Crowdsourced Decision Support for Emergency Responders

Kathryn Laskey
Associate Director C4I Center and Professor, SEOR
George Mason University

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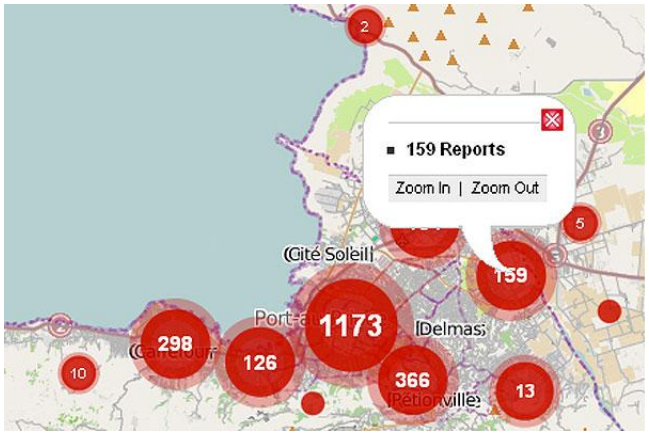
Background: Crowdsourcing and Emergency Response

- Real-time citizen interaction is transforming crisis response
  - Haitian citizens collaborated with volunteers worldwide to map damage during 2010 earthquake
  - Social media figured prominently in government response to Hurricane Irene
  - “Social media follow Hurricane Sandy's destructive path” – USA Today



- Command and control systems and processes must exploit new technologies for communicating directly with citizens
  - Research is needed to design and evaluate new systems and processes
  - Operators must be trained in the new systems and processes

Background: Policy Directives

- Presidential Policy Directive-8 (PPD-8) states: “Our national preparedness is the shared responsibility of all levels of government, the private and nonprofit sectors, and individual citizens. Everyone can contribute to safeguarding the Nation from harm..”
- National Strategic Narrative calls for diverse and deployable Inter Agency, and a well-informed and supportive citizenry. *
- National Capital Region Homeland Security Strategic Plan calls for sharing information needed to make informed and timely decisions; take appropriate actions; and communicate accurate, timely information with the public.
- Department of Defense Quadrennial Defense Review, dated February 2010, identified defending the homeland and support to civil authorities as one of 6 key missions in which the Department must further rebalance policy, doctrine and capabilities

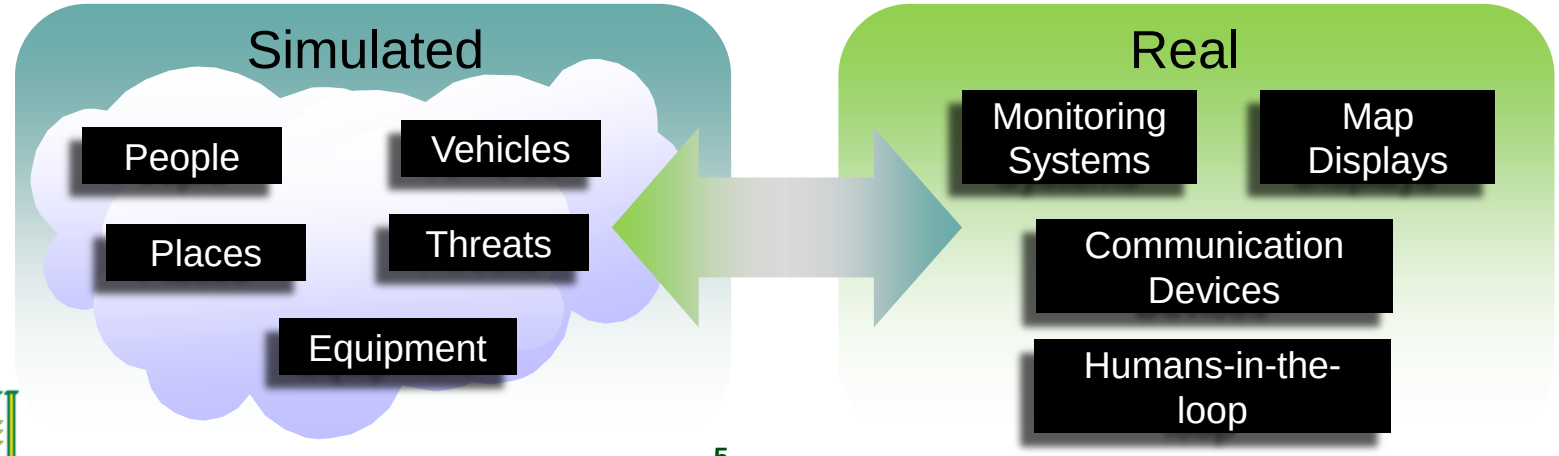
* Monograph from Woodrow Wilson Center for Scholars authored by former members of the Joint

Hypothesis

- American citizen real-time interaction in the planning and execution of a military/civilian contingency operation would improve its result.
- A viable method of including American citizens in the decision-making process would be the employment of a version of crowdsourcing technology.
- Testing the hypothesis:
  - Implement prototype DSS using crowdsourcing for citizen participation
  - Simulate crisis in which civilian/military emergency managers use DSS interact with a cross-section of the American public

Background: SIMEX

- MITRE Net-centric C4ISR Experimentation Laboratory (NCEL)
  - Conducts simulation 3-5 simulation experiments (SIMEXs) per year to examine C4ISR processes in support of ground, maritime, space and air operations
  - Use real operators, real C4ISR systems, simulated scenario and reports
  - 42 SIMEXs conducted since 2002
- SIMEXs support multiple sponsors to examine:
  - Tactics, techniques and procedures (TTPs)
  - Concept of operations (CONOPS)
  - Interoperability requirements



