



Advanced Health and Disaster Aid Network (AID-N)

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National Library of Medicine

Reverse Site Visit

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National Library of Medicine
Scaleable Information Infrastructure
Contract N01-LM-3-3516

APL
The Johns Hopkins University
APPLIED PHYSICS LABORATORY

Topics

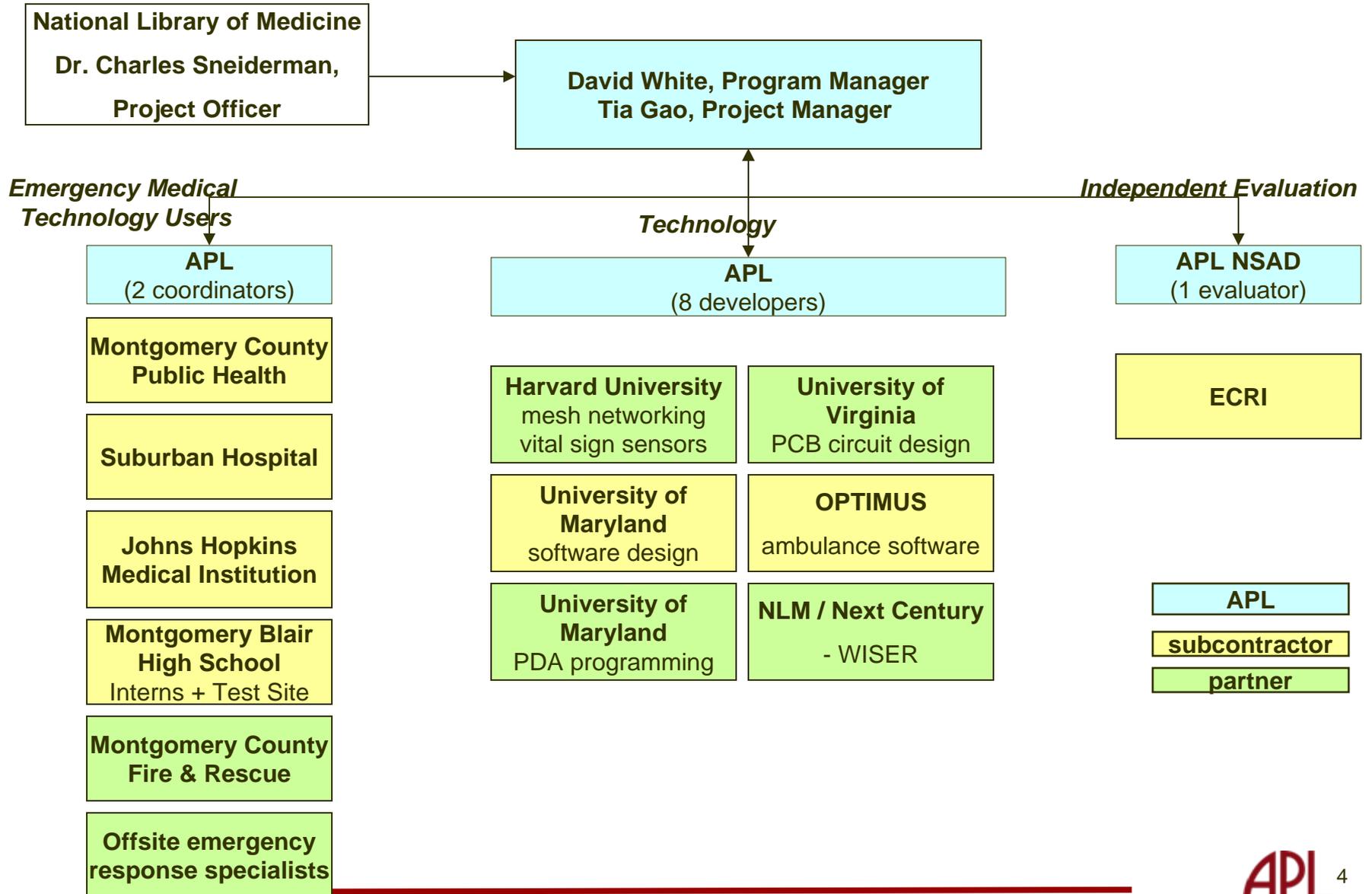
- **Introduction**
- **Pre-Hospital Data Collection**
- **Web Portal**
- **Demonstration, Test and Evaluation**
- **Conclusions**

