Many of you have extensive experience in the field
- Some of this material may seem obvious to you
- The challenges presented are not comprehensive
- We hope you will help us fill in blank spots

Audience
- Consider this the start of a primer document we would distribute to future potential RAPID users. Some of whom would benefit from our collective experience as they develop their plans

Activity
- After this session you will be asked to contribute your own experiences (challenges and success stories)
Hurricane Hazard: Field Data Collection
Data Types

• Structural performance
  • Building envelope (fenestration, roof cover, etc.)
  • Structural integrity & Foundation integrity (including scour)
  • Building characteristics
  • Civil infrastructure characteristics
  • Engineered damage reduction structure characteristics
  • Debris field
  • Water ingress

• Investigation goals
  • Hazard and impacts characterization
  • Structural type focus (residential, commercial, MH, shelters, etc.)
  • Building code compare/contrast performance
  • Life safety
  • Random sample vs most damaged (e.g. Gurley & Masters 2011)
Hurricane Hazard: Field Data Collection

Data Types

• Hazard conditions (loads to pair with damage)
  • Wind hazard
    • Ground level winds: contact Gurley or Prevatt or Masters @ UF
    • ASOS stations fail
  • Water hazard
    • Inundation (depth, extent) by surge/tsunami
    • Inundation flow speeds
    • Wave conditions
    • Precipitation

• Human behavior
  • Interviewing homeowners
    • Evacuation and return
    • Wind and water hazards (e.g., wind speeds, water elevation)
    • Expected infrastructure/building performance
    • Use of policy and mitigation (past or future)
Hurricane Hazard: Field Data Collection
Common Challenges: Perishable Data

- Perishable data requires immediate access
  - Roof cover performance vs the blue-roof
  - Debris field is cleared quickly
  - Shorelines are dynamic
  - Recovery efforts/subsequent events disturb hazard signature
  - Balanced against time needed to properly plan a deployment
  - “Let’s just get out there” can be problematic

- Prepare
  - Rely on other sources (NOAA images)
  - Interface with government agencies
  - Talk with property owners about damage
Hurricane Hazard: Field Data Collection
Common Challenges: Technical Failures

• Technical failures
  • Sometimes the fancy stuff doesn’t cooperate
    • Weather conditions
    • Access to power sources
  • Access
    • Not possible to bring equipment because access limited to what can be carried by foot, small boat, or small aircraft

• Prepare
  • Have a backup plan and more than one data collection scheme
  • Always have the basics
    • Numerous cameras with GPS stamp, backup batteries
    • Pen and paper
    • Backup portable digital storage and power
  • Reassess and adapt based on daily data-take
Hurricane Hazard: Field Data Collection
Common Challenges: Safety Hazards

- **Safety hazards**
  - Power lines (shock and road access)
  - Snakes, ants, no-see-ums, mosquitoes
  - Sharp stuff everywhere (assume everything wants to cut you)
  - Stressed population
  - Your truck full of goodies vs stretched law enforcement
  - Standing water

- **Prepare**
  - Training (team needs to be told and monitored)
  - Multiple first aid kits
  - Proper footwear and clothing
  - Where are the medical and EM facilities?
  - Bug spray and bite treatments
Hurricane Hazard: Field Data Collection
Common Challenges: Resources

• Resources: don’t assume anything is easy to get
  • Water, Food, Fuel, Dry clothes
  • Suitable vehicle(s).
  • Where do we sleep? Hotels are booked!
  • Internet access (but I need my smartphone map!)
  • Communication with team members

• Prepare
  • Bring inverters
  • Mapping software with GPS unit
  • Partner with local/regional entities (in Florida? Call Kurt!)
  • Write out your every move and assume you have to provide everything
  • ALWAYS know where your crew is and have a rendezvous plan
Hurricane Hazard: Field Data Collection
Common Challenges: Interactions with Locals

• Interactions with the local population
  • You are potentially competing with:
    • Search and rescue operations
    • Other damage inspection teams
    • Predatory contractors
  • Locals may not assume you are ‘friendly’

• Prepare
  • Point person to talk to homeowners and the curious
  • Practice your wrap, sound authoritative
  • Have credentials, uniform look with logo
  • Magnet sign for each vehicle
  • Project business cards on every member
  • Do NOT argue, just move on
Hurricane Hazard: Field Data Collection
Common Challenges: Permission

