Summary and Outcomes of EERI’s 2022 Stakeholder Workshop on Organizing Post-Earthquake Reconnaissance to Optimize Impact

Over 40 Organizations Represented
26 High Priority Coordination Goals Identified
48 Next Step Ideas for Reconnaissance Coordination Planning
New Six Category Coordination Framework

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EERI’s Learning From Earthquakes (LFE) Strategic Working Group invited about 175 earthquake reconnaissance researchers and practitioners to a half-day workshop in July 2022. The aim was to clarify important needs and potential next steps for improving earthquake reconnaissance coordination in advance of the next Big One.

Through several activities, invitees were asked to imagine themselves two years after a major quake occurs in the U.S. Participants then followed this hypothetical through three lines of inquiry:

- What impacts do they want to see resulting from the scientific reconnaissance activities conducted in the aftermath of the quake?
- During the reconnaissance period for that major U.S. earthquake, what kinds of coordination challenges or gaps do they think might affect our ability to achieve those impacts?
- Given the desired impacts and coordination needs just discussed, what coordination next steps would they or their organization most benefit from or want to be involved in in the coming months following this workshop?

**WORKSHOP OBJECTIVES**

The workshop involved three different information exchange activities, each involving different, overlapping sets of participants and interaction.

First, invitees were invited to fill out a pre-event questionnaire, which allowed anyone to give input on the topics to be covered at the workshop, even if they couldn’t attend in person. Sixty five people responded. The Working Group then analyzed this information and integrated it into the content and activities conducted at the workshop.

Second, key leaders in earthquake reconnaissance presented at a technical session at the 12th National Congress on Earthquake Engineering (12NCEE) about what their organizations are doing. Third, a series of interactive exercises and in depth discussions took place at the half-day in-person workshop, with 55 people in attendance from over 40 organizations.

This report summarizes findings from the pre-event questionnaire and workshop aspects of this effort. To organize the large amount of resulting information, the Working Group used a framework of six opportunity areas for reconnaissance coordination, as described on the next page.
<table>
<thead>
<tr>
<th>OPPORTUNITY AREAS FOR RECONNAISSANCE COORDINATION</th>
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<tbody>
<tr>
<td><strong>WORKFORCE</strong></td>
</tr>
<tr>
<td>Who plans and carries out reconnaissance</td>
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<td>research. What roles do they play, how are</td>
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<td>people trained, what is their expertise?</td>
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<td><strong>RESEARCH AGENDA</strong></td>
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<td>Knowledge creation objectives. The work that's</td>
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<td>planned and done and topics to be investigated,</td>
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<td>including when, who is involved, and how that</td>
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<td><strong>PLANS &amp; PROTOCOLS</strong></td>
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<td>How organizations will jointly approach</td>
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<td><strong>DATA COLLECTION &amp; MANAGEMENT</strong></td>
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<td>Data collection practices, both in the field</td>
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<td>and remote, including technologies, platforms,</td>
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<td><strong>OUTPUTS &amp; DISSEMINATION</strong></td>
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<td>The products of the research process and how</td>
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<td>they are disseminated. What formats, audiences,</td>
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<td>messages, and channels are used?</td>
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<td><strong>CHANGES IN POLICY &amp; PRACTICES</strong></td>
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<td>The influences that reconnaissance outputs</td>
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<td>have on the world, such as reduced risk via</td>
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<td>methods, or building practices.</td>
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There is a lack of plans for how we involve and get information to potential volunteers and inform researchers about how to join and deploy. Especially missing seems to be information technologists and potential users (e.g., emergency managers, building officials, and affected communities).

Disciplinary involvement in coordination planning and reconnaissance in general are too narrow. We want improved overall interdisciplinary cooperation during all reconnaissance phases, including IT/data sciences, public health, applied and social systems scientists.

There is a need to provide opportunities for a wide swath of engineers and researchers to participate in reconnaissance activities (especially early career, diverse A/E/C professions).

Not all of the reconnaissance workforce is sufficiently ready, especially for working in interdisciplinary teams and doing ethically- and community-grounded research. A variety of difficulties exist in assuring adequate professional development and effective knowledge transfer from one generation of researchers to the next.

A variety of difficulties exist to involving more people in reconnaissance. There is a need to provide opportunities for a wide swath of engineers and researchers to participate in reconnaissance activities (especially early career, diverse A/E/C professions).

There is a lack of plans for how we involve and get information to potential volunteers and inform researchers about how to join and deploy. Especially missing seems to be information technologists and potential users (e.g., emergency managers, building officials, and affected communities).

