DAY 1 SLIDES
Welcome!—and workshop overview

Joe Wartman
Director

RAPID Facility Workshop
24 July 2018, Seattle, WA

NSF Award Number: CMMI 1611820

Welcome to Seattle
Welcome to Seattle

Some fun things to do near here:

- Take the light rail to capital hill or downtown (or airport)
- Rent a “Lime” or “Ofo” bike on the Burk-Gilman trail
- Rent a kayak at Aqua Verde, or a canoe at UW waterfront center
- Walk to University Village

Welcome to UW and vicinity

Google: “uw food services summer”
Welcome to UW

https://tinyurl.com/yaoydty5

Contact information during the workshop:

Jake Dafni 1-207-751-7378
Jeff Berman 1-206-616-3530
Campus police: 911
Workshop Overview

Main Objectives

- \textit{Learn how to use the RAPID’s instrumentation}
- Understand how users can access the facility
- Provide a basic understanding of and best practices for reconnaissance missions
- Galvanize the community around critical research needs and next-generation reconnaissance strategies identified in the NHERI/RAPID science plan
- Inspire research ideas involving the use of the facility, and data developed with facility resources
- Meet and interact with others in the natural hazards and disaster research communities

\textit{You were selected as likely users of the facility}
Workshop Overview

Other items

• Wi-fi

Username:  event0380
Password:  56Va=84Bu=26Sm

• Laptops
• Designsafe-CI account
• Dress comfortably (and casually)
• Save hardcopies of your receipts
• We need you help to improve the workshop in future years
Introduction to the RAPID Facility

Joe Wartman
Director

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RAPID Facility Team

Kurtis Gurley (UF), Wind Hazards Specialist
Jennifer Irish (VT), Coast Hazards Specialist
Laura Lowes (UW), Structural Engineering Specialist
Jeffrey Berman (UW), Site Operation Director
Scott Miles (UW), Social Science Specialist
Michael Olsen (OSU), Technical Director
Ann Bostrom (UW), Social Science Specialist
Troy Tanner (UW-APL), IT and Data Director
Jake Dafni (UW), Site Operations Manager
Joseph Wartman (UW), Director
RAPID Facility Mission and Values

◆ The RAPID facility provides investigators with the equipment, software, and support services needed to collect, process, and analyze perishable data from natural hazard events. The facility supports natural hazard and disaster researchers through training and educational activities, field deployment services, and facilitating engagement between scientists, engineers, stakeholders, and the public.

◆ We promote reconnaissance-based science, shared resources, open data, interdisciplinary research, community engagement, and innovation to reduce the adverse impacts of natural hazards.

RAPID Facility Strategic Activities

To achieve its mission, the RAPID facility engages in the following strategic activities.

◆ Acquiring, maintaining, and operating state-of-the-art data collection equipment

◆ Developing and supporting mobile applications to support interdisciplinary field reconnaissance

◆ Providing advisory services and basic logistics support for research investigations

◆ Facilitating the systematic archiving, processing and visualization of acquired data in DesignSafe-CI

◆ Training a broad user base through workshops and other activities

◆ Engaging the public through citizen science, as well as through community outreach and education
1906: The Dawn of Natural Hazard Reconnaissance in the U.S.

- Three days after the earthquake, Governor Pardee appoints a California State Earthquake Investigation Commission (lead by A. C. Lawson) to unify the work of scientific investigation teams

- "Lawson Report" (1908) - a detailed, benchmark compilation on scientific investigation of the earthquake and the damage it caused


1906: The Dawn of Natural Hazard Reconnaissance in the U.S.

- Inspired new, fundamental understanding of earthquakes: e.g. ground movement surveys leads H. F. Reid to introduce the landmark "theory of elastic rebound"

- Post-event mapping across the city begins to provide a coherent story that explains damage concentrations: the notion of "site effects"

Origins of Social Science Disaster Reconnaissance Research

- First systematic social science study of disaster by Samuel Prince: 1917 Halifax Explosion.

- 1949-1954: Charles Fritz (w/ R.A. Enrico Quarantelli) at University of Chicago studied divergent behavior (panic) in disasters.

- 1963: Enrico Quarantelli, Russell Dynes and Eugene Haas founded the Disaster Research Center (DRC) at Ohio State University. "Formalized" social science recon research.

- DRC initially supported by U.S. Office of Civil Defense to inform cold war civil defense efforts.

