

NYC Office of Emergency Management
Situational Awareness for Field Operations Support System
ESIG URISA AWARD 2010 – Single Process System

May 3, 2010

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A. System

1. Name of system and ESIG™ category for which you are applying (Enterprise System or Single Process System).

Situational Awareness for Field Response System
Category: **Single Process System**

2. A letter from the executive administrator authorizing submission of the system application (letters must be signed and scanned).

Letter from James McConnell, Assistant Commissioner for Strategic Data, GIS Division, NYC Office of Emergency Management
See attachment: JM_Exec_Signoff_ESIG.pdf

3. One (1) page, or less, summary of what the system accomplishes and why it is exemplary.

The NYC Office of Emergency Management (OEM) was formed in 1996 as a mayoral office and was granted department status in the New York City Charter in 2001. Its primary objective is to plan and prepare the city for emergencies, coordinate emergency response and recovery and educate the public in order to better prepare for emergencies.

Public safety agencies such as police (NYPD), fire (FDNY) department respond to emergencies within their jurisdiction as mandated by NYC Charter. OEM also sends field responders to major incidents within NYC in order to facilitate inter-agency communication, resource request, and compliance with incident command protocol. The Watch Command unit works directly with the Field Operations unit to provide logistical support from headquarters.

In a major incident, the Emergency Operation Center (EOC) becomes the central point for information coordination, resource requests, and decision making. In the case of recovery and relief, OEM works with governmental agencies and non-profit organizations to provide disaster relief and assistance. The primary threats OEM responds to are building collapse/explosions, utilities disruption (power), extreme heat/cold, fire, flooding, coastal storms and hurricanes, disease outbreaks & biological events among others.

The Situational Awareness for Field Response System was developed to assist the agency's Operations Division in acquiring immediate situational awareness as an incident is reported as well as to provide citywide tracking on all OEM monitored incidents. The system allows watch commanders and citywide interagency coordinators/field responders to access and query the agency's GIS data sets from their desks or vehicles. The primary users of the application are watch commanders and field responders and therefore the system is geared towards a task-oriented approach.

Components of the Situational Awareness for Field Response System are:

- Active Incident Dashboard – This web mapping application spatially displays all active incidents monitored by OEM. It integrates with OEM's commercial off-the-shelf (COTS) incident management solution (E-Team) and electric network status board and displays the information with a clear and easy to decipher mapping symbology.

The dashboard is designed to be at-a-glance view of all incidents in the OEM monitored incident in city: a snapshot of incidents. The system is designed to be displayed on large screens in the EOC and the Watch Command unit. Labeling the incidents is a key issue in the system design and the ability to assimilate incident summary report via this interface makes it an appealing application for emergency managers in making key decisions. Population figures for electric network with potential issues are available via the dashboard and this in addition to network status will assist in determining response type.

- Emergency Response Data Packet (ERDP) system – An automated system for generating maps and reports about an incident scene thus providing immediate situational awareness for emergency response first responders. The “incident response packet” consists of three maps (area, aerial and neighborhood maps) and four reports (administrative boundary, nearest critical facilities, demographic, land use reports).

The Situational Awareness for the Field Response System is exemplary on account of 1). The ERDP system embodies the main elements of the GIS Incident Response protocol established at NYC OEM. The first set of maps required during an incident by the protocol is an aerial, area and neighborhood map. The protocol established best practices for layers, symbology and scales for each map. The ERDP system provides an automated way to generate the maps and reports in approximately 60 seconds. As the incident escalates, a GIS specialist can conduct more advanced spatial analysis and enhance the maps needed for an incident. 2.) The dashboard shows a snapshot of incidents monitored by NYC OEM in the city. The sophisticated symbology and labels enables a user to quickly scan the web map and determine spatial trends and as well as provide a visual tool for citywide incident management by an emergency manager.