We want improved overall interdisciplinary cooperation during all reconnaissance phases, including IT/data sciences, public health, applied and social systems scientists.

We need a multi-disciplinary, inclusive, well-prepared, and sustainable reconnaissance workforce.

Create and publish formal reconnaissance preparation expectations and protocols.

Encourage reconnaissance organizations to be even more proactive in getting the organization and its employees more informed and ready to participate.

Encourage taking responsibility for personal readiness to participate.

Create lists of reconnaissance scientists, volunteers, organizations, and past and potential participants with contact and expertise information.

Conduct targeted recruitment to expand those lists, filling in gaps and get those people up to speed and involved.

Consider and address barriers to participation.

Start building multi- and interdisciplinary teams in advance of an earthquake.

Consider who are the vital stakeholders beyond the scientists and initiate targeted, sustained relationship-building.

Find ways to involve stakeholders beyond the scientists in reconnaissance agenda-setting, operational planning and results-sharing that will affect them in all phases.

Conduct region-specific reconnaissance coordination summits.
RESEARCH AGENDA

We want clarity and agreement about what is most important to study together to advance hazard understanding and get solutions implemented.

ADVANCE GEOPHYSICAL KNOWLEDGE
Concerns exist about site access, redundant effort, consolidating and getting information quickly into the hands of users, and assuring findings get translated into policy change.

UNDERSTAND STRUCTURAL PERFORMANCE
There are issues in the selection of sites and topics of study, for instance, how to avoid redundancies of effort, the “sexy damage” problem, and crowding at certain sites and missing data collection about “non-events” and less visible impacts.

MORE INTER-DISCIPLINARY & LONGITUDINAL RESEARCH
There are concerns about forming and operating effective interdisciplinary teams, such as overlooking opportunities to work together, getting the right discipline mix, and how to fund and merge their deep experiences into better understandings of multi-dimensional disaster causes and impacts.

PRIORITIZE RELEVANCE FOR RISK REDUCTION
There are gaps in our understanding of community, emergency manager, and other user needs, capabilities, and potential roles. Also, there is an ambiguous level of commitment to addressing equity and vulnerable population needs through our research emphases and processes.

NEXT STEP IDEAS

- Consolidate any (already available) “grand challenges” type of documents with specific application to reconnaissance.
- To reduce over-focus on high-interest sites, write up a challenge to develop a cooperative structure for triaging and distributing efforts in the field.
- Develop list of research needs, questions, and potential study designs to support creation and implementation of functional recovery standards.
- Map out potential post-event research projects in advance that can address key identified knowledge gaps, for instance in the following areas:
  - Seismology, geophysics, and hazards
  - Structural performance, including non-events and evaluating retrofits and code changes over time
  - The socially constructed nature of natural hazard vulnerability, human and economic impacts both monetary and intangible
  - Environmental aspects of damage and recovery
  - Recovery tactics and trajectories
  - Longitudinal and post-event phenomena.
There are ambiguous roles and unclear priorities and plans of approach among key reconnaissance organizations, which causes confusion and potential overlaps, gaps, and inefficiencies.

There is a lack of consistent, shared plans for formal coordination with officials at local, state and federal levels.

Concerns exist about there being adequate, stable, scalable, and equitably-distributed funding and resource support for earthquake reconnaissance research, including for smaller and/or rural events.

There are concerns about having sufficient communication systems, tools, and protocols in place, well-funded and maintained over time. There may be confusion for the public and local actors due to communication gaps within and among reconnaissance teams and responders.

All organizations conducting reconnaissance should have and proactively exchange operational plans.

Initiate a collective effort to plan for communication needs, roles, timelines, and develop the necessary supporting infrastructure and protocols within the reconnaissance research community.

Initiate an effort to identify funding sources and champions--new and existing--including the private sector and philanthropy.

Identify and better publicize opportunities to coordinate with NSF-funded research networks.

Widely publicize the USGS Circular 1423 update.
DATA COLLECTION & MANAGEMENT

We want to create new and useful data sets, methods, and tools, with centralized access points and sharable platforms so that data is accessible, impactful, and well-maintained.

USEFUL NEW DATA SETS, METHODS, AND TOOLS

There are concerns about how to avoid or jointly address data collection impediments, and a sense that we are not as prepared as we could be in advance for how to operate together in any particular region, issue, or types of sites.