Testing the Hypothesis: A SIMEX examining Citizen Participation in Crisis Response

- Primary Goal: Examine impact of citizen involvement on tactical/operational decision-making and implementation.
- Objectives:
  - Refine and evolve CONOPS and TTPs for citizen participation in tactical/operational planning and implementation
  - Refine and evolve prototype DSS
  - Examine impact of DSS on tactical/operational decision-making & execution.
- Scenario: Defense Support of Civil Authorities
  - Radiological Dispersal Device detonates on George Mason University campus.
  - Notional NCR military/civilian emergency managers collaborate from Emergency Operations Center (emulated at the NCEL lab at MITRE McLean)
  - Student volunteers from George Mason University use DSS to collaborate in response decision making.

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Citizens' Emergency Response Portal System (CERPS)

Simulated Sensory Environment (SSE)

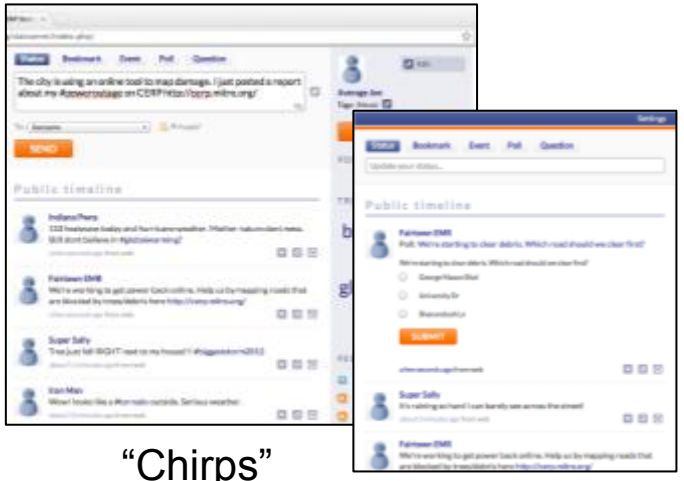
Unfolding experiment events (view)

Reported events (view and post)

Citizens' Emergency Response Portal (CERP)

Citizens (GMU students)

Chirp [open-source Twitter clone]



"Chirps"