- First DRC reconnaissance for the 1964 Alaska earthquake

1971: EERI Multidisciplinary investigation of the San Fernando quake

- Multidisciplinary investigation addressing seismology, emergency operations, lifelines, structural and geotechnical engineering, policy, and governmental response

- Leads to the Earthquake Engineering Research Institute’s “Learning from Earthquakes” program
GEER is a volunteer organization of experts scientists from academia, industry, government organizations, and non-profit organizations that responds to extreme events, conducting detailed reconnaissance and documenting observations. 
Source: GEER

EERs: "A humanitarian mission in the broadest sense" (Los Angeles Times)
Recent Reconnaissance Example: Spatiotemporal Variability of Storm Surge

**Issue:** There is dramatic variability in surge-related damage along the coast, but detailed information on surge variation in space and time was not attainable.

**Approach:** Rapidly deployable onshore water level sensors are installed at moderate spatial resolution along the coast. 117 sensors deployed in Texas prior to Hurricane Ike (2008)

**Outcomes:** (1) Advanced understanding of storm surge timing and spatial distribution; and (2) Detailed dataset for surge prediction validation

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Recent Reconnaissance Example: Impact of Irma on Residential Construction

**Issue:** Majority of insured loss in < Cat 3 hurricanes is associated with roof cover and fenestration losses on residential housing. Capture of perishable data on large sample size critical. Age of roof strongly correlated with damage

**Approach:** UAVs used to canvas coastal neighborhoods that experienced highest winds. Tax appraise database used to determine roof age. Ground teams document fenestration damage. FEMA wind maps accessed for hazard intensity

**Outcome:** Statistically significant assessments of roof cover performance as a function of age and maximum wind speed
Recent Reconnaissance Example: Perceptions of Mexico’s Earthquake Early Warning

**Issue:** How do Mexico City residents perceive SASMEX (earthquake early warning system)? How did they respond to warnings for the September 2017 earthquakes relative to the system’s performance?

**Approach:** Interdisciplinary team of seismologists, sociologist, psychologist, and urban geographer. In-depth interviews. Convenience sample of the public, government officials, academics, business, & NGOs.

**Outcome:** Recommendations for earthquake early warning system development in the United States published in Science.


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Recent Reconnaissance Example: Rapid Assessment of Post-Earthquake Building Damage

**Issue:** Techniques are needed to enable rapid assessment of building damage (i.e. red, yellow/green tagging) in the aftermath of earthquakes. Rapid assessment speeds recovery and reduces the impact of earthquakes on communities.

**Approach:** Collect still image, SfM, and lidar data of earthquake damaged buildings to support development of rapid damage assessment methods.

**Outcome:** Next generation of damage-detection algorithms

Still image of structural damage (Haiti 2010)

Damaged region (a), detected spalling (b), cracking (c), vertical reinforcement (d) and horizontal reinforcement (e)

Images from Paal et al. (2015)

Terrestrial lidar scan and reconstruction of temple (Nepal 2015)

Automated crack detection using lidar data

Images from Shakya and Barbosa (2017)
Recent Reconnaissance Example: Impact of Co-Seismic Rockfall on Buildings

- **Issue:** Landslide risk practices require that the vulnerability of communities to landslides be known, but information was not available to support such assessment.

- **Approach:** Lidar-scan ~30 homes/sites damaged by rockfall during the Christchurch earthquake, and relate impact energy to building damage indices; geotechnical-structural collaboration.

- **Outcome:** A series of rigorous, data-driven fragility relationships to support risk assessment and land-use policy.

Value of Natural Hazard Reconnaissance Data

- Data generated by an extreme event is often "perishable" — and thus, must be collected quickly.

- Disaster data sets include the real-world complexities (e.g., interplay between natural, human, and built systems) that allow us to better understand and to quantify the socio-technical dimensions related to damage, restoration, and resiliency of the built environment.

- Such data is difficult to duplicate in the laboratory.

- Once collected, these data can be used to:
  - develop new fundamental discoveries and insights
  - test and verify simulation models
  - reduce uncertainties in probabilistic models.
Rationale for the RAPID Facility

- There was a single facility or organization with access to the wide range of field equipment required to document complex natural hazard events. Teams seeking different instruments have had to employ equipment specialists from multiple organizations to collect data from single events.

- Organizations have different standards for collecting (practices and equipment), archiving, sharing, and publishing data.