NEXrNT STEP IDEAS

• Create opportunities for researchers to gather to discuss how to unify discipline- and topic-specific data collection practices.
• Develop technology solutions for identified data sharing needs.
• Better define the concept of “information exchange interface” to be implemented in future recon through LFE and clearinghouse activities, especially as it relates to the new centralized earthquake-specific NEHRP websites.
• Outline an initial set of questions for recon orgs to populate the resource parts of the website.
• Create a data structure for listing all the data-collecting organizations/teams, sites, and activities that will be filled out during active reconnaissance periods.
• Initiate a well-thought well coordinated distributed image repository.
• Work on developing an open-source, geo-located database that would allow for input and sharing of observations.
• Identify the data platforms, datasets, data collection infrastructure, etc. that the various players are using.

SHARED DATA STANDARDS, PLATFORMS, AND ACCESS

There is a lack of commonly shared platforms, standardized data collection methods, technologies, and formats, and whether we have sufficient documentation tools ready for everyone to use.

CENTRALIZED WEBSITE

There is currently no definitive information repository for any given quake, and many redundant sites. There is a lack of arrangements for decentralized data access and sharing. We need both public- and scientific-facing web pages.
OUTPUTS & DISSEMINATION

We want to create timely, enduringly-useful research products, reports, and information sharing events that meet a range of different audiences’ needs.

INFLUENTIAL & WIDELY USED PUBLICATIONS

There are a variety of concerns about creating overlapping reports, reaching only limited audiences and missing others, and other dissemination concerns such as over-proliferation of reports, timeliness, need responsiveness to different audiences.

UTILITY TO RESPONSE & REBUILDING

There is a lack of shared protocols for community interactions and joint operations for working with local non-experts. How will we manage relationships and two-way communications with locals (e.g., sharing findings and getting information from them) to maximize the usefulness of our work to their goals?

COMPREHENSIVE IMPACT MAPS & DATABASES

There is a sense that we may miss some critical data gathering opportunities, especially to document human and economic impacts.

FINDINGS SHARING EVENTS

It is not clear for events what the best formats, timing, and content are for different audiences and information-sharing purposes. There are risks of redundancy or inconsistent messaging.

NEXT STEP IDEAS

- Examine the needs of information users, including which pathways, timelines, and the necessary supporting infrastructure will best reach them, such as nightly briefings or findings summits.
- Create a standardized (and hopefully simplified) method of reporting reconnaissance findings for professional audience communities.
- Have EERI subcommittees list out critical datasets for reconnaissance teams to collect.
- Collect and streamline protocols for activation in a database to be used to direct individuals and organizations on a cohesive framework response plan.
- Consider pathways for integrating reconnaissance data into other tools such as FEMA HAZUS and RiskMAP.
- Conduct region-specific reconnaissance coordination summits a few months later after a major quake.

IMPROVED HAZARD MODELS & UPDATED RISK MAPS

It is not clear who is responsible for making sure that new data and lessons learned are integrated into updated models and maps for other at-risk locations.
CHANGES IN POLICY & PRACTICES

Our reconnaissance work supports recovery and increased resilience via new policy and construction practices backed by increased public understanding. The effectiveness of reconnaissance research and mitigation efforts improves after every quake as we learn.

INCREASED PUBLIC UNDERSTANDING

Besides technical reports, there is not enough effort placed in the assembling and publishing of less technical material for the general public.

It is unclear, given the LFE historical mission to learn from major events, how much researchers should prioritize and take responsibility for sharing information with the public.

UPDATED REGULATIONS, CODES, AND CONSTRUCTION PRACTICES

There is a lack of shared protocols for community interactions and joint operations that include local non-experts. How will we manage relationships and two-way communications with locals (e.g., sharing findings and getting information from them)?

APPLY FINDINGS TO RECOVERY AND RESILIENCE

There are challenges around how structural findings and recommended repairs can best inform the work of local builders, developers, permitting processes, FEMA Public Assistance, HUD CDBG-DR and other programs. It is unclear how findings about structural and ground failures can be integrated into post-event mitigation and recovery.

CLARIFIED R&D AGENDA

There is no clear plan for how new data and lessons learned will be used to iterate priorities and resource allocation going forward for the reconnaissance research community, nor to evaluate and iteratively improve how we work together and influence science and society.

NEXT STEP IDEAS

- Share report backs and publications for non-technical audiences to build awareness and facilitate momentum in implementing better codes/resilient buildings.
- Create organizational and inter-organizational response plans for intentionally engaging the public.
- Improved “peace time” communications with social and main media outlets on messaging.
- Develop a database and/or archive of post-event After-Action Reports and lessons learned.
- Initiate better coordination between FEMA Public Assistance/HMA/406 Mitigation and FEMA NEHRP/EERI regarding post-event recovery advisories, Community Education and Outreach (CEO), and PA/406 processes.
EERI RECONNAISSANCE
ROLES & OPPORTUNITIES

WORKFORCE

Training: Grow in-person and virtual training opportunities for EERI members, especially by leveraging training modules developed by partners to train EERI members and potentially collaborate on creating new ones.

