Center for Global Public Safety

Industry Stakeholders' Forum
04/30/18

EVENT NOTES

OBJECTIVES: Identify the greatest research needs in each industry area as they relate to global public safety.

Determine how to leverage the expertise and facilities available at WPI and CGPS academic partner institutions to drive education, outreach, and strategic alliances

ATTENDEES PRESENT:

Table 1: Focus Topic: FIRST RESPONDERS
Laurie Leshin, Mike Lavoie, Pete Costa, Milosh Puchovsky, Mickey Reiss, Kevin Michaelis, Terry Brady, Hui Zhang

Table 2: Focus Topic: EMERGENCY TRANSPORTATION
Wole Soboyejo, Jianyu Liang, Martin Dyer, Dirk Steyn, Wayne Moore, Fang Li, Yu Zhong, Carlo Pinciroli, Yan Wang, Zachary Magnone

Table 3: Focus Topic: EMERGENCY RESPONSE SYSTEMS
Mark Mordecai, Daniel Gottuk, Sergey Dorofeev, Melissa Avila, Robert Avakian, Philip Crombie, Cagdas Onal, Albert Simeoni

Table 4: Focus Topic: FIRE PROTECTION ENGINEERING
Diana Jones, Stephen Schwartz, Chris Wieczorek, Thomas Connell, Don Talka, George Toth, Karen Bean, Doug Petkie, Robert Fitzgerald, Ali Rangwala

Table 5: Focus Topic: WATER SECURITY
Paul Dombrowski, Mark Macaulay, Bob Ferrari, Qing Deng, Diran Apelian, Gbeton Somasse, Natalie Farny, Tricia Stapleton, Paul Mathisen

Table 6: Focus Topic: FOOD SAFETY
Tom Yang, Robert Avakian III, Yi Liu, Linda Looft, Xinming Huang, Songbai Ji, Pratap Rao

DISCUSSION POINTS:

- Identify the most pressing needs within your subject area as they relate to public safety at both the local and global levels
- Consider opportunities to apply new technologies such as robotics, autonomous vehicles, data science and sensors to address challenges in your subject area
- Suggest ideas for research and projects at both the undergraduate and graduate levels
- Identify niche research and educational opportunities that align well with the talent at WPI and Tsinghua University.
- Identify opportunities for international research collaboration
- Propose private and government agencies that might be interested in supporting the research and educational efforts of the Center for Global Public Safety

1. COMMENTS FROM TABLE 1: FIRST RESPONDERS

- Culture of Fire Dept (macho) – affects firefighter safety – how to address this and be more informed about what's happening on the scene before taking action
- Building Construction - engineered lumber, lightweight trusses, lack of knowledge of building codes, time to structural failure
- Knowing if building is occupied – can technology help (occupancy detectors) – there are thermal sensors but only picks up in a single room – doesn't work beyond walls or in complex spaces
- Real-time data of building conditions - how to collect and transmit data in a useful way - who is responsible for interpreting the information and making decisions on site – too much data is not helpful
- High cancer rates for inhaling toxic gases – Firefighters take off protective gear too quickly – new materials being inhaled are more toxic – Is there a way to monitor personal air space after a fire to determine when it is safe to take off mask & gear
- Lighter and cooler turn-out gear – esp. in desert climates

TABLE 1: FIRST RESPONDERS (cont'd)

- Personal Alert Safety System (PASS) – device on firefighters' gear to determine if a firefighter is down (currently it's a pendulum – can go off if stationary for too long)
- Fire hoses – improving quality
- Standardization of data transmission – lots of data (much of it is noise) in different frequencies and formats – need to get critical data to command structure
- Building regulations need to address first responder needs (not just more efficient construction)
- Disabling of Fire Alarms – false alarms mean they are not taken seriously
- Traffic control system – ability to determine the best way to quickly and efficiently get to a location if traffic is high
- Aging/elderly people in high rise buildings – this population is increasing – how do we improve their ability to escape during an emergency – getting harder to do
- Storage – more stuff is being stored in warehouses (Amazon.com) – creates fuel for fires – can we use sensors to reduce risk?
- Counter flow issues in high rise buildings – evacuating occupants while first responders are going in
- Building Systems – (smoke controls, video imaging systems in stairwells, etc.) – how is fire service supposed to know how to operate these effectively – who else can operate all the different systems in the building when the fire service shows up?
- Robot equipment handling – incorporate this with manual fire fighting
- Natural Disasters
- Legal implications of effective technology
- DHS protection for developing technology
- Privacy and surveillance laws regarding data collection and use