- There was no single data gathering software application; instead, a wide range of stand-alone, incompatible programs and applications were used in reconnaissance missions.

- There is no facility specifically focused on the unique needs inherent with fast-tract multidisciplinary reconnaissance missions.

- There was no consensus-based science plan or well-recognized statement of research needs to help guide the community’s post-event data collection efforts. Data collection often reflects investigator’s specific research interests rather than community needs.

"Because of limitations in resources and training...reconnaissance is often cursory and anecdotal" (2011)

Enabling the Next Generation of Natural Hazards Reconnaissance

```
Liquefaction-Induced Building Movements
2011 Tohoku, Japan EQ (Mw = 9.0)
```

- **Fundamental insights**
- **Critical data for validation**
- **Lots of highly perishable data**
- **2D “point” data**
- **Manual measurements**
- **10 cm resolution**

Courtesy of J. Bray, (2017) Ishihara Lecture, Simplified procedure for estimating liquefaction-induced building settlement

Tokimatsu et al. & GEER (Ashford et al. 2011)
Enabling the Next Generation of Natural Hazards Reconnaissance

- Large amount of high-quality data
- High-resolution (<1 cm), systematic data collection
- 3D (and 4D)
- Automation
- Efficient data collection via the RApp mobile application
- Shared resources, broadened user base

2016 Kaikoura, New Zealand Earthquake

• Geo-referenced data sets that can be later analyzed and interrogated
• Open data archived in DesignSafe
Enabling the Next Generation of Natural Hazards Reconnaissance

Example Eyewitness Interview Transcript

Amanda Smith, eyewitness. Newstalk 20110326.

1. Right, let's start with February 22, can you describe your key experiences on that day?

4. I was actually at home, ironically, because the Christchurch City Council was having its first dedicated earthquake recovery meeting so I would have started work at 1, so I was always haunted by that, but I was in a house in Fairlie getting him off for a nap and I went theses in the hallway. The house started to explode around us. I just took him to the body in the middle of the room and things just fell around us. We were in this little bubble in the middle and it was horrific because everyone has that internal counter and you thought 'Oh my god, this is going to be too long, it's supposed to stop.' It got quieter and stuff was just dropping in the hallway. I can just remember knowing it was horrific and trying to think about my kid and I can remember my...
Enabling the Next Generation of Natural Hazards Reconnaissance

Next Generation Natural Hazards Reconnaissance
Complementing Laboratory Instrumentation

Obtain 3D high-resolution point cloud models for NHERI experiments

- Record damage
- Determine precise instrument locations
- Benchmark experiments to field observations
- Develop damage detection and load history determination methods
RAPID Timeline

**Year 1**
Community Input and Resource Requirement Development

- September 2016-September 2017
  - Developing facility headquarters
  - Hiring staff
  - Workshop
  - Science plan revision
  - Specification development
  - Trial equipment deployment and testing
  - Coordination with DesignSafe
  - Facility operating documents
  - Advertising
  - Mobile app development

**Year 2**
Acquisition, Commissioning and Training

- September 2017-September 2018
  - Procurement and commissioning
  - Staff training
  - Facility operating plan and site users manual
  - User training workshops (4)
  - REU program
  - IT cyber security
  - RApp development and testing
  - Fiscal operating plan
  - Proposal support

**Years 3-5**
User Service, Field Operations, Continued Training

- September 2018 and beyond
  - Supporting field missions and data use/reuse
  - Training
  - Maintenance
  - Updating
The RAPID’s Roles

◆ Maintain and calibrate equipment for you to use
◆ Provide staff assistance for use when necessary
◆ Assist with proposal preparation:
  ○ Advice
  ○ Integration with science plan
  ○ Provide budget information for RAPID equipment and staff
◆ Logistical support:
  ○ Arrange and assist with equipment delivery
  ○ RApp (RAPID App) to help with team organization/coordination

◆ Outside our scope:
  ○ Coordinating reconnaissance missions
  ○ Setting the scientific objectives for reconnaissance missions
  ○ Providing funding for reconnaissance

Where can the RAPID Equipment be Deployed? (Anywhere!)

◆ Locations following natural hazards:
  ○ Priorities are wind events, earthquakes, and tsunamis but others possible
  ○ Immediate response
  ○ Recovery monitoring
  ○ Pre-event
◆ To supplement instrumentation at large-scale experimental facilities
  ○ Priorities are tests at other NHERI facilities
◆ Other uses we haven’t thought of: Just ask
◆ Focus on short term deployments:
  ○ Longer term deployments possible
  ○ More than two weeks will require a user agreement to ensure equipment can be returned for high priority use if it is needed
Who can use the RAPID? (You can!)

