Advanced Health and Disaster Aid Network (AID-N)

David M. White, DSc

National Library of Medicine
Reverse Site Visit
August 28-29, 2007
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
Organization

National Library of Medicine
  Dr. Charles Sneideman,
   Project Officer

Emergency Medical Technology Users
  APL
   (2 coordinators)
  Montgomery County Public Health
  Suburban Hospital
  Johns Hopkins Medical Institution
  Montgomery Blair High School
   Interns + Test Site
  Montgomery County Fire & Rescue
  Offsite emergency response specialists

APL
  (2 coordinators)

David White, Program Manager
  Tia Gao, Project Manager

Technology

APL
  (8 developers)

Harvard University
  mesh networking
   vital sign sensors

University of Maryland
  software design

University of Virginia
  PCB circuit design

University of Maryland
  PDA programming

OPTIMUS
  ambulance software

NLM / Next Century - WISER

Independent Evaluation
  APL NSAD
   (1 evaluator)

ECRI

Introduction
Need for Improved IT Systems

Current Systems: Paper Based

- Paper Triage Tags
- Pens & Forms
- Charts & White Boards
- Wireless tag with automated sensors
- Field PDA
- Driver’s license scanner
- Web portals
Wearable Electronic Triage Tags and Vital Sign Sensors
ZigBee Ad Hoc Mesh Network

Wireless Blood Pressure Cuff
2 lead EKG

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 basestations

**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
Surveillance and Incident Reporting PDA (SIRP)

Log In & Select Patient

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

Pocket PC Application

Web Version

Collaborative development with

University of Maryland software design

NLM & Next Century Corp

WISER/Hazmat

Pre-Hospital Data Collection
Real Time Vital Signs

Pre-Hospital Data Collection
SIRP: Incident Documentation

Automated input from sensors

- 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

Web Portal Interoperability with Service Oriented Architecture

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

WISER
Hazmat Reference
- 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

CodeBlue
Patient Tracking
- Patient Vitals
- Patient Location

Public Health

Emergency Depts

EOC

...
Web Portals for Commander & Officers

On Scene

2:00 PM 2:05 PM 2:10 PM 2:15 PM 2:20 PM 2:25 PM 2:30 PM

Transported

Legend:
- Red
- From Green to Red

Triage Status  Bed Availability

Scene Map
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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Usefulness</th>
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<tbody>
<tr>
<td>GPS</td>
<td>3</td>
</tr>
<tr>
<td>Etag</td>
<td>5</td>
</tr>
<tr>
<td>PulseOx</td>
<td>4</td>
</tr>
<tr>
<td>BP cuff</td>
<td>2</td>
</tr>
<tr>
<td>Vital Signs Graph</td>
<td>5</td>
</tr>
<tr>
<td>Vital Signs Alarm</td>
<td>4</td>
</tr>
<tr>
<td>Ability to turn OFF Alarm</td>
<td>3</td>
</tr>
<tr>
<td>Customizable detection thresholds</td>
<td>4</td>
</tr>
<tr>
<td>List patients sorted by color</td>
<td>6</td>
</tr>
<tr>
<td>Buzz/blink to locate patients</td>
<td>5</td>
</tr>
<tr>
<td>Store patient information on wristband</td>
<td>4</td>
</tr>
<tr>
<td>Map on the JavaGUI</td>
<td>5</td>
</tr>
<tr>
<td>Map on the environmental view</td>
<td>4</td>
</tr>
</tbody>
</table>

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

Demonstration and T&E
Mass Casualty Exercise Venue:
Montgomery Blair High School
Site Map for MCI Simulation

- Transport Area
- Treatment Area (secondary triage)
- Triage
- Warm Zone
- Hot Zone
- BUS (20 victims)
- 20 victims
- 20 victims
- 8 victims
- 12 victims
- Blair (triage and treatment cntr)

Transport vehicles
Cargo vehicles EXIT

Demonstration and T&E
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
# 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>
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<tbody>
<tr>
<td>I</td>
<td>22</td>
<td>60</td>
<td>M</td>
<td></td>
<td></td>
<td>Facility Suburban</td>
<td>10:43 AM</td>
</tr>
<tr>
<td>II</td>
<td>28</td>
<td>17</td>
<td>F</td>
<td>Laceration</td>
<td></td>
<td>Scene: 51 university Boulevard East</td>
<td>10:43 AM</td>
</tr>
<tr>
<td>II</td>
<td>27</td>
<td>12</td>
<td>M</td>
<td></td>
<td></td>
<td>Facility Blair</td>
<td>10:44 AM</td>
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<tr>
<td>II</td>
<td>29</td>
<td>9</td>
<td>F</td>
<td></td>
<td></td>
<td>Scene: 51 university Boulevard East</td>
<td>10:43 AM</td>
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<tr>
<td>II</td>
<td>30</td>
<td></td>
<td>F</td>
<td>Penetrating Injury, Respiratory</td>
<td></td>
<td>Scene: 51 university Boulevard East</td>
<td>2:45 PM</td>
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<tr>
<td>II</td>
<td>23</td>
<td></td>
<td>F</td>
<td></td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
</tr>
<tr>
<td>II</td>
<td>21</td>
<td>22</td>
<td>M</td>
<td></td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
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<tr>
<td>II</td>
<td>24</td>
<td>19</td>
<td>F</td>
<td></td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
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<tr>
<td>II</td>
<td>36</td>
<td></td>
<td>F</td>
<td></td>
<td></td>
<td>Facility Blair</td>
<td>10:43 AM</td>
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<tr>
<td>II</td>
<td>25</td>
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<td>F</td>
<td></td>
<td></td>
<td>Facility Suburban</td>
<td>10:35 AM</td>
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## Triage Status

<table>
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<tr>
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<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>
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<tr>
<td>Total</td>
<td>1</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>11</td>
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</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>I</th>
<th>II</th>
<th>III</th>
<th>IV</th>
<th>Total</th>
</tr>
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<tbody>
<tr>
<td>Suburban</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>JHMI</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blair</td>
<td>0</td>
<td>0</td>
<td>0</td>
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</table>

## Bed Availability

<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>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>0</td>
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<tr>
<td>Blair</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>0</td>
<td>10</td>
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</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>
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<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>Unknown</td>
<td>Suburban</td>
<td>10:57 AM</td>
</tr>
<tr>
<td>2591</td>
<td>ALS Ambulance</td>
<td>Enroute to Facility</td>
<td>Suburban</td>
<td>Estimated: 10:53 AM</td>
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</tbody>
</table>

Demonstration and T&E
Patient Triage Counts During the Drill

<table>
<thead>
<tr>
<th></th>
<th>Team A</th>
<th>Team B</th>
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<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?

Dr. David M. White

david.white@jhuapl.edu

240-228-5949

http://www.jhuapl.edu/aidn