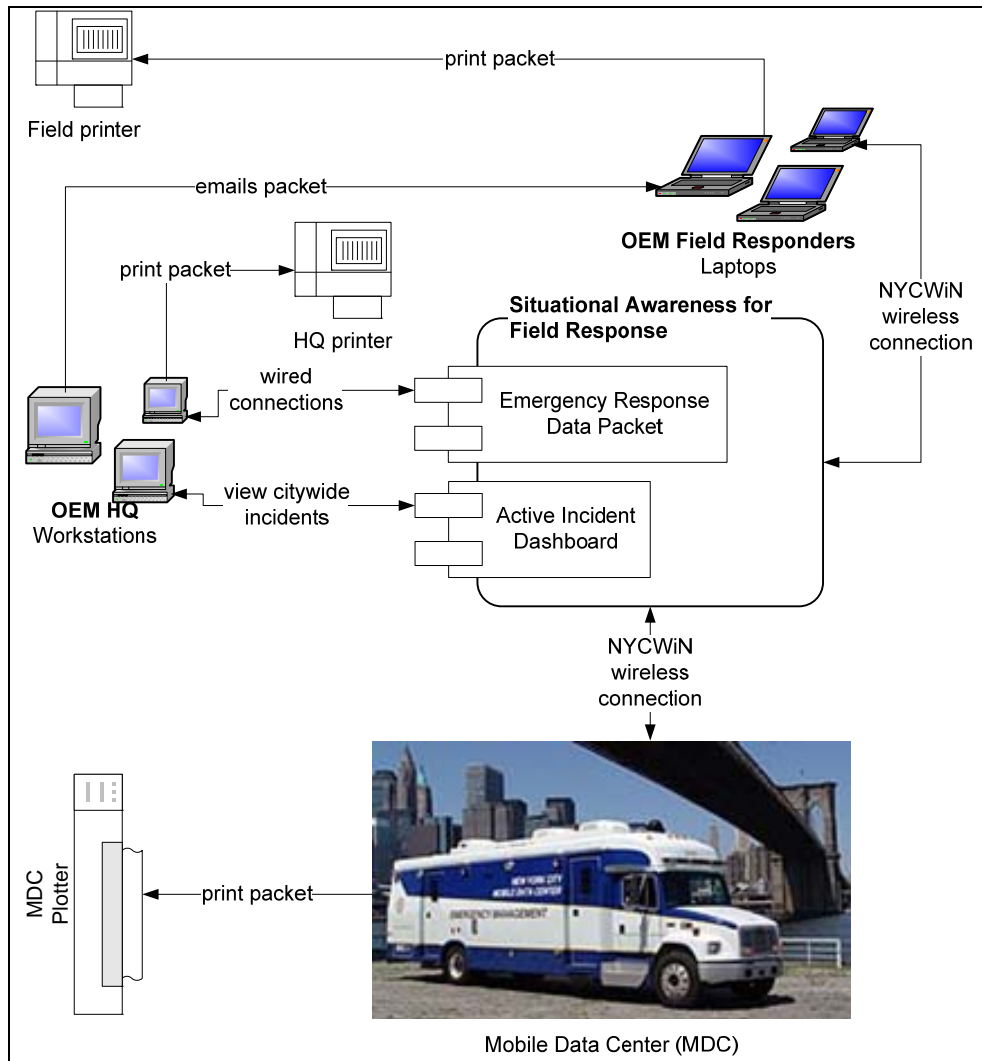


Figure 1: Situational Awareness for Field Response System Component

4. **Three “user testimonials”.** These testimonials should include the title of the system, the person’s name, job title (if relevant), a statement of what specific ways the system improves their work and/or the work of their organization, and how frequently they use the system (testimonials may be signed and scanned).