◆ Open to anyone:
  o Academics, government agencies, private industry, etc.
  o Different rates for NSF vs. non-NSF (RAPID equipment is subsidized by NSF)
  o Different priority for equipment requests
  o We aim to accommodate all requests

◆ NSF Grants:
  o RAPID equipment can be requested for any NSF research
  o Reconnaissance possibilities:
    ▪ RAPID grants
    ▪ NSF supported reconnaissance organizations (GEER [http://www.geerassociation.org/], ISEER [https://hazards.colorado.edu/news/center-news/102])
    ▪ Other NSF proposals

User Training and Site User Manual

◆ User training:
  o Recommended but not required
  o 1-Day overview workshops
    ▪ Joint GEER-RAPID training in San Francisco, week of September 17
    ▪ New 2019 slate being developed
  o 4-Day intensive hands-on workshops (at RAPID headquarters in Seattle)
    ▪ Creates cadre of RAPID equipment experts
    ▪ List of participants and expertise will be maintained on https://rapid.designsafe-ci.org/

◆ Site user manual:
  o In progress, will be posted on the RAPID website by September 1
What to Think About Before Requesting Equipment

- Is the project funded or is it in the proposal stage?
- Will our equipment meet your needs?
  - Review the available equipment and capabilities ([https://rapid.designsafe-ci.org/equipment-portfolio/](https://rapid.designsafe-ci.org/equipment-portfolio/))
- Do you know how to use the equipment you want?
- Will you need field assistance from RAPID staff (required for certain equipment)?
- Will you need assistance processing the data (especially lidar data and development of point cloud models)?

How to Request RAPID Equipment?

- **Steps:**
  1. Go to the RAPID website at [https://rapid.designsafe-ci.org/](https://rapid.designsafe-ci.org/)
  2. Determine the desired equipment from the equipment portfolio at [https://rapid.designsafe-ci.org/equipment-portfolio/](https://rapid.designsafe-ci.org/equipment-portfolio/)
  3. Check that it is available for the dates you want
     - New page coming by June showing deployment of RAPID equipment in a calendar format
  4. Complete the preliminary equipment request form at [https://rapid.designsafe-ci.org/](https://rapid.designsafe-ci.org/)
     - Button coming to our main page soon
  5. Wait for us to contact you (less than 24 hours)
  6. Work through scheduling, logistics, and rates with us
  7. Complete user agreement
RAPID Priorities for Equipment Requests

- The RAPID will make every effort to accommodate all requests
- When we can’t, this table sets our priorities
- We have and continue to establish MOU’s with other organizations that have similar equipment to help handle intensive drawdowns

<table>
<thead>
<tr>
<th>Data Collection Activity</th>
<th>Near-Term Response to a Priority Natural Hazard</th>
<th>Recovery Phase for a Priority Natural Hazard</th>
<th>Experiments at NHERI Facilities</th>
<th>Other Natural Hazards</th>
<th>Other Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>User</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSF Supported</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Non–NSF Federal Agency</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

1 Priority Natural Hazards: Hurricanes, Tornados, Other Windstorms, Storm Surge, Earthquakes, Tsunamis, and Landslides

Equipment Delivery

- The RAPID will organize the shipping of equipment
  - It may meet you in the field
  - You may retrieve from the UW
  - Our staff may meet you with it
  - You may receive a hand-off from another reconnaissance team
- You will be responsible for some of the delivery costs
- The site user manual (coming to the RAPID website) will have detailed requirements
- The RAPID will help with import/export controls
  - Instrument specific
  - Limitations on certain countries
User Agreements and Insurance

- Users are required to sign a user agreement:
  - Safe conduct
  - Read user manual
  - For equipment operated by you:
    - Transfer of liability to you (your agency and/or university)
    - Agreement to replace if lost or damaged in your care

- Insurance (details still forthcoming)
  - RAPID’s insurance will cover:
    - Use by our staff
    - Equipment during delivery
  - User’s may need to:
    - Ensure your agency will cover liability and damage/loss when under your use
    - Most universities have general policies that will cover your use of our equipment
  - See updates on RAPID’s website coming by September 1

User Rates and Fees (tentative)