Pipeline: Engage early career members in the LFE program to build the reconnaissance workforce pipeline, for instance through the EERI Younger Members Committee, the Virtual Earthquake Reconnaissance Team, LFE Travel Study Program, and LFE subcommittees.

Recruitment: Conduct targeted outreach to recruit/partner with individuals with essential knowledge and skills that are currently missing from the workforce (IT, emergency managers, building officials, and affected communities).

Research Agenda

Topic-Focused Reconnaissance Agendas: LFE subcommittees can develop important topics for reconnaissance studies agendas based on their topics of expertise (e.g. housing, schools, etc.). New LFE subcommittees could be formed around identified research areas for which EERI members have special interest and skills.

Research Needs Workshops: EERI will convene post-earthquake research needs workshops to create research agendas based on impacts, following how it organized workshops for the 2010 Haiti Earthquake, 2010 Chile Earthquake, the 2011 Tohoku Earthquake and Tsunami, and the 2010-11 Canterbury Earthquake Sequence. More recently, EERI hosted one-year anniversary events for the 2018 Alaska Earthquake and the 2019 Ridgecrest Earthquake Sequence.

PLANS & PROTOCOLS

State Earthquake Clearinghouses: As a managing partner of several state earthquake clearinghouses, EERI will continue to update and improve clearinghouse response plans and conduct training and outreach to ensure the community is aware of plans and how to engage. Also through state clearinghouses, EERI will work with state partners to outreach to absent stakeholders such as emergency managers and GIS professionals.

Reconnaissance Activation Exercises: Given EERI’s role in state clearinghouses and the NEHRP Post-Earthquake Investigations Plan, EERI is well-positioned to lead regular earthquake exercises to practice the community response to a US earthquake. These should address the needs of different subsets of the reconnaissance community, for instance by holding discipline-, region-, or reconnaissance phase-specific exercises.

Coordination Workshops: With its multi-disciplinary membership, EERI is a natural community convener and can works with partners to organize follow-up events to tackle some of the major coordination concerns identified in this report and elsewhere.
MORE EERI ROLES

DATA COLLECTION & MANAGEMENT

Virtual Clearinghouse Websites: EERI quickly stands up virtual earthquake clearinghouse websites after quakes with a significant reconnaissance response. These websites go live quickly and serve as a good short-term platform for sharing preliminary reconnaissance data.

Long-term Data Curation: EERI recognizes that other partners have more resources to support data curation and long-term archiving. EERI will work with partners such as DesignSafe, FEMA, USGS, and state geological surveys to develop best practices for long-term data storage, access systems, and curation archiving.

Reconnaissance Data Papers: EERI will encourage the publication of data papers on curated reconnaissance datasets through its flagship peer-reviewed publication, *Earthquake Spectra*.

OUTPUTS & DISSEMINATION

Reconnaissance Briefing Webinars: EERI hosts multi-disciplinary reconnaissance briefing webinars to update members and the broader reconnaissance community on preliminary findings. Webinars often include relevant partners conducting reconnaissance.

Meeting and Conference Sessions: EERI organizes technical program sessions on recent reconnaissance findings at its annual meetings, the National Earthquake Conference, and the National Conference on Earthquake Engineering.

Impacted Community Outreach: EERI is committed to sustained engagement with earthquake-affected communities throughout the clearinghouse activation process (pre-event, during and after reconnaissance) through findings reports, briefings, and presentations.

Reconnaissance Reports: EERI teams produce interim and conclusive scientific reports and cooperate in creating multi-organization summary reports.

CHANGES IN POLICY & PRACTICES

Public Policy and Advocacy Committee: Through collaboration between LFE and EERI’s Public Policy and Advocacy Committee, EERI can leverage earthquake events to advocate for national advances in seismic safety building EERI Board-approved Policy Position Statements.

The PPA Committee has also developed training modules for EERI members and the broader community to become citizen advocates for these issues. Based on earthquake impacts, the PPA can also make specific policy recommendations that are relevant and timely.

EERI Regional Chapter Advocacy: With training from the Public Policy and Advocacy Committee, EERI’s regional chapter members are well-positioned to advocate for local change based on lessons learned from earthquakes.