Marzio Penzi, Assistant Commissioner, Operations
 See attachment: MP_User_Testimonial.pdf

Sam Benson, Deputy Director, Watch Command
 See attachment: SB_User_Testimonial.pdf

Didier Dorga, Watch Command Supervisor
 See attachment: DD_User_Testimonial.pdf

B. Jurisdiction

1. Name of jurisdiction

New York City, New York

2. Population served by the organization/agency

Estimated 8.4 million as of 9/22/2008 (NYC DCP)

3. Annual total budget for jurisdiction

64 billion dollars (2010)

http://www.nyc.gov/html/omb/downloads/pdf/sum1_10.pdf

4. Name, title, and address of chief elected and/or appointed official

(Chief elected official)

Mayor Michael R. Bloomberg

City Hall

New York, NY 10007

(Appointed official to NYC Office of Emergency Management)

Commissioner Joseph F. Bruno

165 Cadman Plaza East

Brooklyn, NY 11201

5. Name, title, address, telephone, FAX, and email for contact person for system

Hassan Adekoya, GISP

GIS Application Development Project Manager

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1. What motivated the system development?

Our business problem was three fold. Firstly, we needed an avenue to provide good spatial information to non-GIS personnel whose job is to provide reliable information to decision makers. Secondly, we needed a way to streamline the existing approach to acquiring situational awareness. Lastly, the methodology proposed as a solution to the first two problems must be available 24 hours a day/7 days a week, must be available from a computer, must have excellent NYC centric geo-spatial information and must interface with existing NYC governmental online resources.

Our field response/operations executives determined that an initial data packet containing pertinent information about a building, neighborhood and area is needed within 5 minutes of a reported incident. The data packet will contain information about the building (depending on incident type), neighborhood (defined as 2-3 block radius of incident point), and area (defined as 1-2 miles from incident point). This packet will be the starting point and provides a common operation picture to responders and decision makers.

The field response/operations executives also wanted the ability to obtain a snapshot of all incidents being monitored in the city. This will allow NYC OEM's emergency managers to determine spatial trends in incidents as well as interactively view more incident details such as situation summary, incident status, nearest facilities etc.

The Situational Awareness for Operations workgroup was created to determine requirements for a system whose goal is to assist field operations acquired immediate situational awareness. The members of the workgroup consists of the deputy commissioners for operations and technology, assistant commissioner in charge of strategic data including GIS, the GIS coordinator, the application development project manager and an application developer.

After the requirement gathering process was completed by the workgroup, it was determined that an Active Incident Dashboard web application and the Incident Data Packet Generator will be built.

The goal of the Dashboard is to provide a geographic display of active incidents/events in a web application and to assist the Operations division in tracking incidents and identifying spatial relationships. The goal of the Data Packet Generator is to provide an automated system for gathering information from numerous data sources and present them in a cogent manner for quick understanding by field response personnel.

2. What specific service or services was the system intended to improve?

Without the system, operations personnel (responders and watch commanders) will need to sift through numerous governmental websites, request maps from the GIS division and collate the data for distribution. The wait-time for the necessary information can be 15-30 minutes. The wait time for situational awareness can also be increased if the incident is after work hours.

Specifically the system is meant to reduce the wait-time needed for a responder to acquire situational awareness as well as provide a mechanism for the Operations division

to track incidents and identify spatial relationships. The average time for the system to gather and mine the data is approximately 60 second.

3. What, if any, unexpected benefits did you achieve?

NYC OEM is a coordinating agency in the City Incident Management Structure (CIMS). Maps and report from NYC OEM are generally sought after at emergency scenes. The tool assists OEM's Operation Division to continue to provide well made maps synonymous with NYC OEM. Also NYC OEM's executives use the Active Incident Dashboard to monitor incidents in the city at their desk.

Additional products of the system development process are real time active incident and electric network condition GIS feature layer that can be used in the GIS division for cartography purpose.

4. What system design problems were encountered?

The biggest challenge to this project was to avoid disrupting the workflow of the field response personnel. Monitoring of incidents by NYC OEM/Watch Command unit is accomplished via E-Team (COTS incident management system). It was imperative that the new system preserve that order.

The system must interface with E-Team to acquire the active incident list. The relationships between the tables in the E-Team back-end weren't obvious and E-Team suffers from poor documentation.