- Final rates will be published by September 1
- Preliminary rates (NSF users, for illustration only):
  - Equipment: $5 (small UAV) to $500 per day (long range lidar)
  - RAPID staff in field: $500 per day + travel
  - RAPID data processing (see next slide): $750 per day
- 8% overhead on all costs
- Estimated typical mission cost:
  - Long range lidar + medium UAV for 5 days in field without RAPID staff:
    - Equipment: $2750
    - Shipping: $1000 (conservative)
    - Overhead: $300
    - Total: $4050
Data Processing

- Included for all NSF users at no cost:
  - Registration of lidar data
  - Upload of raw (and registered) data to DesignSafe
- RAPID HQ at UW has:
  - High speed processing computers
  - 3D CAVE for visualization and inspection of data sets
- Additional processing options (point cloud development from lidar and/or images):
  - You or your students/associates come to RAPID HQ, or borrow a high-power laptop computer and work at your location
  - Work within the DesignSafe cloud environment
  - Ask us to process

Questions?
The RAPID Facility Science Plan

Jeff Berman
Operations Director
University of Washington

RAPID Facility Workshop
24 July 2018, Seattle, WA
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Outline

◆ NHERI RAPID Facility Community Workshop – Jan 2017
  o Aims
  o Participants and Activities
  o Outcomes
◆ NHERI Five-Year Science Plan – released Jul 2017
◆ NHERI RAPID Facility Science Plan
  o Grand Challenges
  o Informing Models
  o Strategic Approaches
Workshop Aims

- Identify data gathering opportunities and facility user needs
- Develop prioritized list of equipment for RAPID
- Identify challenges to disaster reconnaissance research (DRR) data collection and reuse
- Develop prioritized list of reconnaissance support needs

RAPID Science Plan

The principal scientific goal of the RAPID is to inform natural hazards computational simulation models, infrastructure performance assessment, and socioeconomic impact analysis by supporting the collection, development, and assessment of high-quality disaster data sets.
Science Plan: Grand Challenges for Natural Hazards Engineering and Science

- Community Resilience
- Hazard and Impact Simulation and Decision Making
- Mitigation
- Design Tools

Adapted from "Science Plan: Grand Challenges for Natural Hazards Engineering and Science"

Science Plan: Grand Challenges for Natural Hazards Engineering and Science

- Community Resilience: RAPID tools
  - Enable the systematic collection and archiving of integrated, interdisciplinary post-disaster data pertinent to engineering and the natural and social sciences, needed to evaluate the utility and validity community resilience frameworks
- Hazard and Impact Simulation and Decision Making
- Mitigation
- Design Tools
Science Plan: Grand Challenges for Natural Hazards Engineering and Science

- Community Resilience
- Hazard and Impact Simulation and Decision Making:
  RAPID elements address the need for
  - extensive data sets for model development and testing of complex simulations, including high-quality data (e.g., initial and boundary conditions) at multiple geospatial scales.
- Mitigation
- Design Tools

RAPID

Science Plan: Grand Challenges for Natural Hazards Engineering and Science

- Community Resilience
- Hazard and Impact Simulation and Decision Making
- Mitigation: RAPID's multi-scale tools provide
  - the means to develop computational models and construction standards capable of identifying critical vulnerabilities and quantifying the impacts of risk reduction measures, as well as
  - post-event data needed to evaluate loss estimation methodologies, such as HAZUS-MH, and the effectiveness of mitigation approaches.
- Design Tools.

RAPID
Science Plan: Grand Challenges for Natural Hazards Engineering and Science

- Community Resilience
- Hazard and Impact Simulation and Decision Making
- Mitigation
- Design Tools: RAPID tools provide
  - high-quality performance data to define model relationships (e.g., fragility functions) for performance-based design.

Science Plan: Strategic Approaches – Acquire and integrate data over a range of temporal and spatial scales, across disciplines

EARTHQUAKE EXAMPLE ILLUSTRATING LINKS BETWEEN STRATEGIC APPROACHES, INSTRUMENTATION, AND DATA COLLECTION PRODUCTS

Overarching Strategic Reconnaissance Research Approaches
1. Collect data across temporal scales, e.g., evolution of co-seismic landslide with time, recovery and return to home for affected persons
2. Collect data across geospatial scales, e.g. community-level and site-specific damage mapping, regional geology trends and site period
3. Collect data and integrate across disciplines, e.g. collect building damage and socio-economic data in identical affected communities
Science Plan: Strategic Approaches – Acquire and integrate data over a range of temporal and spatial scales, across disciplines