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

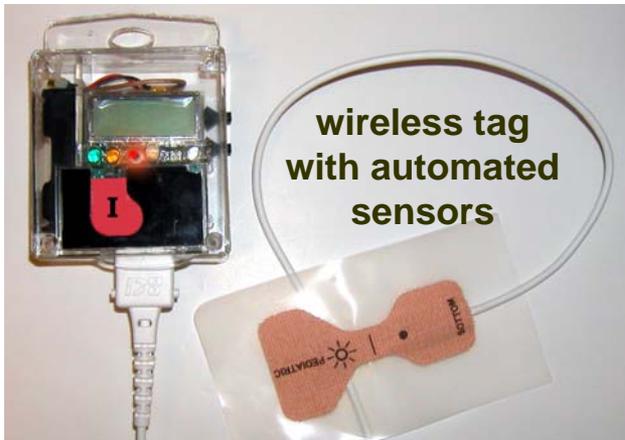


Need for Improved IT Systems

Current Systems: Paper Based



Paper Triage Tags



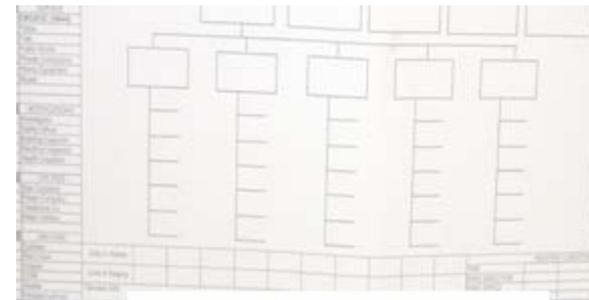
Pens & Forms



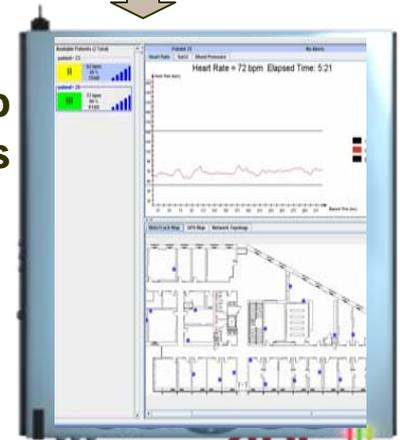
field PDA



driver's license scanner

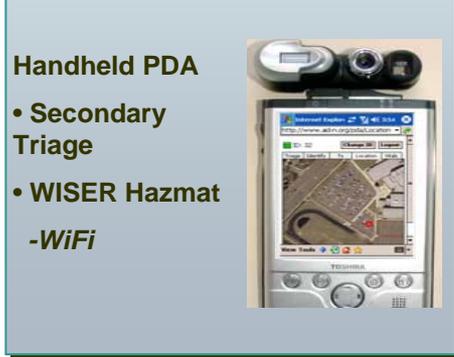


Charts & White Boards



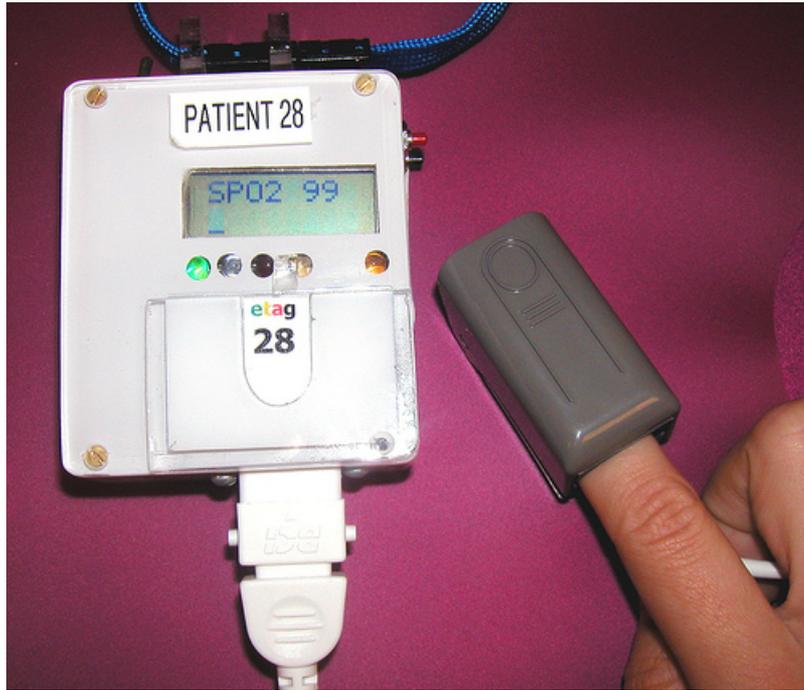
Web portals

AID-N Testbed System

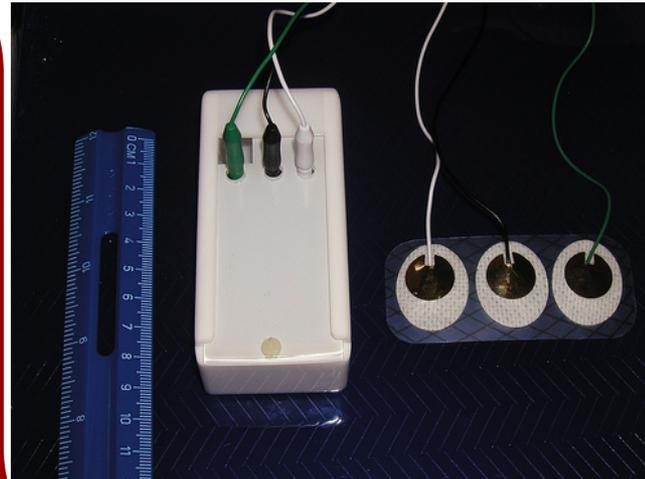


Wearable Electronic Triage Tags and Vital Sign Sensors

ZigBee Ad Hoc Mesh Network



Wireless Blood Pressure Cuff



2 lead EKG



Casualty

Published in: Vital Signs Monitoring and Patient Tracking Over a Wireless Network, Tia Gao, Matt Welsh, Ray Juang, and Alex Alm, In *Proceedings of the 27th IEEE EMBS Annual International Conference*, September 2005.

