Topics

- Introduction
- Pre-Hospital Data Collection
- Web Portal
- Demonstration, Test and Evaluation
- Conclusions
Advanced Health and Disaster Aid Network

Goals

- Collect, track and report patient and incident information for mass casualty (as well as everyday) emergency situations
  - Improve:
    - Collaboration
    - Patient and provider tracking
    - EMS reporting
    - Situational awareness
  - Testbed:
    - Build on existing/emerging technology, products, and prototypes
    - User community involvement
  - Scaleable:
    - All responder groups
    - Extended regions
Introduction

Organizations:
- National Library of Medicine
  Dr. Charles Sneideman, Project Officer
- ECRI
- OPTIMUS ambulance software
- Suburban Hospital
- Johns Hopkins Medical Institution
- Montgomery Blair High School Interns + Test Site
- Montgomery County Fire & Rescue
- Offsite emergency response specialists
- APL (2 coordinators)
- Montgomery County Public Health
- APL NSAD (1 evaluator)
- APL (8 developers)
- Harvard University
  mesh networking vital sign sensors
- University of Virginia
  PCB circuit design
- University of Maryland
  software design
- University of Maryland
  PDA programming
- OPTIMUS
  ambulance software
- University of Maryland
  WISER
- NLM / Next Century
  subcontractor
- APL partner
- Emergency Medical Technology Users
- Independent Evaluation
- Montgomery County Fire & Rescue
- University of Maryland
  PDA programming
- University of Virginia
  PCB circuit design
- APL
- National Library of Medicine
  Dr. Charles Sneideman, Project Officer
- David White, Program Manager
  Tia Gao, Project Manager
- APL
  (2 coordinators)
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- APL partner
- APL NSAD (1 evaluator)
Need for Improved IT Systems

Current Systems: Paper Based

Paper Triage Tags

Pens & Forms

Charts & White Boards

- Paper Triage Tags
- wireless tag with automated sensors
- field PDA
- driver’s license scanner
- Web portals

Introduction
AID-N Testbed System

Disaster Scene

Auxiliary Care Center

Emergency Response Information Center

Hospital ER

EOC

Public Health

ESSENCE Syndromic Surveillance System

Collection and Surveillance of community disease indicators

Legend

Patient Flow

Communication Link

Introduction
Wearable Electronic Triage Tags and Vital Sign Sensors
ZigBee Ad Hoc Mesh Network


Pre-Hospital Data Collection
Patient Monitoring

Vital Sign Monitoring
1) Pulse Oximetry
2) Blood Pressure (upper arm cuff)
3) EKG (2 lead in a Chest Pad)

Location Tracking
1) GPS
2) Indoor Location (MoteTrack)
3) Locality Tracking via base stations

Patient Conditions being Monitored

Category Alert

Cardiac
- No pulse
- Bradycardia
- Tachycardia
- Onset of change
- Stability

Respiratory
- Low oxygen saturation
- Onset of change

Blood Pressure
- Systolic pressure
- Diastolic pressure
- Widening pulse pressure
- Narrowing pulse pressure
- Mean arterial pressure
- Change

Location
- Out of Range

Pre-Hospital Data Collection
Surveillance and Incident Reporting PDA (SIRP)

Log In & Select Patient

Pre-Hospital Data Collection
Pocket PC and Web-Based Versions

Collaborative development with

University of Maryland software design

NLM & Next Century Corp
WISER/Hazmat

Pocket PC Application

Web Version

Pre-Hospital Data Collection
Real Time Vital Signs

Pre-Hospital Data Collection
Functionalities

- Available as PocketPC application and web page (instantaneous deployment to multi-jurisdictional response)
- Offline access
- Update Patient: triage, identification, medication, vital signs, treatments
- Integrate with current paper triage system
- Scan driver’s license for patient identification
- Patient photo for identification
- Photos of patient injuries
- Responder location tracking

Autonomous Aerial Vehicles for Situational Awareness


Pre-Hospital Data Collection
Web Portal Interoperability with Service Oriented Architecture

- **SIRP Clients**
  - Patient ID, complaints
  - Scene info, photos

- **EWISER**
  - Hazmat Description
    - Hazmat Identification Info
    - Hazmat Handling Info