Other system design issues are

1. Incident labeling & symbology
2. Collating all data sources without impacting performance
3. How to display citywide, incident area (e.g. community districts, boroughs), weather events.
4. How to display threats not currently within city limits? (e.g. storm locations: on inset map or listed on side?)
5. How to display overlapping incidents?
6. How to transfer generated packet (maps and PDF) to printers in the field without laptops.
7. Avoiding memory leaks in data packet generator development due to heavy ESRI ArcObject (COM) use in .NET

5. What differentiates this system from other similar systems?

The system is integrated with numerous systems such as E-Team (NYC OEM's COTS incident management system), electric network status board system, National Weather Service (NWS) product feeds, DOITT GeoSupport (Geocoding) mainframe among others.

E-Team built-in mapping interface is related to the Active Incident Dashboard. However, E-Team does not effectively provide spatial information for large scale incident such as power outages & network utility problems. Also the E-Team mapping interface does not

label incidents and relies on hovering over an incident point to give an idea of incident type.

The Active Incident Dashboard goes one further and resolved these labeling issues as well as displaying electric network status and NWS products.

The data packet generator mimics the NYC OEM GIS Incident Response Protocol and generates three maps (area, aerial & building level maps), four reports (administrative boundary, land Use, nearest critical facilities and demographic report), and creates reference to other web resources that might be useful during an incident. As far as we know, there are no similar applications that currently do this.

D. Implementation

1. What phases did you go through in developing the system?

Visioning → Requirement Gathering → Analysis → Incremental Application Development → Cartographic Development → Testing → Workgroup Evaluation & Signoff → Post Implementation Support

The initial requirement gathered for the system was continuously revised through the development of the system. The application development process adopted the agile development methodology. All functionalities and features were developed with active input from field response/operations personnel.

The application development process involved database design, ESRI ArcGIS server, ESRI ArcObject (COM), ASP.NET/C#/AJAX/web services programming.

2. Were there any modifications to the original system design? Why? What?

An original system design for the data packet generator was to design a web crawler that gathers information from several governmental resources based on location information (address, intersection, building identification number (BIN), borough block & lot (BBL) number etc.). The information gathered by the crawler would then be processed into a stream and converted to a PDF to be included in the packet. This process would be online. Due to the intelligence required of the crawler, it was agreed that a human being is best suited to sift through the external resources. Hence we provide pre-populated entry points to the external resources/web applications on the results page of the data packet generator. See figure 2.

1. What user community does the system serve and how?

The system was designed to be used by NYC Office of Emergency Managements' (OEM) field response/operations personnel to support an emergency. Theoretically, it can be used by any OEM's staff from any location since it is a web-based application. Other public safety agencies (police (NYPD), fire (FDNY), health (DOHMH) and environmental protection (DEP) agencies) can request copies of the data packet from OEM's field responders at the emergency scene.

2. What are the ultimate decisions/operations/services being affected? If appropriate, provide a few examples including, but not limited to: screen input/output forms, paper products, or other descriptive graphics.

The services being affected by this system is the field response/operations process.

In the past immediate situational awareness during the first 15 minutes of an emergency was not available. There were numerous emergency personnel necessary in acquiring some level of base intelligence: A GIS specialist had to be available to make several base maps and the Operation Division's Watch Command unit has to sift through governmental resources web sites and gather required resources. The typical wait-time for situational awareness is approximately 30-60 minutes.

With the advent of the system, we can now have PDF maps, reports (nearest critical facilities, administrative boundaries, demographic (for vulnerable populations), land use information), and pre-populated entry point to several governmental resources in approximately 60 seconds. This represents over 6000% decrease in wait-time.