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)



Collaborative development with

University of Maryland
software design

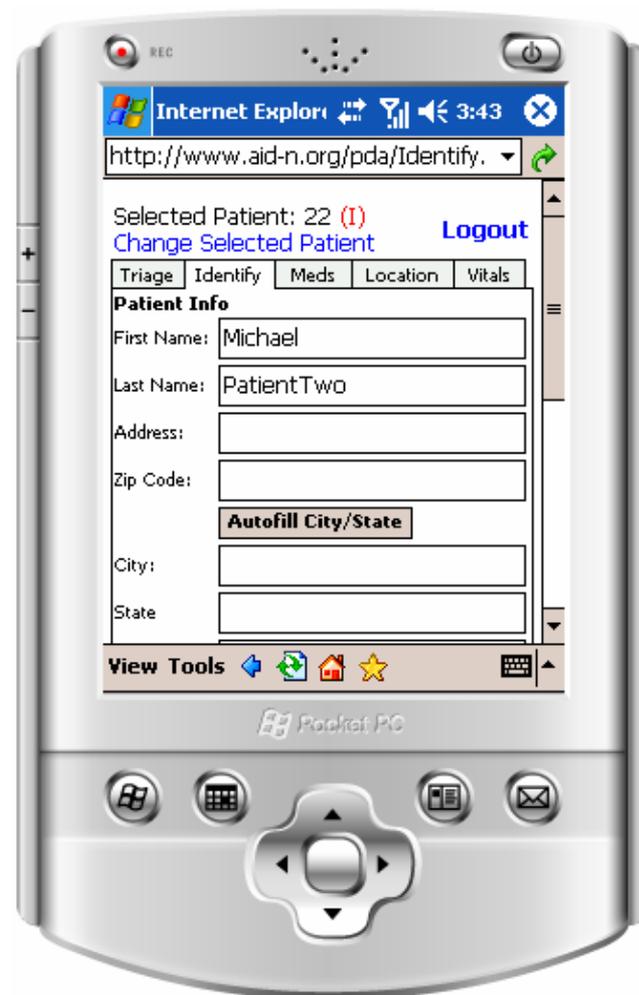
NLM & Next Century Corp
WISER/Hazmat

Log In & Select Patient

Pocket PC and Web-Based Versions



Pocket PC Application



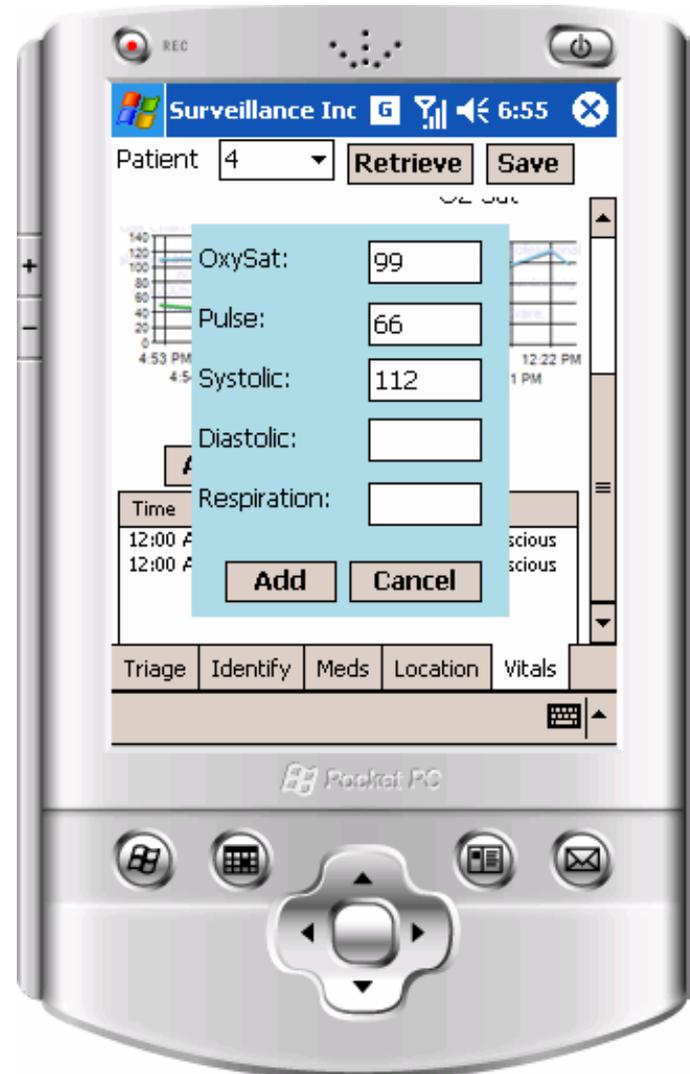
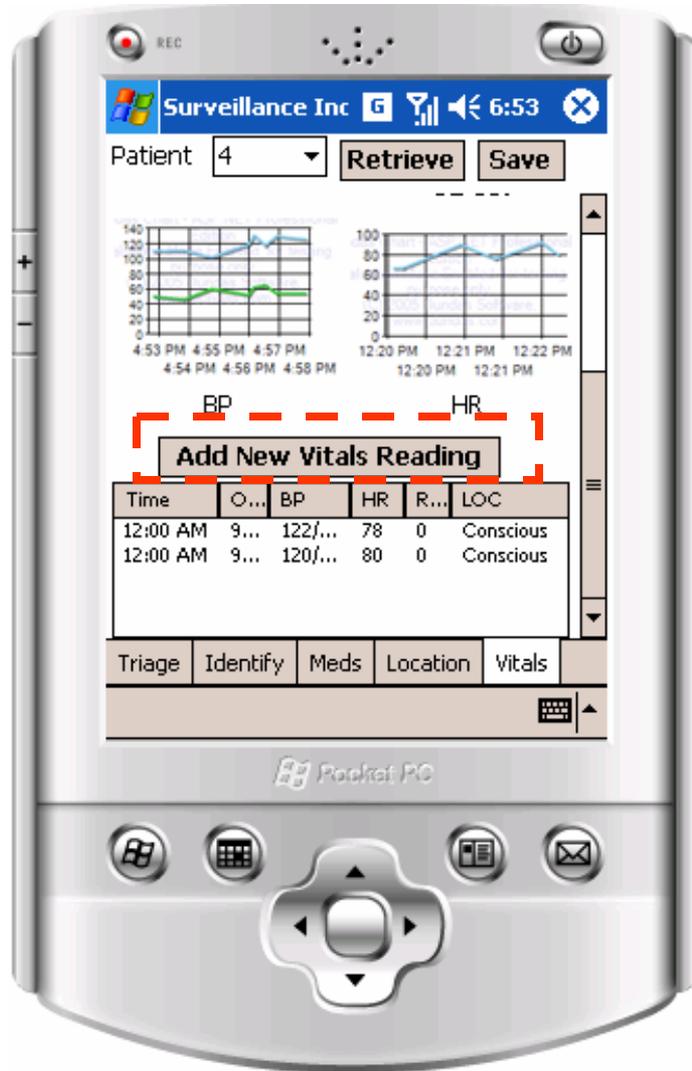
Web Version