2. COMMENTS FROM TABLE 2: EMERGENCY TRANSPORTATION

- Simple is better – firefighters shy away from technology
- Maintenance and dependability of equipment
- Too much data can be a burden – need clear actionable info
- Operational flexibility in various conditions and scenarios
- Funding for maintenance (and in general) is scarce – it's often cheaper to replace an engine than to maintain – more predictable budgeting
- Many interoperable systems that don't work together
- Optics of impact
- Inventory management
- Resiliency of equipment
- Cybersecurity & infrastructure - as you put sensors into everything - standardization
- Can IoT sensors and diagnostics reduce the cost of life savings systems and extend life expectancy of equipment?
- Want to get info to fire service – how to do it without increasing cost to fire service
- Can cities save money by installing smart systems not just with emergency vehicles but also public utilities – sanitation, water, police, etc. so city can save money
- Data analytics is another hurdle – who analyzes data? Not just a local problem
- How do we get the information to the point where we can make the decision – there are systems already that monitor who's in the building – buildings that require a card for the elevator has data but how do we share that
- Fire inspections – consistency problems – sensors can improve consistency – need actionable information

TABLE 2: EMERGENCY TRANSPORTATION (cont'd)

- Niche research opportunities – how do you manage sensors that can monitor for corrosion/degradation – we need a place to submit those research ideas (WPI) – IQP/MQP/project centers – give problems to students and send them out into communities

- If building owners see reduction in costs that will be an incentive for them to make changes

- Need good data to make changes to codes – code changes might be necessary before people really change

3. COMMENTS FROM TABLE 3: EMERGENCY RESPONSE SYSTEMS

- Situational awareness and communication issues - how do you integrate sensor info for first responders without it being too much - need to use it in a smart way to guide

- Communication - central hub - simplification of info to incident command center

- Emergency response platform - emergency response vehicles – want to integrate data to be analyzed (may need a dedicated person) –

- IoT - Networked at the city level for situational awareness - traffic, people, incident, systems, resources, etc. Emergency response – not always just a structure fire - could be shooter or bombing - lot of info that could be presented in overall response to that scene - having a network at city level - a lot of info being used after the fact (video surveillance, sensors in place,) - you can use data for traffic - navigating streets - if there are a lot of people to be moved out and away from center of incident - a lot of opportunity for networked cities to provide ...

- Pre-planning - helps a lot of emergency response to situation - but things change over time - how well are systems being updated for info - are they being updated in a timely fashion so you can respond better - how do you transfer that info - if someone leaves the department

TABLE 3: EMERGENCY RESPONSE SYSTEMS (cont'd)

- Dynamic egress - having systems that would help people respond in a way that can be useful - for firefighters - need redundant reliable systems - are there sufficient technologies ....real-time info .....direct evacuation...need redundancy and reliability ....when there is a system failure

- Data sets – Buildings & First Responders:

  - *Buildings:* systems within & occupants - how do you get better tracking of those people - how many, where are they? Do search and rescue?

  - *First responders:* knowing where they are and what they're doing - pointing out that you don't need to know what they're doing if it's all going according to plan - only need to know if something went wrong - how to process and present and target info that's necessary

- 3D real-time tracking of firefighters/emergency response personnel
  - Too much data - how do you down-select? (when things going wrong)
  - How much can you use automatic decision-making vs. real person assessment
  - Wildland fires – tracking firefighter units

- Needed resources $$$ - where do you get funding for these projects? DHS & Smart Cities programs

4. COMMENTS FROM TABLE 4: FIRE PROTECTION ENGINEERING

- Awareness of FPE as a discipline - helping people understand the need for codes and standards - why it's important - as a discipline - ROI/cost-benefit analysis

- Thinking globally - adoption of codes and standards worldwide

- Local data science
  - *Metrics* - specific data of fire incidents in particular countries - need to look at country by country
  - *Collection* - how do we gather this data? Is it possible? What tools are available?
  - *Social/economic impact* – community education as a response to data; what is the social-economic impact? What if a country doesn't have enough money to implement?

TABLE 4: FIRE PROTECTION ENGINEERING (cont'd)

- Education & Research
  - FPE fire science on-line course (certificate, not degree)
  - IQP
  - Data Science
  - "GQP" (graduate level project)
  - Mine Global Safety tools & indices

- Leverage distribution of WPI project centers, CGPS sites & other university partners
  - World Bank
  - United Nations
  - World Health Organization
  - They have funding and data to share

5. COMMENTS FROM TABLE 5: WATER SECURITY

- Very broad topic - interdisciplinary - lots of aspects - there are HUGE needs in water area - locally, regionally and globally

MOST PRESSING NEEDS REGARDING GLOBAL PUBLIC SAFETY:

- Protection of water supplies (including cyber security)

- Source water quality, quantity, and sustainability

- Access to clean water (ie: Capetown) – affordability vs. protection

- Resilience –
  - Water/energy nexus - can supplies be sustained - when things happen how resilient are water sources?