Polling

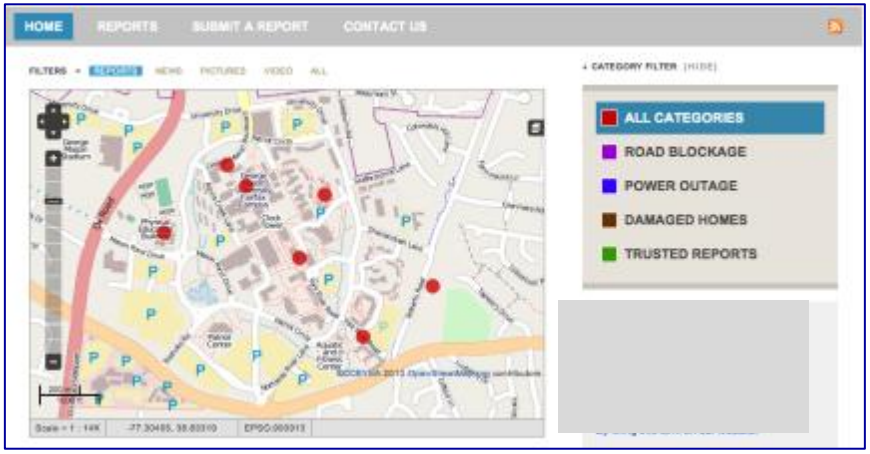
News

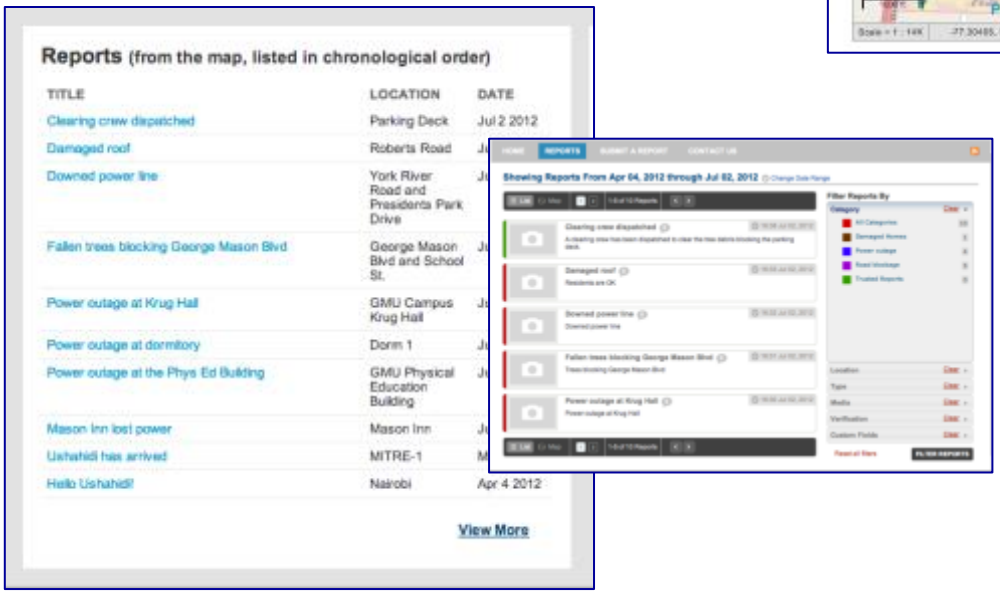
Simulated News Network

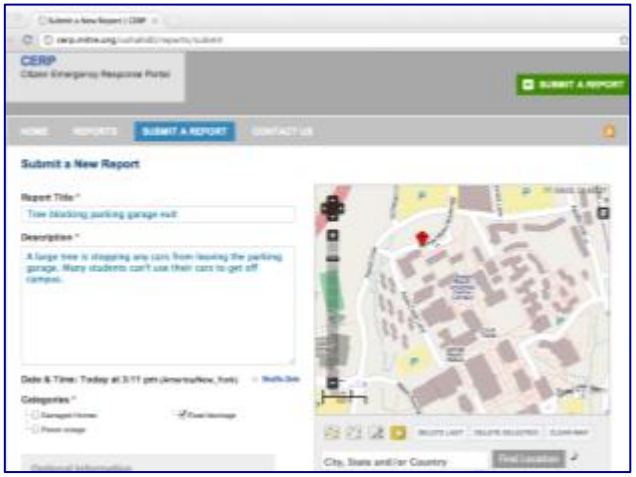
Discussion of events (view and post)

Citizens' Emergency Response Portal (CERP)

- Based upon Ushahidi platform
- Geographic display of incident reports and a means to review submitted reports
- Operators can post directly to CERP to provide official information