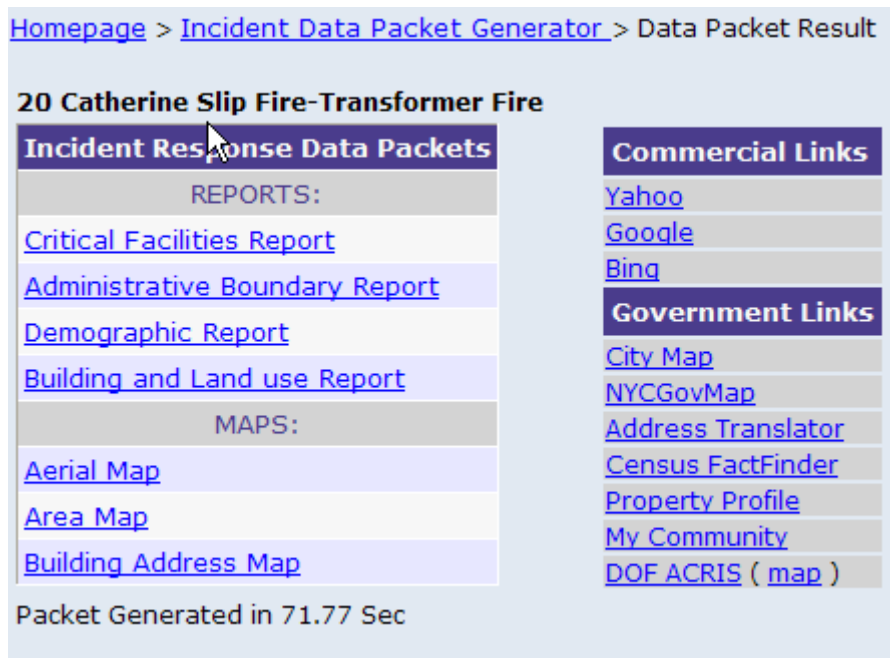


Figure 2: Emergency Response Data Packet Result

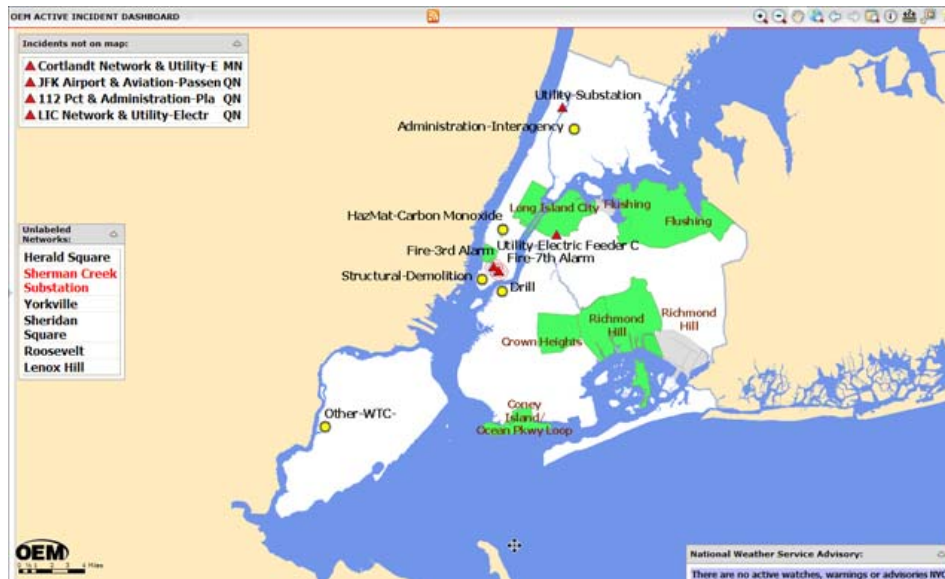


Figure 3: Snapshot of Active Incident Dashboard

3. What were the quantitative and qualitative impacts of the system?

The quantitative impact of the system is reflected via the decreased wait-time for immediate situational awareness and the annual savings of not having a GIS specialist on staff (after business hours) in the field response/operations division.

Immediate situational awareness for an incident can be acquired in approximately 60 seconds down from the worst case wait-time of 60 minutes without the system.

These operations typically run in three tours/shifts. Round the clock GIS support would imply that a GIS specialist would have to be around at non-business hours between 5pm and 8am.

The annual cost of round the clock GIS specialist availability (excluding regular business hours) would be \$174,000. That cost thus represents savings created by the Data Packet Generator component of the system.

