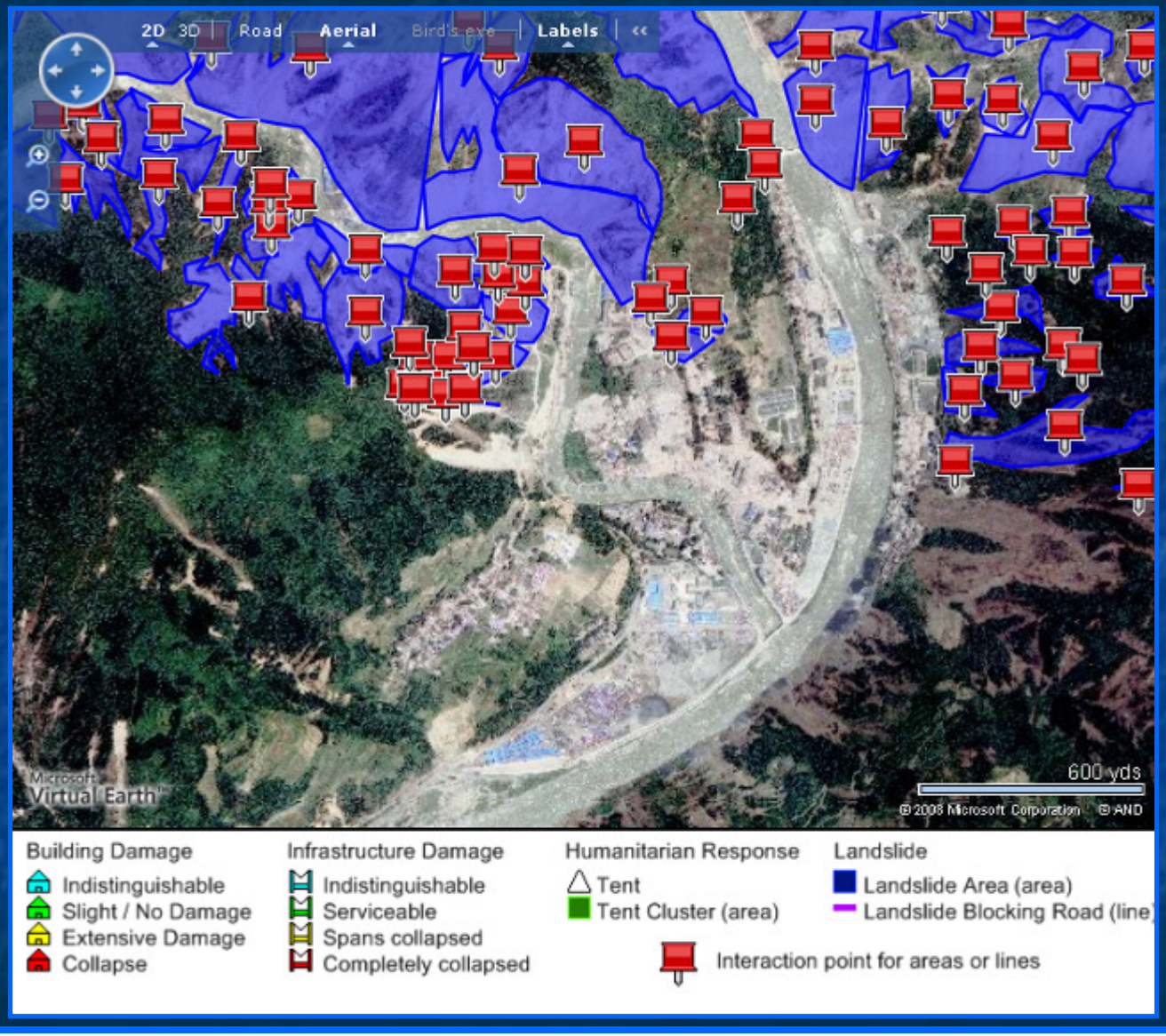
ImageCat, Ltd.

Inventors of Risk Management Technologies

Results

INFRASTRUCTURE DAMAGE

EPICentre MCEER EERI EEFIT EPSRC



Results

LANDSLIDE EXTENT

Results

TENT COUNTS

Evolution of VDV

VDV China: Damage Assessment

VDV Italy: Field Team Support

VDV Charley: Video Functionality

VDV Turkey: Data Repository

VDV Future...?

Functionality: Field Support

L'Aquila, Italy (2009)

- Field support
  - Pre-deployment planning
  - Instant upload of field photos
- Birds Eye functionality
- Ancillary data:
  - Fault lines
  - Kinematics

Evolution of VDV

VDV China: Damage Assessment

VDV Italy: Field Team Support

VDV Charley: Video Functionality

VDV Turkey: Data Repository

VDV Future...?