Overarching Strategic Reconnaissance Research Approaches
1. Collect data across temporal scales, e.g., evolution of co-seismic landslide with time, recovery and return to home for affected persons
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UAS lidar: Aerial mapping of ground failure to obtain high-resolution, bare-earth DEM
UAS camera: Aerial mapping of building damage patterns to obtain orthophotos and DEM
Camera and geomatics control: SHM survey to map building damage to obtain 3D model for interrogation
iPad App: Interview affected persons to obtain social science data
Terrestrial lidar: Map ground failure and affected structures to obtain high-resolution DEMs
AUV/single beam: Submarine mapping to obtain bathymetry

Storm-induced landslide
Undamaged building
Wind-damaged building
Storm surge inundation
Levee damage and erosion
Storm-induced erosion and deposition
DesignSafe: Introduction to DesignSafe

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A Cyberinfrastructure for the Natural Hazards Community

Slides courtesy of Ellen M. Rathje, Director, DesignSafe-ci, and Professor, University of Texas
What is DesignSafe?

◆ A web-based research platform that provides computational tools to manage, analyze, and understand critical data for natural hazards research

DesignSafe Vision

◆ A CI that is an integral part of research discovery
  − Support end-to-end research workflows and the full research lifecycle, including data sharing/publishing
  − Cloud-based tools that support the analysis, visualization, and integration of diverse data types
◆ Amplify and link the capabilities of the NHERI partners and natural hazards researchers around the globe

NHERI: Natural Hazards Engineering Research Infrastructure

◆ NSF-funded, shared-use research infrastructure to enable transformative research in natural hazards engineering
  o Network Coordinating Office (NCO)
  o Cyberinfrastructure (CI)
  o Seven shared-use experimental facilities (EF)
  o Natural hazards reconnaissance facility (RAPID)
  o Computational Modeling and Simulation Center (SimCenter)
DesignSafe Components

◆ Research Workbench
  o Data Depot
  o Workspace
  o Reconnaissance Portal

◆ Learning Center
  o Training resources and student engagement

◆ NHERI Facilities
  o Access to information about all NHERI facilities

◆ NHERI Community
  o News and online Slack community

Data Depot Features

◆ Different areas:
  o My Data (Private)
  o My Projects (Semi-Private, Collaborative)
  o Published (Publicly accessible, curated)
    o Community Data (Publicly accessible, uncurated)

◆ Upload files/folders via web browser, cloud service providers, or bulk transfer (Globus)

◆ Manage, preview files within Data Depot

◆ Data curation and publishing
Data Management Philosophy

- **Vision:** Allow users to easily store, share, document, and publish the data associated with their research, supporting the full data lifecycle
  - Focus on achieving community’s research goals
  - Flexible data models that support how researchers organize their data
- Different data models for different types of projects:
  - Experimental, Simulation, Hybrid Simulation, Field Reconnaissance, and Other

Workspace: Data analysis

Apache Spark is a big data processing framework designed to simplify data analysis by distributing its complex tasks across a cluster of machines. It is used to perform complex analyses on large datasets, including machine learning algorithms, graph processing, and data streaming. The Spark application is designed to be run on top of other systems such as Hadoop, and it can read data from various sources, including relational databases, flat text files, and Hadoop sequence files. Spark provides a high-level API for data manipulation, and it can execute tasks in parallel across a cluster of machines. This makes it possible to perform complex operations on large datasets in a matter of minutes. Spark is widely used in fields such as data science, machine learning, and big data analytics.
Interactive Interface with Data

From Prof. S. Brandenberg, UCLA

Interactive Interface with Data

From Prof. S. Brandenberg, UCLA
Recon Portal → Data Depot

HazMapper: Landslide Distribution

*Interactive Map Viewer of Event Data*
DesignSafe: Open for Business

www.designsafe-ci.org

- Capabilities available to the global natural hazards research community—account registration is free
- Training webinars
  - Overview webinars, as well as detailed training on Jupyter, etc.
  - Archived training webinars available at https://www.designsafe-ci.org/learning-center

Please share your feedback, ideas, experiences!

Ellen Rathje e.rathje@mail.utexas.edu
Small Unmanned Aircraft Systems (UAS) or "Drones" Use in the U.S.