- You need permission to breathe
  - Accessing areas restricted by law enforcement and emergency management
  - UAV use needs to be licensed, flight restrictions (near airports) still apply. Even with these in place, you can still be told to bug-off. Operator should be clothed appropriately (difference between an investigator and a voyeur/looter)
  - Stepping on a property can be hazardous to your health
    - Permission from officials ≠ permission from property owner

- Prepare
  - Never step on a property without permission or isolation
  - Never enter a dwelling without permission
  - Partner with local/regional entities who have EM/building official contacts
  - Secure official credentials when you can
  - UAV: get a professional operator with proper licensing
Hurricane Hazard: Field Data Collection
Common Challenges: Getting Oriented

• Knowing what you are looking at can be challenging
  • Street signs to not do well in a hurricane
  • Street view of a house cannot tell you:
    • If that masonry wall was reinforced
    • If that shingle roof is 20 years old or a new Class H shingle

• Prepare
  • Mapping software with GPS, don’t rely on your phone
  • Metal finder (for reinforcing)
  • Train team uniformly on how to I.D. characteristics
  • Collect the address and GPS, and look up the T.A. record
  • More than one means of data acquisition
  • Consider more than one evaluator per property
Preliminary Field Investigation of Damage Caused by Hurricane Matthew

David O. Prevatt, Ph.D.
David Roueche, (new) Ph.D.
University of Florida

windhazard.davidoprevatt.com/
Hurricane Matthew
September 28-October 9, 2016

Max rating: Category 5, 160 mph
Min pressure: 934 mb

McClellanville, SC
75 mph / 967 mb

Jauco, Cuba
140 mph, 949 mb

Les Anglais, Haiti
145 mph, 934 mb

Max coastal statement
- Hurricane Warning
- Hurricane Watch
- Tropical Storm Warning
- Tropical Storm Watch

Thin gray lines are forecast tracks over time.
Damage Assessment

Objectives (FBC project):

• One day, small team
• Investigate regions along the Florida coast that experienced hurricane force wind speeds
• Demonstrate survey methodologies:
  – Ground survey: Survey123 app
  – Aerial Survey: UAV flights
• Provide recommendation for a full assessment
UF Damage Assessment Team

Kwasi Perry
UAV Survey, Inc

David Roueche
PhD Candidate

Quinten Ozimek
Undergraduate

Kurt Gurley
Professor

Mark Mimms
Undergraduate

David O. Prevatt
Aso. Professor

Alyssa Egnew
Undergraduate
Ground Survey

- ESRI Survey123 for ArcGIS mobile survey app
- Allows for creation of custom survey forms that are accessed and submitted via smartphone
Ground Survey

- Submitted surveys are automatically compiled into an online database that can be shared with stakeholders.
UAV Survey

- Quad copter UAV
- Flight Elevation: 220 ft
- Flight Speed: ~30 mph
- Imagery Pixel Size: 5 cm (2 in.)
- Total high Resolution Photos: 581
- Survey completion time: 15 minutes
Year Built: 2015

UAV Imagery

Ground Survey Photo

Shingle Damage

Shingle Damage

Broken Window
Soffit damage not observable by drone
Shingle Failure Primarily on North Slope of Roof
Scattered Shingle Debris Downwind of Home
Hurricane Hazard: Field Data Collection
Case Study: Hurricane Matthew 2016

- Primary Challenges and solutions
  - Access to Flagler Beach restricted to emergency operations
  - Acquired State Emergency Response Team tags prior to deploying
  - Small team and limited time
  - Developed goals and plans commensurate with resources
  - Aerial images critical for “roof cover event”
  - Contracted professional UAV operator
  - Despite UAV licensing, law enforcement shut down UAV operation due to heavy news-copter traffic
  - “Yes sir” and moved to a less congested area after completing ground survey
Hurricane Hazard: Field Data Collection
Case Study: Hurricane Sandy 2012
Hurricane Hazard: Field Data Collection
Case Study: Hurricane Sandy 2012
RECONNAISSANCE TIMELINE CHALLENGES AND SUCCESSES ACTIVITY

> What challenges and pain points have you faced before, during, and after reconnaissance research missions?

> What successes and positive experiences have you had before, during, and after reconnaissance research missions?

Write one answer per sticky note and post on the appropriate poster board.

Post at least one answer on each board.

Walk the boards to learn about your colleagues’ challenges and successes.