Drones and Broadband Data for the PSAP
The Role of Robotics and Artificial Intelligence

Barry H. Luke, Deputy Executive Director
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Center for Regional Disaster Resilience (CRDR)
Disruptive Trends in Public Safety Technology Symposium
The National Public Safety Telecommunications Council is a federation of organizations whose mission is to improve public safety communications and interoperability through collaborative leadership.
Session Overview

• NPSTC UAS-Robotics Working Group Update
• Robots, Drones and AI
• UAS and the PSAP
• The Role of Broadband Data
• Analytics and Artificial Intelligence (AI)
• Future Vision
NPSTC UAS-Robotics Working Group

• A Working Group to study Unmanned Aerial Systems (UAS) and Robotics formed in February of 2016.
• 105 participants representing public safety, industry and academia.
• Conference calls are held on the 2\textsuperscript{nd} Wednesday of each month at 9:00 a.m. Pacific Time Zone.
  – All NPSTC conference calls are open to anyone who wants to dial in.
  – Meetings listed NPSTC.org and click on “Public Safety Calendar”
• The Working Group recently published their first report “Unmanned Air Systems and Robotics – Guidelines for Creating a UAS Program”.
What is a Robot?
What is a Robot?
What is a Robot?
What is a Robot?
Robots and the Military

- Navy Fish Robot
- Navy Shipboard Firefighting Robot
Paro, Elder Care Robot

PARO has five kinds of sensors: tactile, light, audition, temperature, and posture sensors, with which it can perceive people and its environment. With the light sensor, PARO can recognize light and dark. He feels being stroked and beaten by tactile sensor, or being held by the posture sensor. PARO can also recognize the direction of voice and words such as its name, greetings, and praise with its audio sensor.

PARO can learn to behave in a way that the user prefers, and to respond to its new name. For example, if you stroke it every time you touch it, PARO will remember your previous action and try to repeat that action to be stroked. If you hit it, PARO remembers its previous action and tries not to do that action.

By interaction with people, PARO responds as if it is alive, moving its head and legs, making sounds, and showing your preferred behavior. PARO also imitates the voice of a real baby harp seal.
Robots as Concierges?

Robots greet Westfield mall shoppers in San Francisco, San Jose

By Benny Evangelista  Updated 7:34 pm, Tuesday, November 22, 2016
Robots as Concierges?

HILTON AND IBM PILOT “CONNIE,” THE WORLD’S FIRST WATSON-ENABLED HOTEL CONCIERGE

Domain knowledge from Watson and WayBlazer will help personalize and enhance the Hilton guest experience.

March 09, 2016 | This information originated in American English

MCLEAN, Va. - Hilton Worldwide (NYSE: HLT) and IBM (NYSE: IBM) today announced a collaboration to pilot "Connie" - the first Watson-enabled robot concierge in the hospitality industry. Connie draws on domain knowledge from Watson and WayBlazer to inform guests on local tourist attractions, dining recommendations and hotel features and amenities.

Connie, named for Hilton's founder Conrad Hilton, marks the first time IBM has developed a Watson-enabled robot for the hospitality market. Connie will work side-by-side with Hilton's Team Members to assist with visitor requests, personalize the guest experience and empower travelers with more information to help them plan their trips.
Robots: Analytics and Artificial Intelligence (AI)

- **Analytics** is “…systematic computational analysis of data or statistics."
- **Artificial Intelligence (AI)** is “…computer science dealing with the simulation of intelligent behavior in computers."
- **Machine Learning** is “…a type of AI that provides computers with the ability to learn without being explicitly programmed.”
Robots: Analytics and Artificial Intelligence (AI)

• This is where raw data becomes usable data.
• This is where faster and better decisions become possible.
Is a Drone a Robot?

ro·bot (noun)
A machine capable of carrying out a complex series of actions automatically, especially one programmable by a computer.
Future Vision: UAS and the PSAP
UAS As a First Responder: House Fire
UAS As A First Responder
Rural Vehicle Crash
UAS As A First Responder
Crime In Progress
UAS As A First Responder
AED Delivery

The ambulance drone that could save your life: Flying defibrillator can reach speeds of 60mph

- $19,000 drone tracks emergency mobile calls and uses the GPS to navigate
- Operators can watch, talk and instruct those helping the victim by using an on-board camera

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UAS As A First Responder
Medication Delivery

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Future Vision: UAS and the PSAP

• Drones will be “dispatched” by the PSAP.
• Drones can provide an aerial communications platform.
• Drones can provide situational awareness through transmission of data and video.
  – Drone data is more credible and useful than citizen video.
  – Drone video can be directed by the PSAP.
Future Vision: 
UAS and the PSAP

• What does the PSAP do with the data?
  – Do you watch the video and make decisions?
  – Do you forward the video to the responding units?
  – Do you store the video for future use?
Future Vision: UAS and the PSAP

• UAS has arrived at a rural house fire and is sending broadband data to the PSAP
  – Location Data
  – Video/Imagery
  – Sensor Data
Future Vision: UAS and the PSAP

- UAS has arrived at a rural house fire and is sending broadband data to the PSAP
  - What do you see?
  - What do you do?
Future Vision: UAS and the PSAP

- What if the UAS told you what it was seeing and what it was sensing?
Future Vision: UAS and the PSAP

• UAS “Arrival Report”
  – Two story structure
  – 2,100 square feet (70 feet by 30 feet)
  – Active Fire 20%
  – Fire Visible – Roof
  – Exposure - Yes
  – Vehicles in Garage
  – Thermal Image scan in progress.