Functionality: Video Footage

Hurricane Charley (2004)

- Video footage:
  - Geo-referenced
  - Stores field footage from 5 days after the event
- Currently used in NSF project on hurricane recovery

Evolution of VDV

VDV China: Damage Assessment

VDV Italy: Field Team Support

VDV Charley: Video Functionality

VDV Turkey: Data Repository

VDV Future...?

Functionality: Data Repository

Izmit, Turkey (1999)

- Archive BGS/EEFIT data:
  - Field photos
  - Damage Map
- Used for dissemination at workshops
- Used in follow-up projects

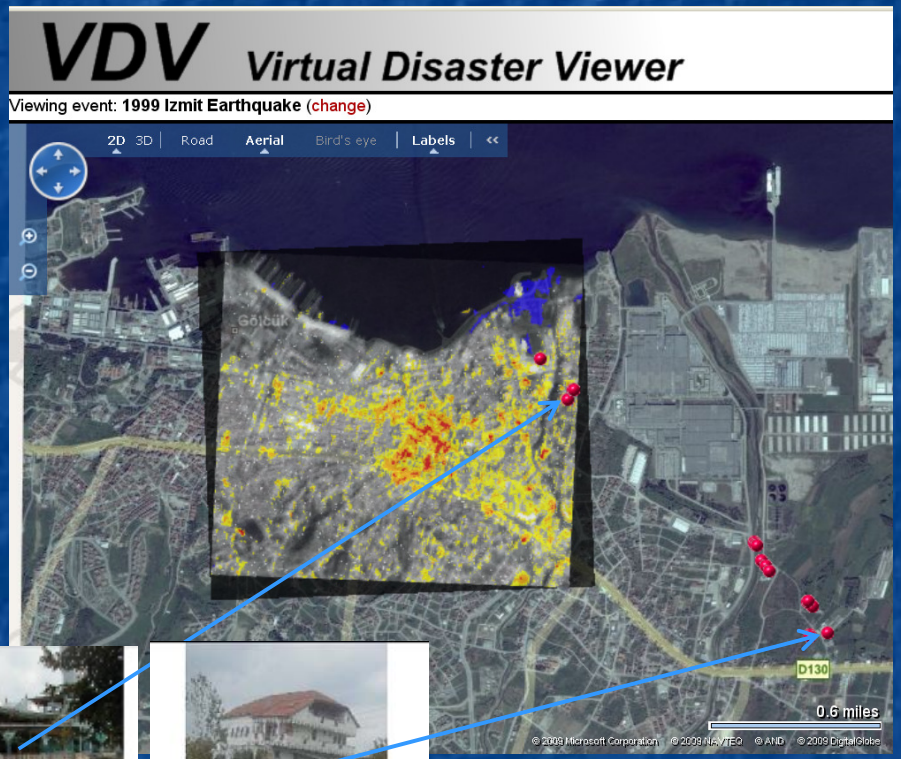



Photo courtesy of NERC. © 2009 NERC
View Comments


Photo courtesy of NERC. © 2009 NERC
View Comments

British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

EPICentre MCEER EARTHQUAKE ENGINEERING TO EXTREME EVENTS EERI EEFIT EPSRC

Evolution of VDV

VDV China: Damage Assessment

VDV Italy: Field Team Support

VDV Charley: Video Functionality

VDV Turkey: Data Repository

VDV Future...?

Future VDV

- Sumatra & Samoa currently being developed
- Validation of expert analysis & assessing experts' skills – *"superusers"*
- Extend functionality may include
  - Video field blogs & text summaries of professional findings
  - Greater use of commenting facilities
  - Develop analytical tools for automatic interpretation of results

VDV Events

Custom events created for:

- 1999 Izmit Earthquake (Turkey)
- 2004 Hurricane Charley (USA)
- 2008 Wenchuan Earthquake (China)
- 2009 L'Aquila Earthquake (Italy)

New commissions for:

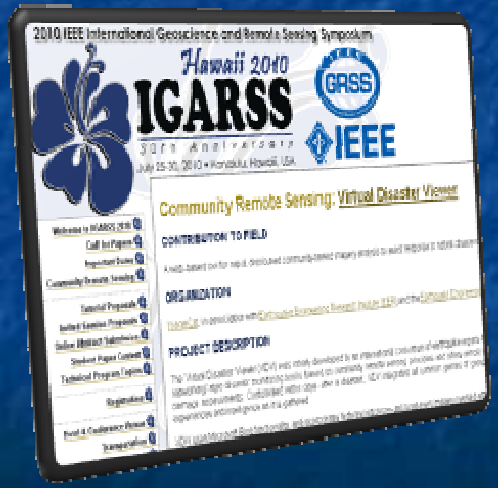
- 2009 South Pacific Tsunami (Samoa, A. Samoa, Tonga)
- 2009 Padang Earthquake (Indonesia)