Collaborative development with

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WISER/Hazmat

Real Time Vital Signs



SIRP: Incident Documentation

Automated input from sensors



PDA w/ Camera



barcode scanner



Driver's license



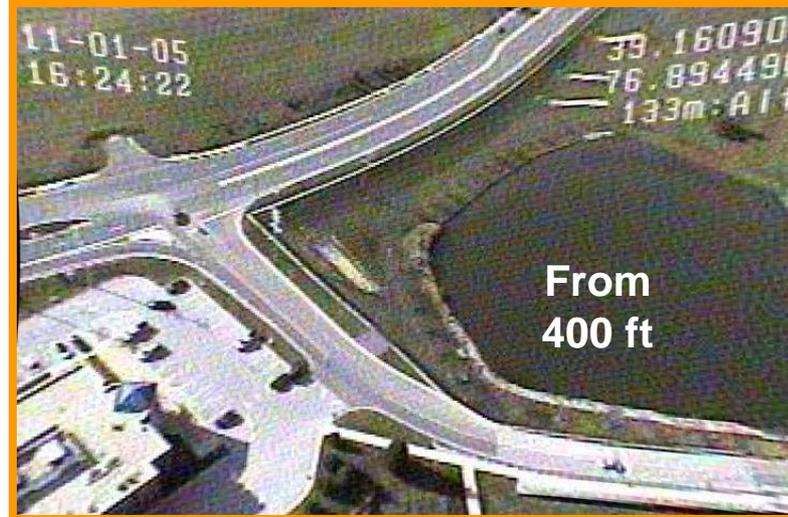
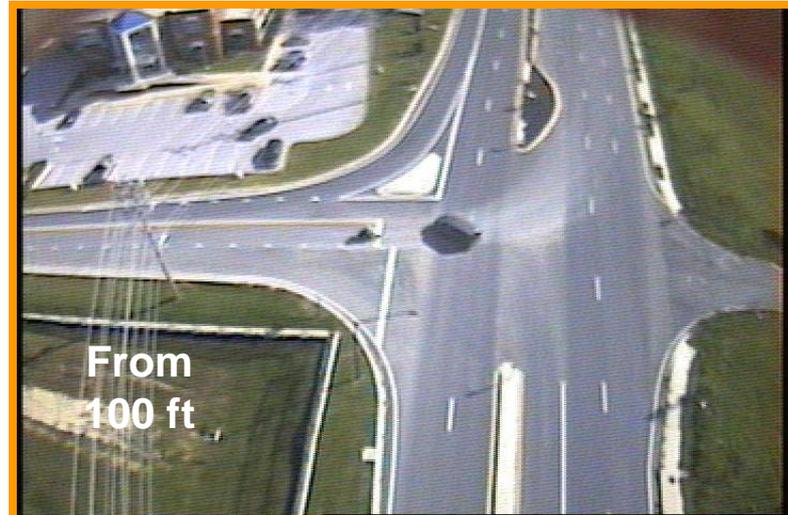
GPS