• UAS “Recommendation”
  – Add 2 engines to response.
Future Vision or Current Vision?
PSAP Automation

• Computer Aided Dispatch (CAD) System Functionality
  – Analyzes Location of Incident (123 Main Street).
  – Analyzes Type of Incident (Building Fire).
  – Analyzes Unit Availability (Engine 1, Engine 4).
  – Analyzes Unit Location (AVL).
  – Analyzes Station Run Order for Location (STA 1,4,3).
  – Analyzes Hazards and Special Instructions.
• CAD System then recommends units to respond
  – Automation sends dispatch alert.
CAD System Automation

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Robots and AI

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Robots and AI

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AI and First Responders

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Future Vision - AUDREY

ARTIFICIAL INTELLIGENCE
How NASA is using artificial intelligence to save lives of firefighters, first responders

There's more data than ever available to first responders, but finding the right data at the right time poses big challenges. NASA's Jet Propulsion Laboratory might have an answer.

JPL is working on an artificial intelligence solution called Audrey (Assistant for Understanding Data through Reasoning, Extraction, and Synthesis) that is designed to help local law enforcement, firefighters and other first responders filter the clutter of available information to achieve situational awareness.

(Razum / Shutterstock)
In one example provided by NASA, AUDREY predicted a possible explosion in a building. The AI automatically warns a police officer inside to evacuate, while also telling incoming firefighters or hazardous-material teams to address the threat quickly.

At the same time, a message goes out to personnel outside to limit access to the building.
Future Vision - AUDREY

- DHS Science & Technology Directorate is planning to install AUDREY in a PSAP.
  - Monitor incoming 911 call audio
    - Link seemingly disparate incidents
    - Extrapolate incident severity through multi-call analysis
    - Automatic alerting during call processing
      - To PSAP Supervisor
      - To First Responders
  - Analyze databases of stored information
  - Analyze CAD incidents
Future Vision - AI

- AI can “connect the dots” quickly
- Sensor Data to the PSAP
  - Analyze incident severity based on totality of available information
  - Fire Alarm Activation – Senior Living Center
    - Fire Alarm Sensor: Multi-Detector Smoke and Heat
    - Video Analysis: Thick Smoke
    - Video Analysis: People running toward exits
    - Location Analysis: Assisted Living Facility, reduced evacuation capability
  - Recommend agency designated full alarm response before the first call to 9-1-1 arrives in the PSAP.
### Public Safety Analytics

**Example of Analytic Assisted Emergency Response:**
Fight with weapons in a high school:

<table>
<thead>
<tr>
<th>Impact of Technology on Time: Detection to Arrival</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PROCESS SEGMENT</strong></td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td><strong>TIME (MIN:SEC)</strong></td>
</tr>
<tr>
<td><strong>CUMULATIVE LAPSE TIME</strong></td>
</tr>
<tr>
<td>KEY FUNCTIONS</td>
</tr>
</tbody>
</table>

**Next Generation First Responder Improvements**
- *Video analytics detect fight in progress; identify probable weapon*
- *Sensor alert to PSAP via NG911*
- *Data call routed directly to PSAP*
- *Automatic call entry using ASAP protocol, reviewed by Call Taker. (Call takes also processes 911 call from school)*
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- *Rapid dispatch to officers, with building plan and image/video file.*
- *Automatic Route suggestions*
- *Enhanced GIS data to ID building and access*
- *3D building plans available prior to arrival*
- *Video imagery provides complete suspect description*

*Time segments are estimates and actual values vary greatly among public safety agencies*
*Chart is designed to show conceptual time savings made possible through the use of sensor technology*

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Summary

- UAS will become an important tool for PSAPs.
- Advancements in AI and Machine Learning will help PSAPs manage an incoming flood of broadband data.
  - NG911 data flows from voice, text, images, video; as well as from machine to machine interfaces and sensors.
  - FirstNet data flows from applications, sensors and cameras.
- The Challenge is to envision the future
  - PSAPs should determine how they want to fit into this new technology puzzle.
  - PSAPs should start advocating for staffing, training, and inclusion in the planning process.
Circa 1968

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Circa 1974
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Circa 1986
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Circa 2008
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Reports Available for Review

- Reports located on NPSTC website, www.npstc.org
  - Mission Critical Voice Over LTE
  - Local Control Definitions
  - Unmanned Air Systems and Robotics – Guidelines for Creating a UAS Program
  - FirstNet Web Status Page
  - EMS Telemedicine Report
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Questions (and Answers)

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Thursday, April 13, 2017
APCO Western Regional Conference
Ontario, California

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