- Operators view reports posted by citizens







SSE: Participants' View of Scenario

Visualization:

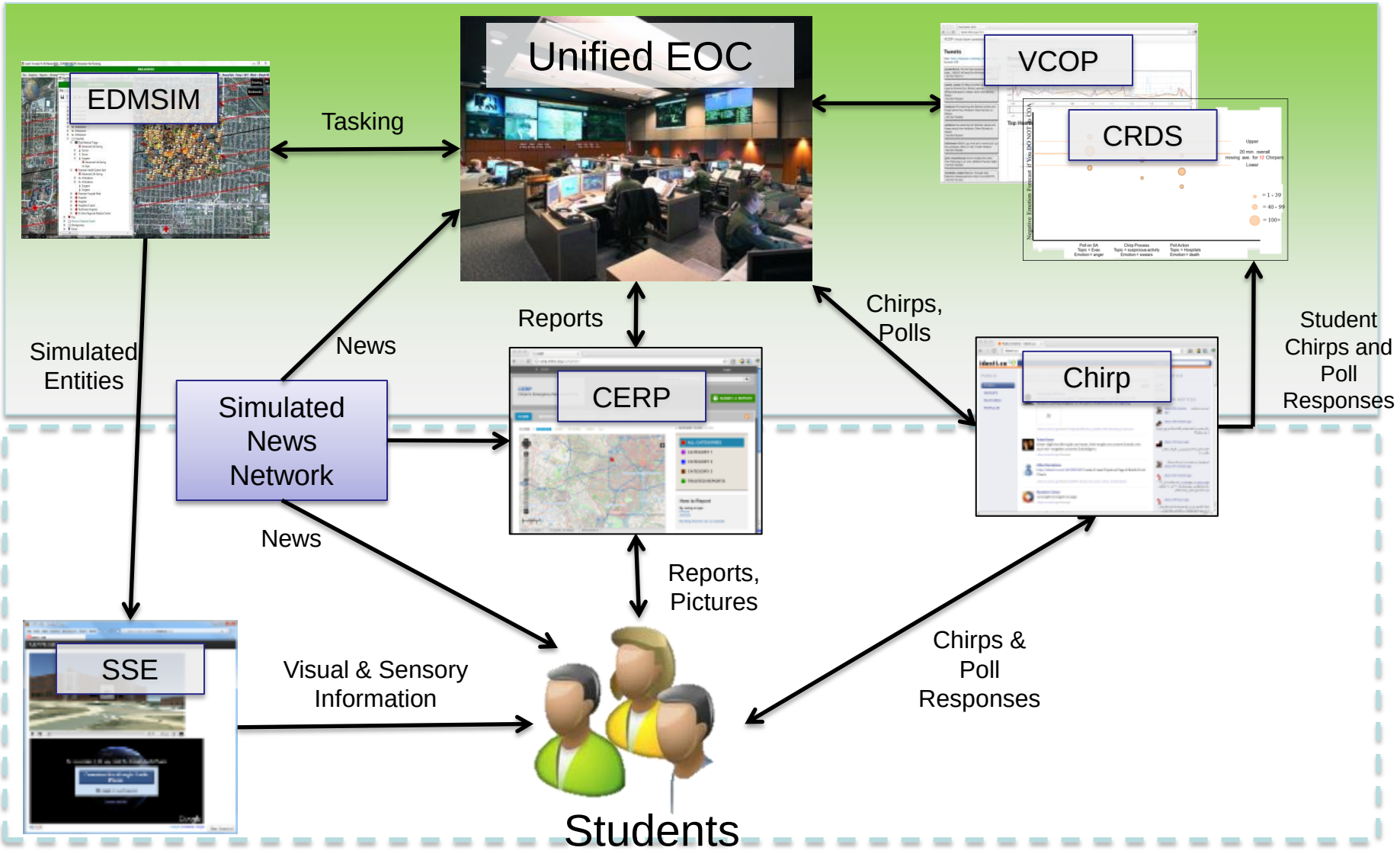
- A live video stream of the 3D virtual environment
- A 2D map with notable locations
- A virtual camera to take pictures and share with others

Simulation of other senses:
Descriptions of auditory, tactile and olfactory sensations