- **Emergency Response Information Center**
  - **WEB PORTAL**
    - Services Oriented Architecture

- **ESSENCE**
  - Disease Surveillance
    - Ambulance Info
    - Patient Status

- **MICHAELS**
  - EMS Reporting
    - Patient Information
    - Disaster Scene Info

- **Public Health**
- **Emergency Depts**
- **EOC**

**CodeBlue**
Patient Tracking
Web Portal View for Triage Officer

Web Portal for Emergency Department

Evaluation

Approach
• User evaluation and feedback throughout the project
• Component and subsystem functional evaluation
• Simulated mass casualty incident

• Development Team
  - APL/NSTD
  - Optimus
  - JHMI
  - Suburban Hosp

• User Community
  - EMS groups
  - Optimus
  - JHMI
  - Suburban Hosp

• Independent Evaluators
  SYSTEMS:
  APL/National Security Analysis Department

  SUBSYSTEMS/COMPONENTS:
  ECRI Institute
User Community

- + 50 EMT-P: medics, platoon chiefs, officers
  - Baltimore County, MD, EMS
  - Montgomery County, MD, EMS
  - Maryland Task Force One
  - Arlington, VA, EMS
  - Richmond, VA, EMS
  - International contacts from EMS conferences

- 2 HCI experts
  - User interface designers from APL

- 12 physicians
  - 4 from Hopkins Med
  - 3 from APL
  - 3 from Suburban Hospital
  - 1 from Stanford Med
  - 1 from Maryland Shock Trauma

- 2 Emergency Department administrators
  - 2 from Suburban Hospital

- 3 Disaster Response Expert
  - Knox Andress, RN, Bioterrorism coordinator for Louisiana Region 7
  - Jeff Michell, PhD,
  - Guy from Maryland Shock Trauma

Triage tarps inside the MCI truck (BWI Airport EMS)
Field Studies

- 50 hours of Ambulance Ride-Alongs with Arlington County EMS
- Anonymous Surveys of medics, over 300 year of combined EMS experience
- Interviews with multiple users
- Mass Casualty Drills observation with Baltimore County EMS
- Round Table Discussions with Baltimore, Arlington EMS and Maryland Task Force One
- Demos with multiple users
- Conferences
  - EMS Today 2006
  - FireHouse Expo 2005

Jul 05 demo at Firehouse EXPO
Selected Survey Results

Results from survey of paramedics on usefulness of Patient Tracking

50 EMS first responders
AID-N Mass Casualty Exercise

What?
- school bus accident

Where?
- Montgomery Blair High School Campus

When?
- 5 August, 2006
  - Exercise Training: 9AM-10AM
  - Exercise: 10AM-11:30AM
  - Patients Arrive at Suburban Hospital: 11AM-12:30PM
  - Debrief/Lunch
    - At Blair: 12PM
    - At Suburban: 1PM

Who?
- 20 victims with trauma injuries
  - 10 tagged with paper tags (control group)
  - 10 tagged with electronic tags
- 13 responders

Exercise Goals
1. Test the usability and applicability of AID-N in a simulated mass casualty incident
2. Compare effectiveness of AID-N technologies versus current emergency medical response tools
3. Collect feedback and suggestions from user community
Mass Casualty Exercise Venue: Montgomery Blair High School
Exercise Participants

- 20 patients
- 16 responders
- 1 hospital, 1 Auxiliary Care Center
- 2 teams with identical structure: 1 commander, 3 officers, 3 medics
  - Electronic Team
  - Paper Team

Paper Team Patients: green shirts

Electronic Team Patients: yellow shirts

Demonstration and T&E
Pre-Drill Training

- Electronic Team Group Training
  - 10 minutes
  - Medics played with devices
- Paper Team pre-trained by standard EMS procedures
Disaster Drill Process

- Patients triaged (tagged)
  - EMS Protocol: Patients *should* be reassessed every 3 - 15 minutes.
- Highest priority patients transported to Hospital
- Remaining patients transported to Auxiliary Care Center