- Business and Research: Need a remote pilot certificate (RPC)
  - Operate under FAA Part 107 or a Certificate of Waiver or Authorization (COA)
- Hobbyist: Do not need an RPC

"Small" implies drones less than 55 pounds
Some of the FAA Basic Rules (14 CFR part 107)

Operating Rules

- **Class G** airspace
  - Class A, B, C, D, E – need authorization from air traffic control
  - Check with B4UFly App
- Stay within line-of-sight
- Fly under 400 feet
- Fly during daylight hours
- Yield right-of-way to manned aircraft
- Do not fly over people
- Do not pilot from a moving vehicle

*Can request a waiver for all of above

Real-World Issues with Drone Deployment in Post-Disaster Settings

- In post-disaster settings, local officials may prohibit drone flights to accommodate for increased low altitude helicopter flights
- Rules and regulations vary by country and must be checked before deploying for a foreign mission
- Bad weather (e.g., rain, snow, fog) can ground flights, or produce poor quality images
- Batteries must be hand-carried on flights; international carry on rules vary
- *It is important to have a contingency plan in the event drones can not be used*
Supplementary Materials and References: Rules and Regulations

Related Rules & Regulations
Becoming a Drone Pilot: U.S. Requirements

- At least 16 years old
- Read, speak, write, and understand English
- Physically and mentally able to operate a small UAS
- Pass initial aeronautical knowledge exam at FAA-approved knowledge test center (KTC)

Becoming Pilot: Application Process

**Step 1:** Schedule an appointment with a KTC

- [https://www.faa.gov/training_testing/testing/media/test_centers.pdf](https://www.faa.gov/training_testing/testing/media/test_centers.pdf)
- Bring government issued ID with current address (or some proof of current address) to the test
- Cost ~ $150
Becoming Pilot: Application Process

**Step 2: Pass the test!**
- Unmanned Aircraft General (UAG)
- FAA-CT-8080-2G supplied for test
- 2-hour exam
- 60 multiple choice questions
- Need 70% correct to pass
- Immediate Results

Test Topics:
- Applicable UAS regulations
- Airspace classification and rules
- Weather sources and effects
- UAS loading and performance
- Emergency Procedures
- Crew Resource Management
- Radio Communication Procedures
- Determining Performance of UAS
- Physiological effects of drugs and alcohol
- Aeronautical decision-making and judgment
- Airport operations
- Maintenance and preflight inspection procedures
Becoming Pilot: Application Process

Step 2: Pass the test!

Study Resources:

- UAG Knowledge Test Study Guide
- Part 107 Advisory Circular (AC No 107-2)
- Code of Federal Regulations
  - Title 14, Chapter I, Subchapter F, Part 107
- Aeronautical Chart User’s Guide
- UAG Knowledge Test Sample Questions
  - Will need Airman Knowledge Testing Supplement for Sport Pilot, Recreational Pilot, and Private Pilot (FAA-CT-8080-2G)

Becoming Pilot: Application Process

Step 3: Complete FAA Form 8710-13

- Register using the FAA Integrated Airman Certificate and/or Rating Application (IACRA) system
- Login and start new application
  - Type: Pilot
  - Certifications: Remote Pilot
- Enter 17-digit Exam ID
  - Can take 48 hours from test date to appear
- Sign electronically
Becoming Pilot: Application Process

**Step 4**: TSA background check
- Once complete, will receive a temporary pilot certificate

**Step 5**: Permanent remote pilot certificate sent in the mail

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Some of the Basics (14 CFR part 107)

**Aircraft**
- Less than 55 lbs
- Must be registered ([http://registermyuas.faa.gov](http://registermyuas.faa.gov))

**Remote Pilot Certificate**
- Easily accessible during UAS operations
- Valid for 2 years
  - Must pass a recurrent knowledge test
Beyond the FAA regulations

- FAA Part 107 or COA is not enough – need to be aware of additional city, county, and public works agency have their own rules and regulations for which you MUST be aware and comply

- Additional regulations vary by country – figure them out first, collaborate with locales, have documentation with permissions.
  - https://droneregulations.info/

- Even then, local law enforcement entities may shut you down.

Beyond the FAA regulations

- National Park Service does not allow drones
- Drones have been shown to cause distractions to drivers
  - Operate away from highway
  - Do not fly directly over road surface
  - Provide warning signage
- Be aware of privacy laws and best practices
  - Inform people if possible
  - Don’t fly over private property unnecessarily
  - Secure data against loss or theft
  - Don’t harass people