  - Natural disasters/extreme events/risk – impact of sea level rise, climate change, flooding – implications for water supplies - high flows and low flows - infrastructure constraints (ie: N.E. rainfall/Hurricane Sandy – how do deal with severe events

TABLE 5: WATER SECURITY (cont'd)

OPPORTUNITIES FOR NEW TECHNOLOGIES:

- Technical & Management/Monitoring (interdisciplinary):
  - Bio-sensors
  - Smart sensing - real-time monitoring of water conditions, quality, and supplies – protection of human health related to that
  - Remote sensing – for waste-water treatment plants – want them to be efficient and minimize energy use
  - Monitoring platforms – open architecture
  - Operational security - cyber security – significant risk - terrorism
  - Interdependence of food/water – maintaining energy is critical for water supplies (regional considerations)
  - Re-use/reclamation – understanding different types of water: drinking water, storm water, waste water - and requirements for different uses - need to recognize the difference for water re-use...technical aspect of managing water and all the people involved - political and social factors involved - tremendous breadth and uncertainty – systems approach for water management – integrated WRM over range of scale (length/time)
  - Cost aspect - all these things cost money - how to do it most cost-effectively?

- Considerations:
  - Risk/uncertainty and decision-making
  - Risk communication/prioritization
  - Political structure
  - Infrastructure/management/restoration (ie: Hurricane Katrina, Puerto Rico)
  - Scientists/engineers/communication
  - Model accuracy/model development
  - Simulating Field Monitoring Data (ie: drones, remote sensing)
  - Climate Change/meteorology simulation - predictions/data management
  - Integrate public policy with good science
  - Technology – affordability in the integration of technology

IDEAS FOR RESEARCH AND PROJECTS:

- Biological techniques for sensing (biosensors) & environmental control (bioluminescence)

- Real-time control for optimal operations (feedback/A.I.) & asset management

TABLE 5: WATER SECURITY (cont'd)

- Risk/psychology of environment
  - Action & response for global public safety
  - Behavioral considerations
  - Public perception/visualization technology for communication
  - IQP/MQP – public perception of water safety (building buy-in)
  - On-line sensors for contaminants of emerging concern for re-used water
  - Indicators for water safety with wide applicability

- C.E.C. (Clean Energy Center?) – identifying novel biosensors for analysis, monitoring, and remediation

- Treatment techniques applicable to a wide array of C.E.C.'s

- Balancing cost/treatment

- Evaluating sensor reliability

- Integrated simulation food, energy and water systems - modeling - nexus of those areas....very much related....can you re-use water for irrigation....energy required to manage these things also matters

- Water chemistry & corrosion (ie: lead/copper)

- Better predictive models – good opportunities

IDEAS FOR INTERNATIONAL COLLABORATIONS:

- Middle East – water availability, potable water, etc.
- WPI Project Centers – Morocco, Capetown, etc.
- Global Water Policy – understand problems and what are solutions with multiple/wide applications
- Cloud seeding?
- Agencies & organizations:
  - Water for People
  - WERF
  - USAID
  - Water.org
  - NSF/NIH/NOAA
  - Engineers without Borders
  - Foundations, State of Mass. (C.E.C. – Clean Energy Center)

TABLE 6 - FOOD SAFETY

- Post-processing contamination - after treatment process it's being handled by people and can be contaminated
- Sensors that are universal; can be sensitive to e-coli
- Better sampling of techniques for food - how do you measure (especially for fresh produce)
- Looking for broader expertise in bio-sensing and microbiology
- Inexpensive temperature control packaging
- Semi-moist food (residual water allows bacteria to grow) - use special resolution to measure moisture
- USDA (NIFA) & FDA – Aug. Meeting @ NSRDEC (Natick Soldier Research, Development, & Engineering Center)
- Ways to sterilize foods with organic certification - only certain kill steps are allowed - how can we work better with USDA

ADDITIONAL REMARKS:

- Wildland fires/floods - we may be able to plan for these and mitigate
- Directed evacuation (dynamic egress) - could WPI have a potential project to look at legal implications that might prevent or stagnate technology growth? At J.C., we have addressable notification and direction but we can't tell people where they need to go because it would create massive liability. So even though we have the ability to save lives, liability holds us back. If there were things like DHS' safety app program to provide some protections for technologies that are deployed - that might ease some of the concerns restricting private sector development.
- Regarding cyber security – there's been a lot of talk about collecting data & real-time tracking. We should consider some of the ethical concerns that may be related to this such as what recently happened with Facebook and what we might see in terms of surveillance and what that data might be used for - in thinking about collecting that data - then it becomes a vulnerability to be hacked or disrupted - to give false info - to create chaos - purposeful contamination of water supply - terrorism - more data can provide negative outcomes or possibilities