Demonstration and T&E
# Web Portal View for Transport Officer

**Live demo:** [http://www.aid-n.org/eric](http://www.aid-n.org/eric)

## Patient Transport Status (11 patients)

<table>
<thead>
<tr>
<th>Triage</th>
<th>Patient ID</th>
<th>Age</th>
<th>Gender</th>
<th>Chief Complaint</th>
<th>Exposure</th>
<th>Location [Type: Name]</th>
<th>Departed Incident At</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>22</td>
<td>60</td>
<td>M</td>
<td></td>
<td>Facility Suburban</td>
<td>10:43 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>28</td>
<td>17</td>
<td>F</td>
<td>Laceration</td>
<td>Scene: 51 university Boulevard East</td>
<td>10:43 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>27</td>
<td>12</td>
<td>M</td>
<td></td>
<td>Facility Blair</td>
<td>10:44 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>29</td>
<td>9</td>
<td>F</td>
<td></td>
<td>Scene: 51 university Boulevard East</td>
<td>10:43 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>30</td>
<td></td>
<td>Unknown</td>
<td>Penetrating Injury, Respiratory</td>
<td>Scene: 51 university Boulevard East</td>
<td>2:45 PM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>23</td>
<td></td>
<td>Unknown</td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>21</td>
<td>22</td>
<td>M</td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>24</td>
<td>19</td>
<td>F</td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>26</td>
<td>18</td>
<td>F</td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>25</td>
<td>65</td>
<td>F</td>
<td></td>
<td>Facility Suburban</td>
<td>10:36 AM</td>
<td></td>
</tr>
</tbody>
</table>

## Triage Status

<table>
<thead>
<tr>
<th>Location</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>On Scene</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Departed</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>1</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>

## Bed Availability

<table>
<thead>
<tr>
<th>Facility</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Suburban</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>JHMI</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>Blair</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

## Vehicle Status (3 vehicles)

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Type</th>
<th>Status</th>
<th>Destination</th>
<th>Arrival Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>2149</td>
<td>ALS Ambulance</td>
<td>Unknown</td>
<td>Suburban</td>
<td>10:57 AM</td>
</tr>
<tr>
<td>2149</td>
<td>ALS Ambulance</td>
<td>Enroute to Facility</td>
<td>Suburban</td>
<td>10:57 AM</td>
</tr>
<tr>
<td>2591</td>
<td>ALS Ambulance</td>
<td>Unknown</td>
<td>Suburban</td>
<td>Estimated: 10:59 AM</td>
</tr>
</tbody>
</table>

**Demonstration and T&E**
## Triage Counts 8/5/07

### Patient Triage Counts During the Drill

<table>
<thead>
<tr>
<th>Patient</th>
<th>Team A</th>
<th>Team B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient 1</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Patient 2</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Patient 3</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>Patient 4</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>Patient 5</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Patient 6</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Patient 7</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>Patient 8</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Patient 9</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Patient 10</td>
<td>12</td>
<td>2</td>
</tr>
<tr>
<td>Unspecified</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Totals:</strong></td>
<td><strong>78</strong></td>
<td><strong>29</strong></td>
</tr>
<tr>
<td><strong>Mean:</strong></td>
<td><strong>7.8</strong></td>
<td><strong>2.9</strong></td>
</tr>
<tr>
<td><strong>Standard Deviation:</strong></td>
<td><strong>2.8</strong></td>
<td><strong>1.8</strong></td>
</tr>
</tbody>
</table>

- Patients required to be re-triaged/assessed until they reached the hospital or the end of the drill
- Team A patients re-triaged 2.5 times more frequently than Team B and more evenly distributed across patients

Team A: E-Tags
Team B: Paper Tags
Advanced Health and Disaster Aid Network

Accomplishments

- Successful demonstration of AID-N System

- Introduced new technology
  - VitalMote: Patient Wearable Device
  - SIRP (Surveillance and Incident PDA)
  - Miniature autonomous UAV
  - Web Portal: Emergency Response Information Center
  - Services Oriented Architecture
    - SIRP, ESSENCE, Michaels, and WISER integration

- Large team of collaborating partners and user organization involvement
Advanced Health and Disaster Aid Network

More Work Required

- Further Development and T&E
  - Pilot tests
  - GPS and Indoor location
  - Web conferencing/collaboration
  - Integration with other advanced emergency response IT systems

- Barriers to Adoption
  - Limited training; must use everyday
  - New technologies require new procedures
  - Some responders uncomfortable to be watched over by the technology
Questions?

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http://www.jhuapl.edu/aidn