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

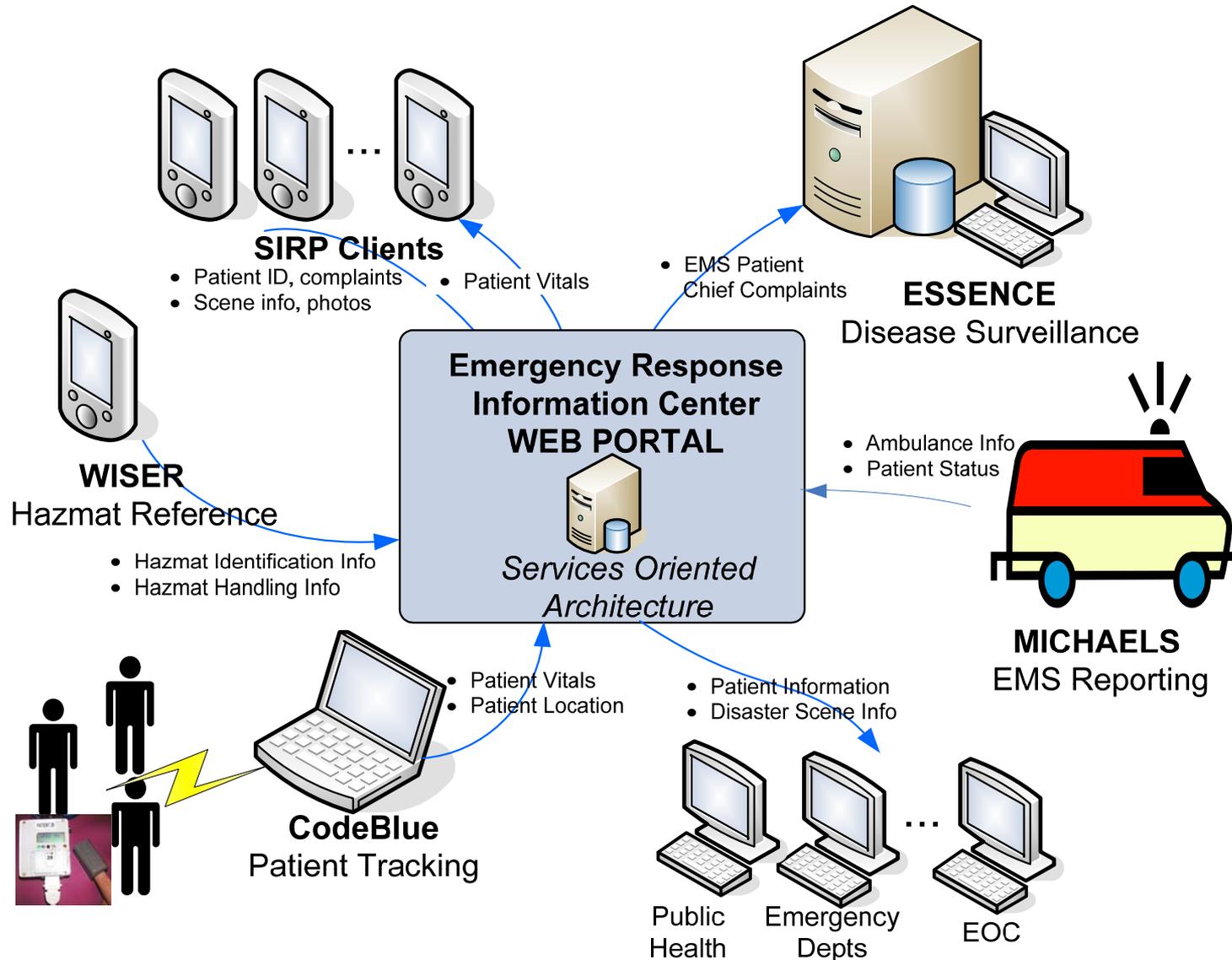
Information Collection and Dissemination: Toward a portable, real-time information sharing platform for emergency response, David Crawford, et al. *Proceedings of AMIA 2006 Annual Symposium*, November, 2006.

Autonomous Aerial Vehicles for Situational Awareness



Published in: UAV Surveillance System To Support Emergency Response to Disasters, Pedro Rodriguez, et al. *Proceedings of AMIA 2006 Annual Symposium*, November, 2006.

Web Portal Interoperability with Service Oriented Architecture



Web Portals for Commander & Officers



Web Portal View for Triage Officer



Iterative User-Centered Design of a Next Generation Patient Monitoring System for Emergency Medical Response, Tia Gao, Matthew Kim, and Alex Alm, *Proceedings of AMIA 2006 Annual Symposium*, November, 2006.

Web Portal for Emergency Department

File Edit View Back Address http://aidn/mentor/default2.aspx Go

Home Documents and Lists Create Site Settings Help Up to AID-N ERIC

Suburban Hospital Emergency Room Personnel View [Modify Shared Page](#)

patients enroute to Suburban Hospital ER Show Admitted Patients

Patient ID	Estimated Arrival	Age	Gender	Chief Complaint	Chemical Spill	Admitted
12	7/1/05 10:40AM	30	M	fever	None	<input type="checkbox"/>
11	7/1/05 10:52AM	42	F	head trauma unconscious	None	<input type="checkbox"/>
10	7/1/05 11:20AM	50	M	syncope	None	<input type="checkbox"/>

Individual Patient View

Latest Photo of Patient 12 

Last Update	7/1/05 10:35AM, EST
Identification	Last Name: Greenspan First Name: Dan Age: 30 Gender: M
Vital Signs	Pulse: 119 bpm SpO2: 92% Respiration Rate: 26 bpm Blood Pressure: 130/88 Body Temp.: 106.5
Status	Respiration Effort: Normal Perfusion: None Mental: coherent
Presence of	Ambulatory Bleeding Penetrating Wounds Burns Fractures Limb Loss Contamination: none on skin
Identification	Contagious Agent Language Ethnicity name Address Phone Number
Patient Disposition Underlying conditions	

Pervasive Patient Tracking for Mass Casualty Incident Response, Alex Alm, Tia Gao, David White, *Proceedings of AMIA 2006 Annual Symposium*, November, 2006.