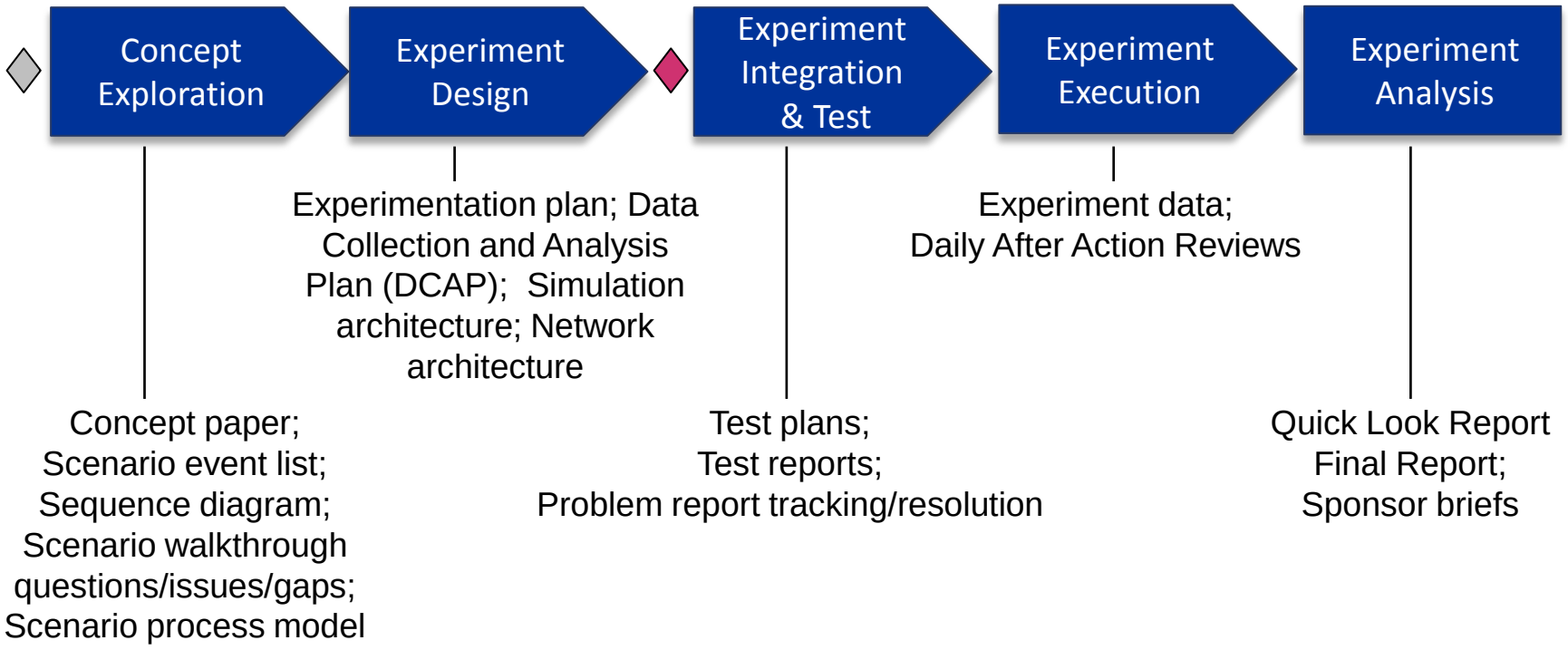
CERPS SIMEX

- **Objective:**
  - Examine impact of CERPS and citizen involvement on tactical / operational decision-making and execution
- **Participants:**
  - Emergency management personnel: national (DoD, FBI, DHS, National Guard), state , county, city, and university
  - GMU student volunteers to play role of citizens
- **Experiment:**
  - Simulate crisis
  - Execute crisis procedures
  - Students interact with responders via CERPS
- **Evaluation:**
  - Examine results on metrics of interest

CERPS SIMEX Operational View



SIMEX Process



- Initial Planning Conference (IPC)
- Final Planning Conference (FPC)

GMU Tasks

- Advise on CONOPS
- Coordinate IRB approval
- Recruit student participants
- Support training

- Coordinate strategic communications plan with MITRE community relations (avoid “war of worlds effect”)
- Participate in EOC

Student Participation

- Participants
  - Goal: 200 student participants
  - Actual: 199 recruited, 125 trained, 114 participated
  - Paid $95 in Mason money plus iPad for top performer
- Activities:
  - Training session (2 hrs)
  - Test runs (2 hrs)
  - Experimental sessions (at least 5 hrs)
    - A different virtual emergency each day for 5 days
    - Respond to virtual environment through CERPS
    - Minimum of 5 hours
  - Feedback session (no more than 30 min)