Qualitative impacts of the system are reflected in well-thought out cartography employed in the map documents as well as reliability of the data provided to first responders. The spatial database used in this system is maintained continuously by the Public Safety GIS Data Development Center. The center is mandated to collect and proactively maintain spatial data within NYC for the five public safety agencies.

4. What effect has the system had on productivity?

Productivity is enhanced on every level: emergency managers, watch commanders and field responders. The wait-time to acquire geospatial intelligence is reduced by the automated Data Packet Generator component of the system.

Emergency managers can effectively track incidents spatially and assign field responders appropriately using the Active Incident Dashboard. Emergency managers can also be effectively informed by viewing the situation summary related to an incident as well as be notified of weather advisories/alerts for the region on the dashboard.

5. What, if any, other impacts has the system had?

A byproduct of the system is NYC OEM's active incidents feature layer which is available in geospatial web service format (WFS, WMS, KML/KMZ). It is also available through a GeoRSS feed. A sister agency such as the public safety agencies (police, fire etc.) can make use of this GIS feature layer in their situational awareness dashboard to determine relationships between theirs and OEM's monitored incidents amongst others.

6. How did the system change the way business is conducted with and/or service delivered to clients? Give specific examples comparing the old way with the new.

In the past, a GIS specialist had to be available for field response/operation duty at all hours of the day. With the advent of the system, immediate situational awareness can be attained by non-GIS personnel (field responder, watch commanders etc) while additional GIS support can be requested for escalating incidents.

1. What are the system's primary hardware components? Give a brief list or description of the hardware configuration supporting the system.

- 2 development computers
- 1 test server
- 1 production (blade) server with SANS storage

- Field responder laptop – equipped with NYCWin (NYC Wireless network) card for broadband internet connectivity
- Field responder printer – HP Deskjet 460 mobile printers in the responder vehicles

- Mobile Data Center (MDC) – The MDC is a bus equipped with 3 computers, printer and plotter connected to a server and GIS data repository. Maps/reports can be printed from the bus if deployed to an emergency scene.

2. What are the system's primary software components? Describe the primary software and, if a commercial package, any customizations required for the system.

Software Stack

- Visual studio 2005 – Integrated Development Environment (IDE) for development
- .NET 2.0 – CLR/IL framework
- ASP.NET/ADO.NET/C# – Web & database programming language
- ESRI ArcObject (COM) – Map COM library for class library and desktop development
- ESRI .NET Web ADF – Map library for web map development
- IIS – Web Server
- AJAX – Asynchronous web communication essential for rich user experience
- Crystal Report – Professional report creation
- Microsoft SQL Server 2005 – Database management system
- ESRI ArcGIS Server 9.3.1 – Map service engine
- ESRI ArcSDE 9.3.1 – Spatial database
- ESRI ArcMap 9.3.1 – Map & GIS data Editor
- Subversion (SVN) – Software version repository

3. What data does the system work with? List and briefly describe the database(s).

Databases:

E-Team: OEM's Incident management database

Network Status: NYC electric network status database

Public Safety GIS database: Contains continuously maintained GIS datasets such as critical facilities, Planimetric data (building, curblines, street center lines etc.) among others

Feeds:

National Weather Service (NWS) Advisory feed

System:

DOITT/DCP GeoSupport mainframe – Citywide geocoding service

4. What staff resources were required to implement the system? (i.e., report approximate staff and consultant time as FTE's)

The design and development of the system was supervised by the Assistant Commissioner for strategic data (GIS).

OEM GIS Staff assigned to work on the project and their FTE:	
Project Manager – Hassan Adekoya	0.80
GIS Coordinator	0.25
2 Application Developers	0.50
Graphic Designer	0.05

5. Comment on anything unusual about the resources used to develop your system, such as data, software, personnel and financing.

The system is 100% in-house designed and developed. The system is integrated with several other systems and the workflow of the other systems weren't compromised. The maps generated for field response were 100% designed by a GIS specialist. Subsequent updates can be made to the maps without application development support.