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:

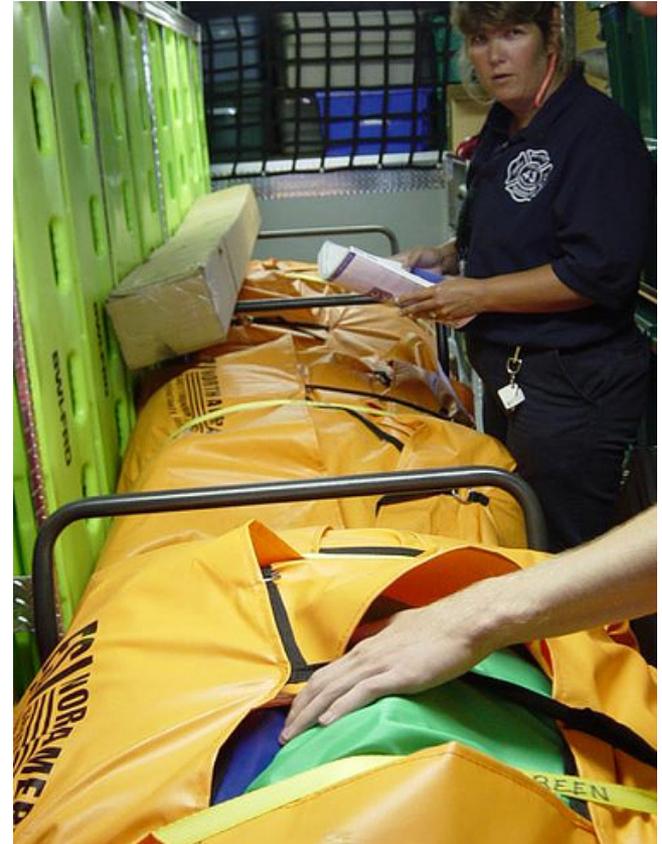
APL/National Security Analysis Department

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)

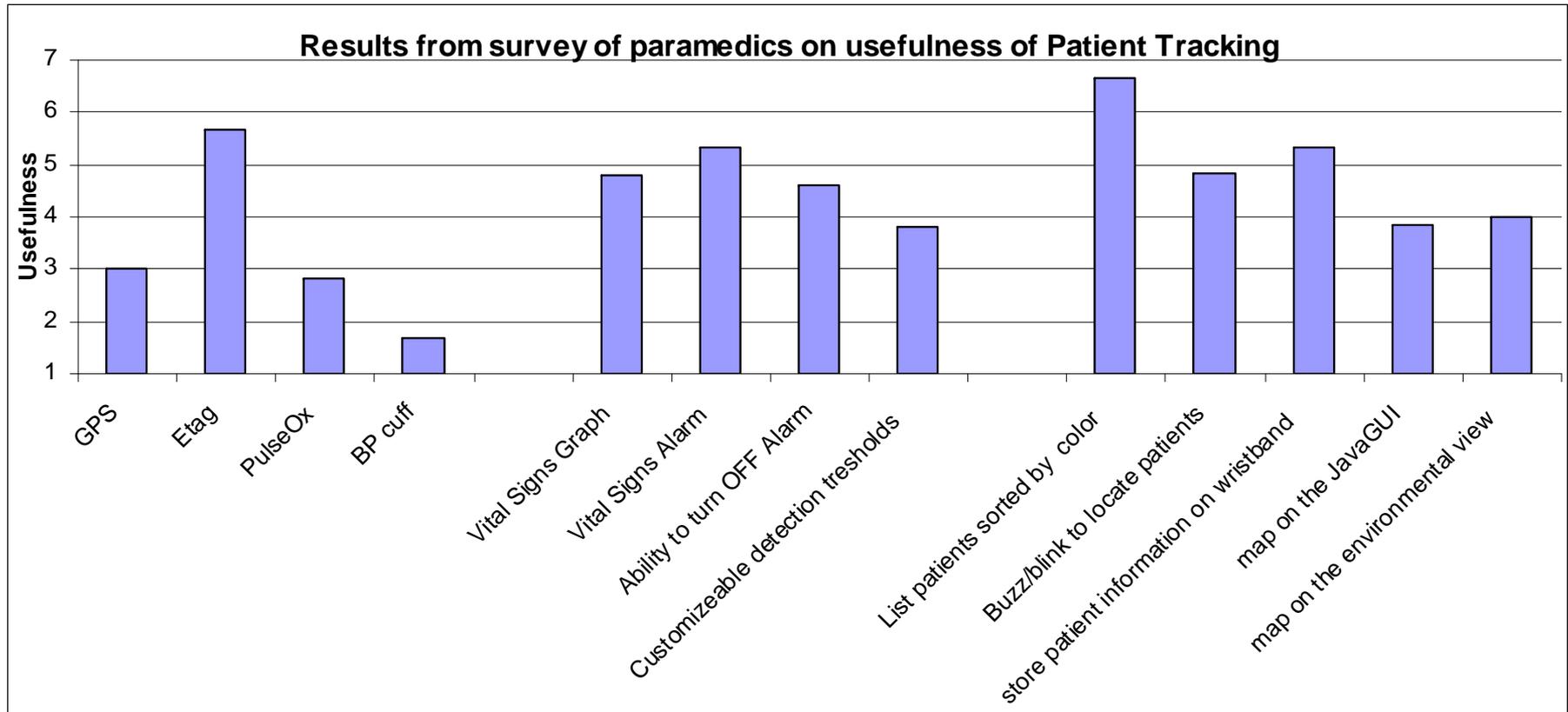
Field Studies

- 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



50 EMS first responders

AID-N Mass Casualty Exercise

What?

- school bus accident

Where?

- Montgomery Blair High School Campus

When?