The VDV Community...so far

- Initial funding from EPSRC (UK), EERI, MCEER (USA)
- Tool developed by ImageCat
- Currently being developed for inclusion in EEFIT missions to Indonesia & South Pacific
- 84 expert volunteers from 8 countries

VDV Outreach

- Conferences & Workshops
- **Wired** Magazine article: April 2009
- **Imaging Notes** Magazine article: Fall 2009

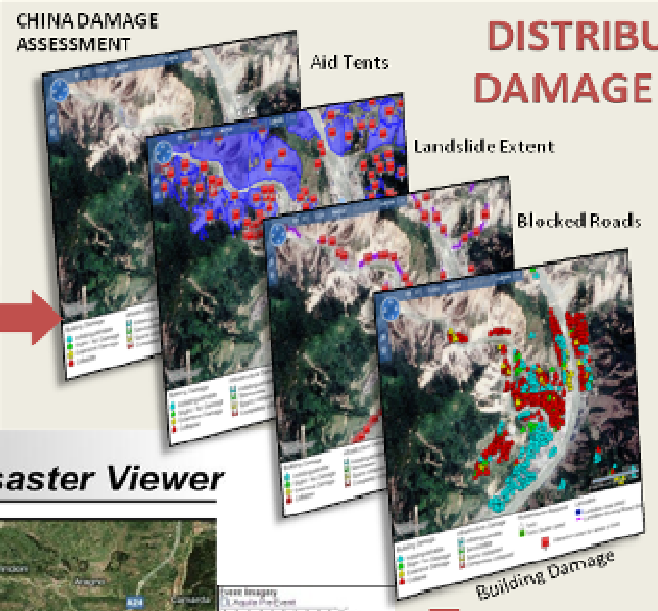


- Flagship project for *Community Remote Sensing* theme: IEEE International Geoscience & Remote Sensing Symposium (IGARSS) 2010

VIRTUAL DISASTER VIEWER (VDV)
Understanding disasters through shared knowledge

BACKGROUND

- VDV created after 2008 Wenchuan, China Earthquake
- Incorporates Microsoft BING functionality with pre & post event high-resolution satellite imagery
- Includes geo-referenced field images & video
- Ability to include event specific GIS layers
- Beta version customized for:
  - 2009 L'Aquila Earthquake (Italy)
  - 2008 Wenchuan Earthquake
  - 2004 Hurricane Charley (USA)
  - 1999 Izmit Earthquake (Turkey)



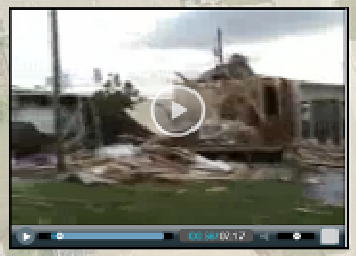
DISTRIBUTED REMOTE DAMAGE ASSESSMENT

- Disaster area divided into grid cells
- Cells assigned to community of volunteer experts for analysis of damage classes
- Nearly 100 volunteers from 3 continents
- Analysis of results is ongoing

VDV Virtual Disaster Viewer

http://www.virtualdisasterviewer.com

HISTORICAL DATA LIBRARY



Field video from Hurricane Charley

- Storage of event-specific data
- Allows public dissemination of scientific results & data
- Stores maps, field images, video & comments

FIELD TEAM SUPPORT

Field photo from L'Aquila earthquake

- VDV used to prioritize field deployments
- Ability to rapidly upload geo-referenced photos from the field
- VDV incorporates all field-collected data
- Comments facility allows specialists to share their expert knowledge

ImageCat, Inc.™

EPICentre MCEER EEFIT EPSRC

Summary

- VDV developed to fill technological need for a post-disaster data portal
- Multiple functions developed according to needs of field teams on per-event basis
- Currently broadening VDV's outreach for future funding and data partnerships
- A growing community of expert users and contributors are realising VDV's potential

Why not see what it can do for you?

What the experts say:

"The general picture of the disaster that one could obtain by working in VDV is unique and very valuable…reconnaissance teams will vastly benefit from spending some time in VDV before departing to a site" (**EERI** member #1)

"VDV as a platform has great potential for fast damage assessment"
(**UNOSAT** member)

"It was more enjoyable and interesting that I had envisaged…I would be happy to interpret more grids" (**EEFIT** member #1)

"I wish I had the option to assess all the hazards and not just one!"
(**EERI** member #2)

"With a small effort, by integrating the effort of many people, valuable information can be generated" (**EEFIT** member #2)

ImageCat, Ltd.

Inventors of Risk Management Technologies

Thank you

For more information on the **Virtual Disaster Viewer**, please contact:

John Bevington
ImageCat R&D

jb@imagecatinc.com

www.virtualdisasterviewer.com