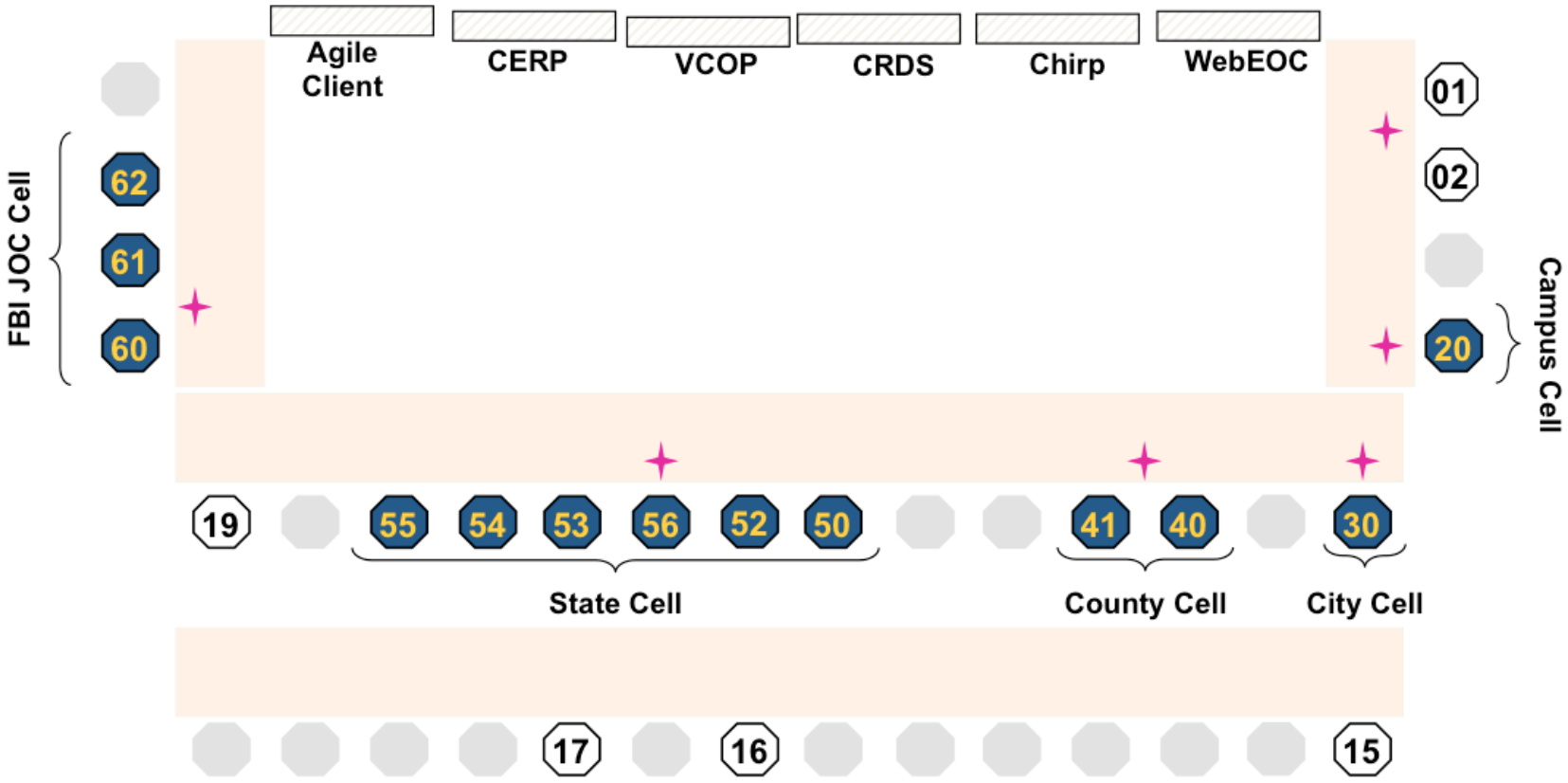
Government Stakeholders

- NORTHCOM
- Joint Staff
- Fairfax County
- Virginia Commonwealth
- DHS/FEMA
- National Guard Bureau
- FBI
- Israeli Home Front Command*

Timeline

- Summer 2012:
  - Develop concept of operations, scenario, data collection and analysis plans
  - Obtain IRB approval
  - Develop publicity plan
- September 2012:
  - Recruit and train participants
- October 2012:
  - Conduct SIMEX (Oct 1-5)
  - Produce quick-look briefing
- November 2012:
  - Release report to public

SIMEX: Emergency Operations Center



01 EXCON
02 Data Collection Lead
03 Scenario Lead
04 SIM Control
05 Integration Lead
06 Development Lead
07 Decision Support Lead
08 Tech Support
09 SSE Lead
10 Incident Commander / Campus Police
11 News Media
12 DCO

13 CERP Administrator

15 City EDMSIM
16 JTF EDMSIM
17 NGB EDMSIM
19 FBI EDMSIM

20 Campus Cell Commander / EDMSIM

30 City Cell Commander / PR

40 County EOC Commander / EDMSIM
41 County PR
42 WebEOC Controller

50 State Cell Commander / PR / EDMSIM
52 JTF-NCR LNO
53 State NG SEPLO
54 FEMA FCO
55 FEMA External Affairs
56 JTF-CS LNO

60 FBI SAC
61 FBI PR
62 FBI CTOC Coordinator

VoIP
White Cell
Operators

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Results: Impact & Usage

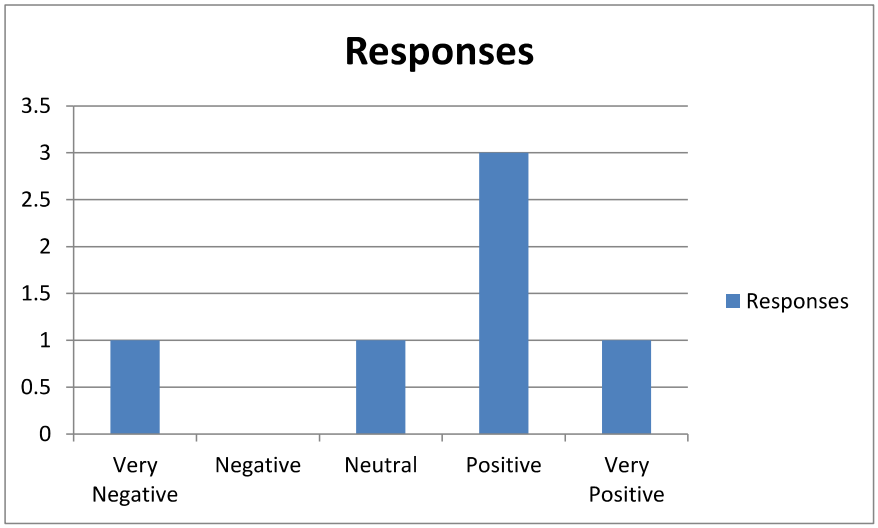

Figure 6. Responses from Operators:
Impact of Social Media and Citizen Participation