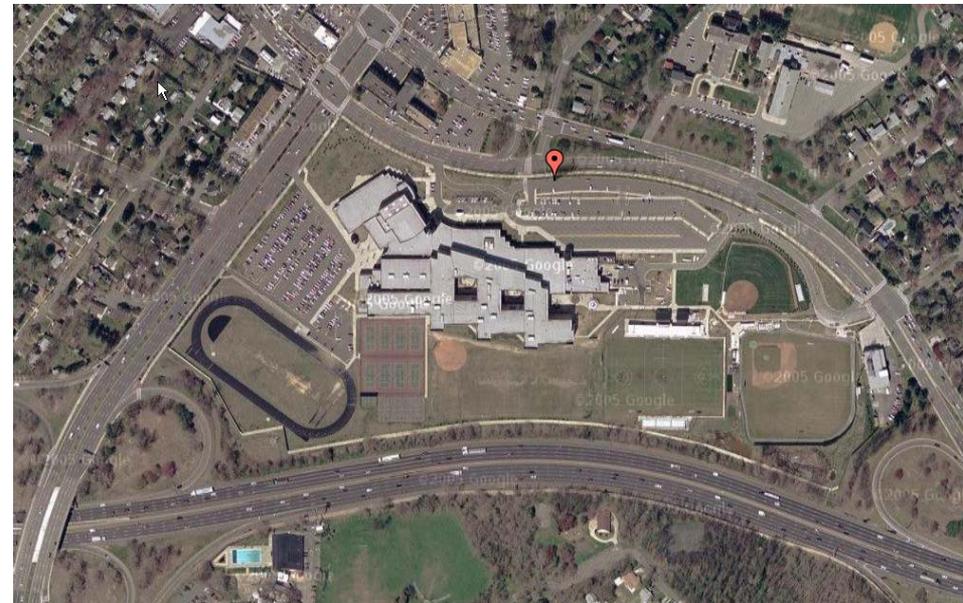
- 5 August, 2006
 - Exercise Training: 9AM-10AM
 - Exercise: 10AM-11:30AM
 - Patients Arrive at Suburban Hospital: 11AM-12:30PM
 - Debrief/Lunch
 - At Blair: 12PM
 - At Suburban: 1PM

Who?

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

Exercise Goals

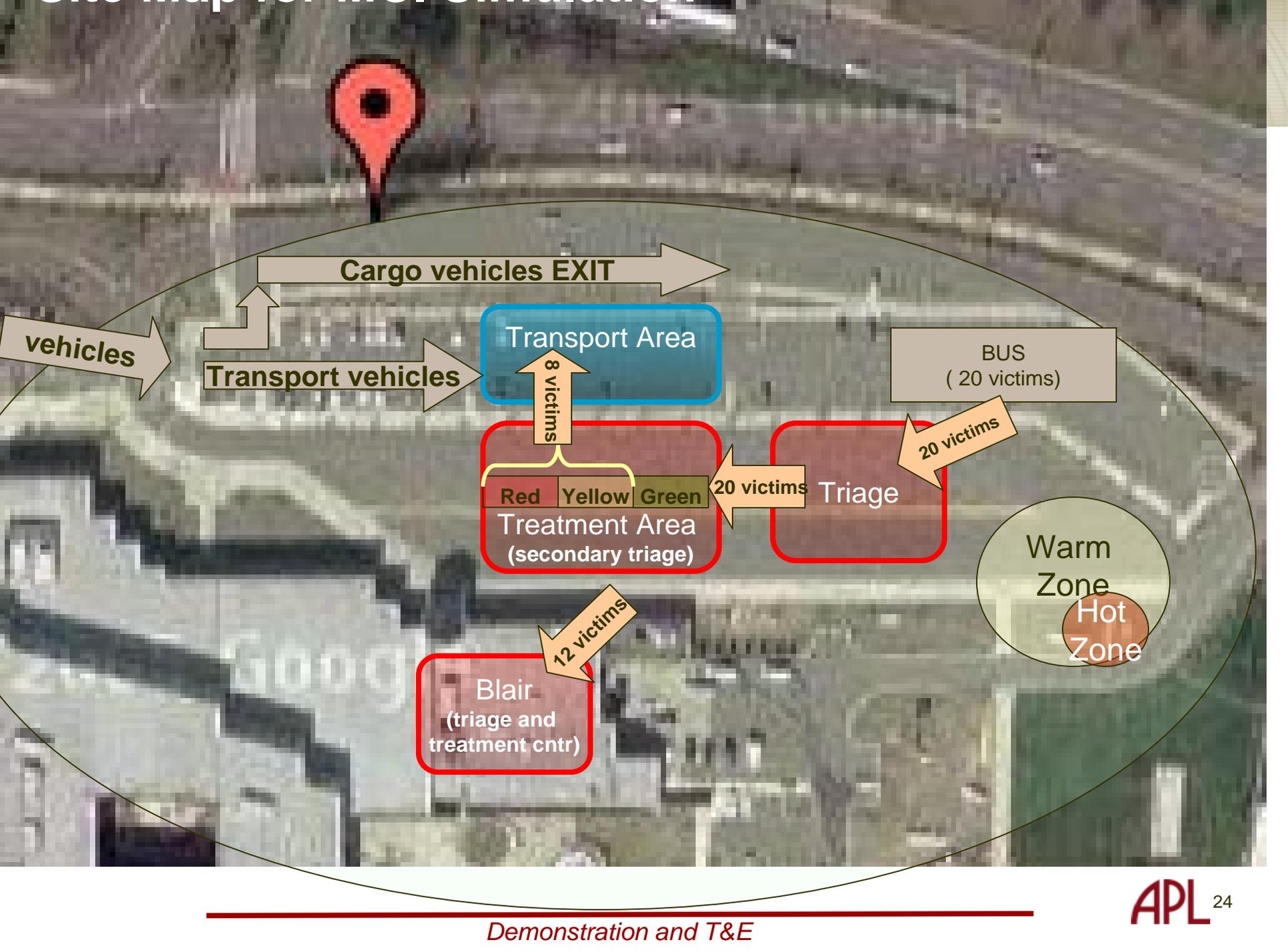
1. Test the usability and applicability of AID-N in a simulated mass casualty incident
2. Compare effectiveness of AID-N technologies versus current emergency medical response tools
3. Collect feedback and suggestions from user community