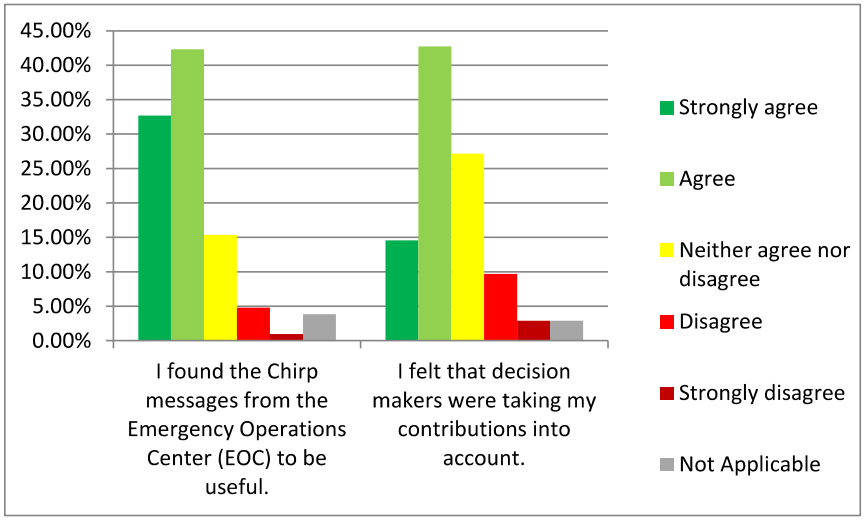

Figure 7. Responses from Students:
Impact to Public from Interaction

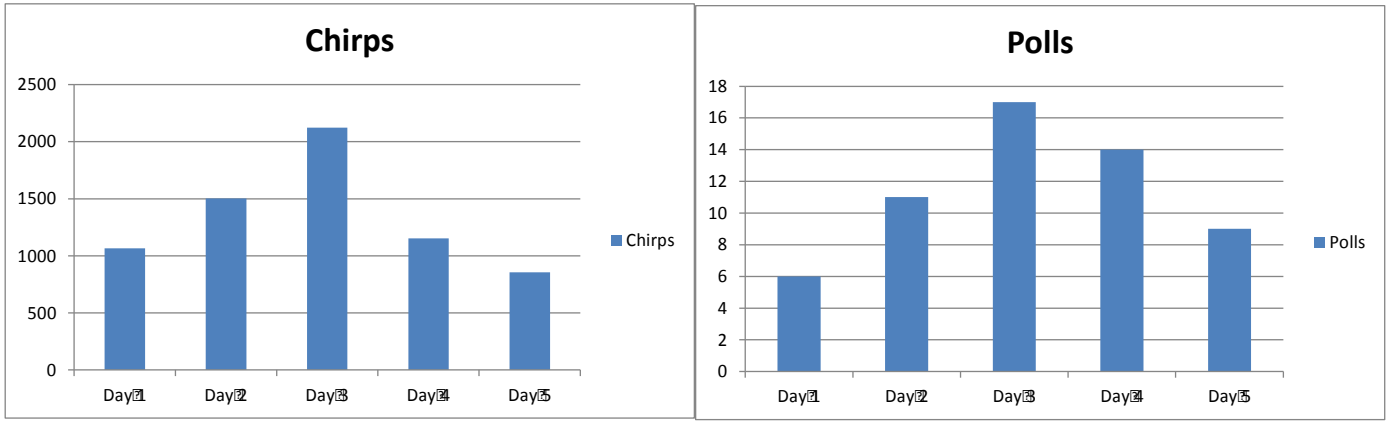

Figure 8. Chirp and Poll Usage

Results: Utility & Usability

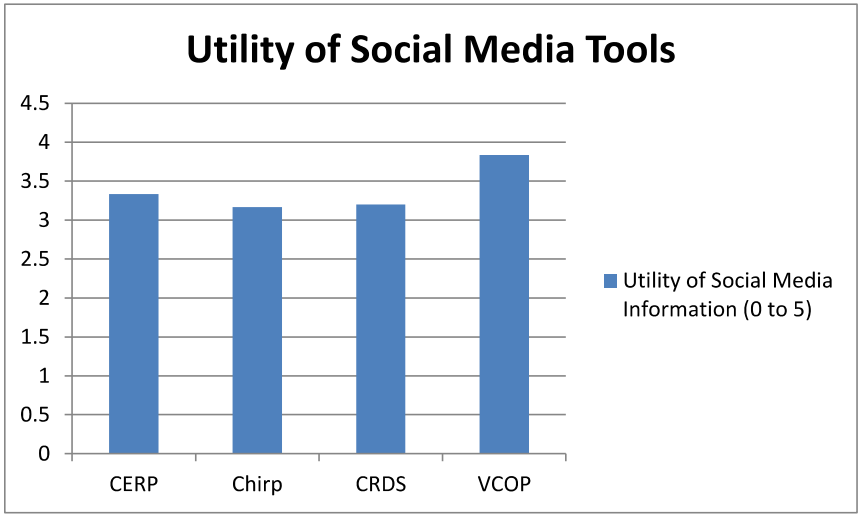

Figure 9. Emergency Managers' Self-Assessed Utility of Social Media Tools

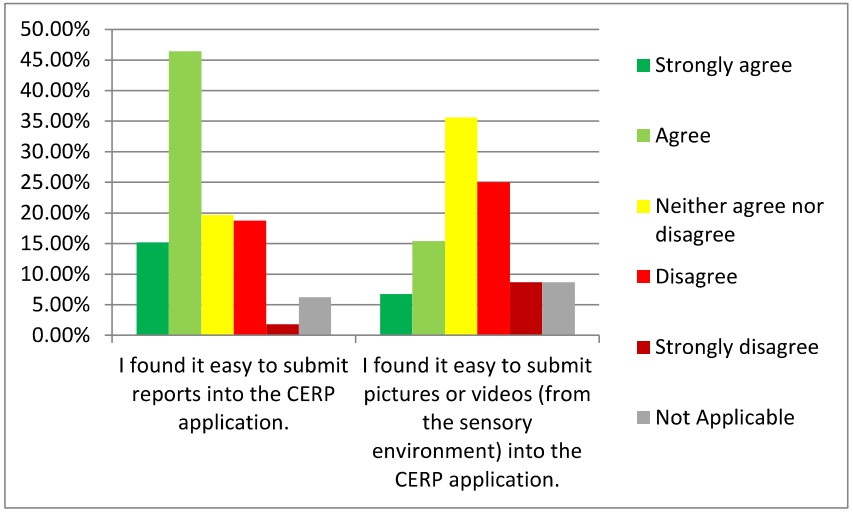

Figure 11. Student Ratings of Ease of Use of CERPS

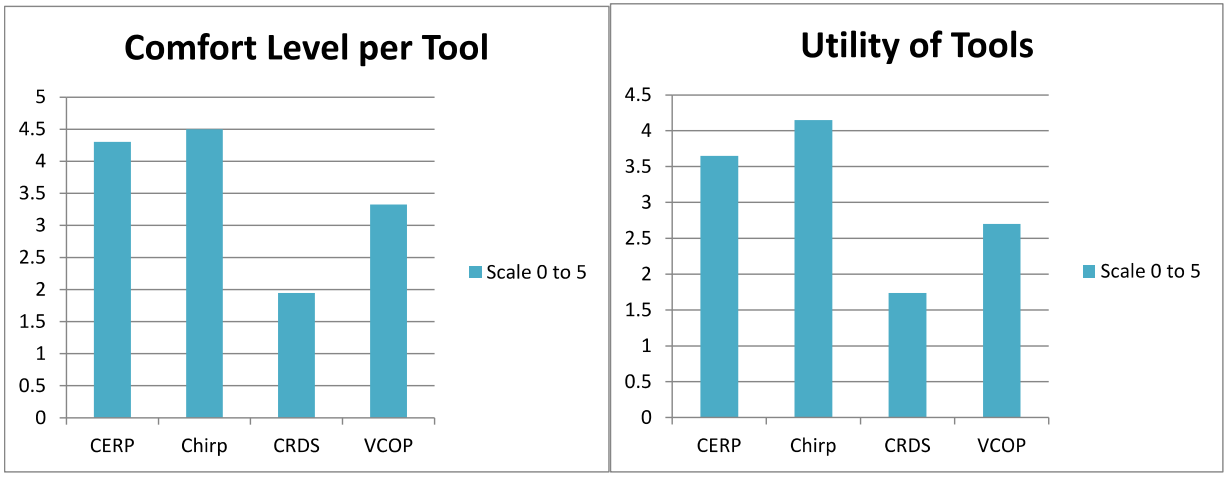

Figure 10. Comfort and Utility of Social Media Tools as Assessed by Data Collectors