Mass Casualty Exercise Venue: Montgomery Blair High School



Demonstration and T&E



Cargo vehicles EXIT

vehicles

Transport vehicles

Transport Area

BUS
(20 victims)

8 victims

Red Yellow Green
Treatment Area
(secondary triage)

20 victims

Triage

20 victims

Warm
Zone
Hot
Zone

Blair
(triage and
treatment ctr)

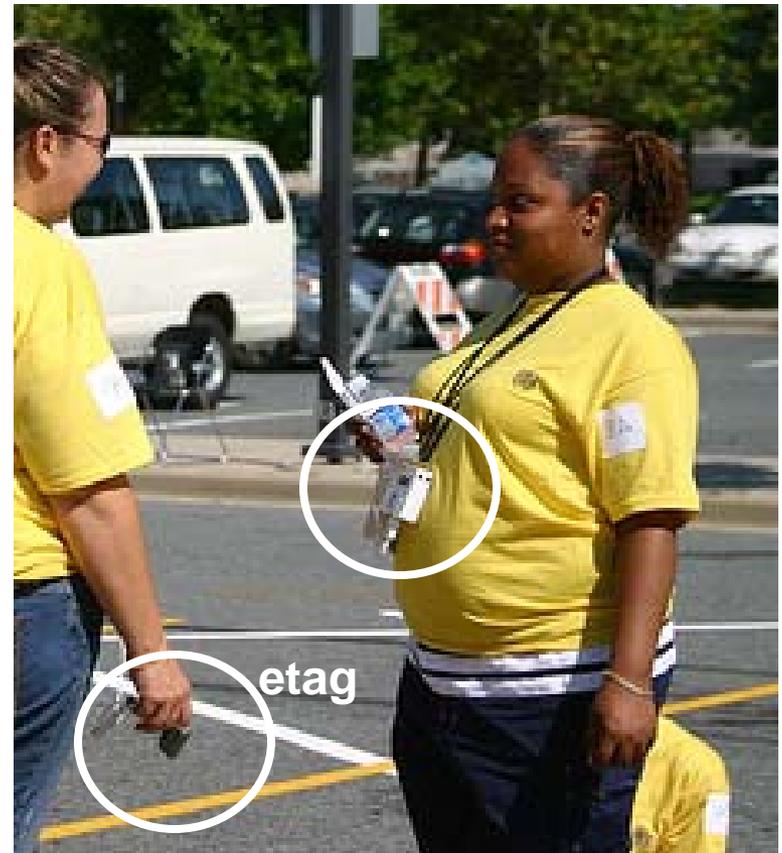
12 victims

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 tag



e-tag

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>

Address <http://www.aid-n.org/eric/IncidentCommander/informations.asi> Go Google Search 40 blocked Check

Patient Transport Status (11 patients)

Triage	Patient ID	Age	Gender	Chief Complaint	Exposure	Location [Type: Name]	Departed Incident At
I	22	60	M			Facility: Suburban	10:43 AM
III	28	17	F	Laceration		Scene: 51 university Boulevard East	10:43 AM
III	27	12	M			Facility: Blair	10:44 AM
III	29	9	F			Scene: 51 university Boulevard East	10:43 AM
III	35	Unknown	Unknown			Scene: 51 university Boulevard East	-
III	30	Unknown	F	Penetrating Injury, Respiratory		Scene: 51 university Boulevard East	2:45 PM
III	23	Unknown	Unknown			Facility: Blair	10:43 AM
III	21	22	M			Facility: Blair	10:43 AM
III	24	19	F			Facility: Blair	10:43 AM
III	26	18	F			Facility: Blair	10:43 AM
III	25	65	F			Facility: Suburban	10:38 AM

Location	I	II	III	IV	Total
On Scene	0	0	4	0	4
Departed	1	0	6	0	7
Total	1	0	10	0	11
Suburban	0	0	0	0	0
Enroute to	0	0	0	0	0
Arrived at	1	0	1	0	2
JHMI	0	0	0	0	0
Enroute to	0	0	0	0	0
Arrived at	0	0	0	0	0
Blair	0	0	0	0	0
Enroute to	0	0	0	0	0
Arrived at	0	0	5	0	5

Facility	I	II	III	IV	Total
Suburban	0	4	0	0	4
JHMI	0	0	0	0	0
Blair	0	0	10	0	10

Vehicle Status (3 vehicles)

Vehicle	Type	Status	Destination	Arrival Time
2149	ALS Ambulance	Unknown	Suburban	10:57 AM
2149	ALS Ambulance	Unknown	Suburban	10:57 AM
2591	ALS Ambulance	Enroute to Facility	Suburban	Estimated:10:59 AM

Refresh Last Updated: 9/5/2006 12:43:25 PM

Triage Counts

8/5/07

Patient Triage Counts During the Drill		
	Team A	Team B
Patient 1	7	5
Patient 2	7	4
Patient 3	7	3
Patient 4	12	4
Patient 5	8	1
Patient 6	10	0
Patient 7	4	1
Patient 8	7	5
Patient 9	4	2
Patient 10	12	2
Unspecified	0	2
Totals:	78	29
Mean:	7.8	2.9
Standard Deviation:	2.8	1.8

Team A: E-Tags

Team B: Paper Tags

- **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**

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**

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>