Student Ratings: Usefulness and Quality

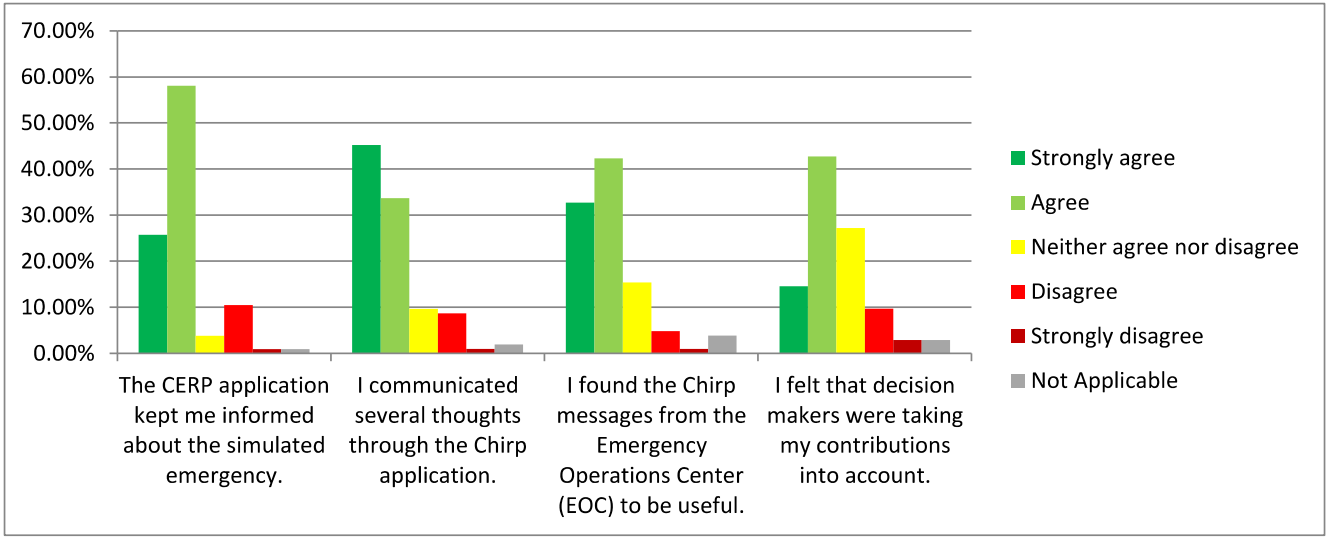

Figure 12. Student Ratings of Usefulness of CERPS

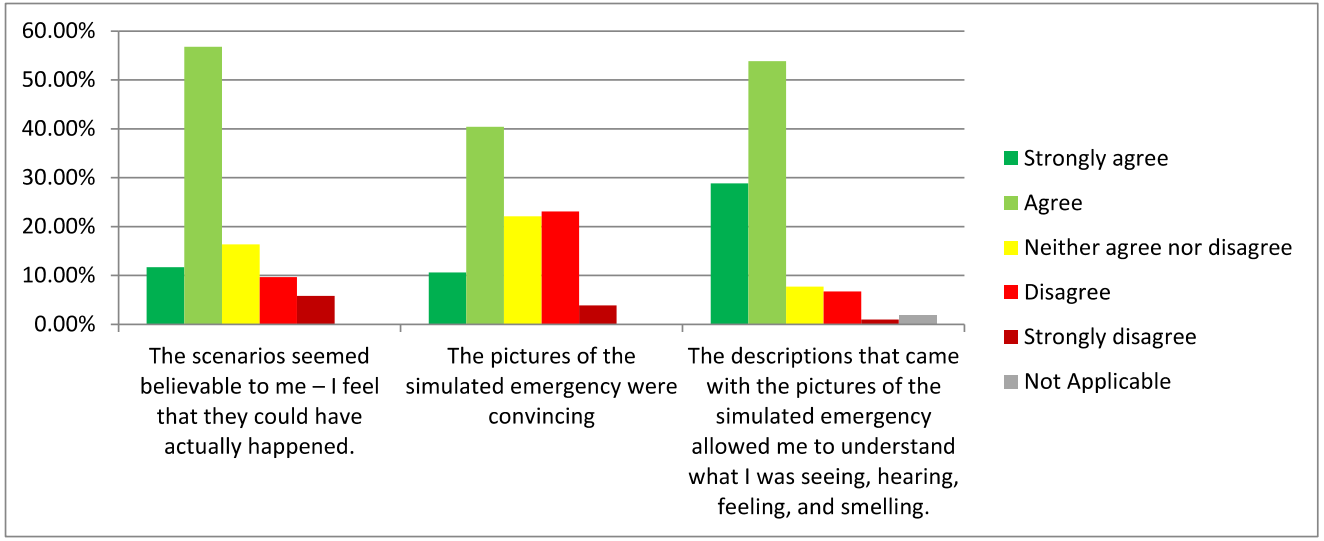

Figure 13. Quality of the Virtual Environment

Media Attention

- Experiment Crowdsources Public in Emergency Response Decision-Making
  - http://www.hstoday.us/industry-news/general/single-article/experiment-crowdsources-public-in-emergency-response-decision-making/9e632d951b75fa299ac746a4ce2d55df.html
- This is just a test: Emergency responders tap the Twitterverse
  - http://www.nextgov.com/emerging-tech/2012/10/just-test-emergency-responders-tap-twitterverse/58622/?oref=ng-HPtopstory
- Mason Students Observe and Report During Mock Attack in Fairfax
  - http://about.gmu.edu/mason-students-observe-and-report-during-mock-attack-in-fairfax/
- Safety Tweet: Northern Virginia Magazine by Jenna Makowski January 14, 2013
  - http://www.northernvirginiamag.com/buzz-bin/2013/01/15/safety-tweet/

Conclusions

- Demonstrated potential for positive impacts from citizen interaction with emergency managers
  - Augment 911-type information about incidents
  - Sentiment analysis of social media traffic
    - Helped emergency managers understand mood of public
    - Allowed managers to adjust communications strategies to better respond to needs of public
- Highlighted challenges of public interaction through social media
  - Vet information for accuracy
  - Account for possible influence of bad actors
  - Mitigate potential for emergency managers to be distracted by vocal social media users

Proposed SIMEX 14-1

- Maintain theme
- Include additional stakeholders
- Follow similar planning and execution schedule
- Incorporate alternative tools as appropriate from government and industry
- Expand to include GMU campus and surrounding region (“College Town USA”)
  - Larger population sample
  - Students, staff and faculty
  - Other participants from community
- Expand / revise EOC staffing

Next Steps

- The cloud and social media bring major new opportunities for decision support
- CERPS SIMEX was an important first step
- Many open research issues
  - Effective integration of citizen input into C2 processes
  - Logistics
  - Human factors
  - Information security
- Additional simulation experiments are proposed

Thank You!

GMU

- Stu Wharton (participant coordinator)
- Dave Farris (emergency management)
- Paul Liberty and Jim Greif (public relations)
- George Ginkovsky (university police)

MITRE

- Jim Dear (Project Lead, NCEL)
- Jackson Ludwig
- Jennifer Mathieu
- Alaina McCormack
- Tobin Bergen-Hill
- Karina Wright
- … and many others

and all the SIMEX participants