3D Building Visualization and Scene Management for Incident Commanders
Company Information

• Phoenix, AZ & Atlanta, GA
• Specialize in mission-critical software and hardware products
• DoD, DHS, DHHS and the unmanned aerospace industry
• Applied R&D – 14 SBIR & STTR Awards – 100% Commercialization
Core Competencies

1. **Earth** – Kutta's projects in this category consist of a Digital Underground Radio for Miners and Subterranean Wireless Electronic Communications for the military.

2. **Air** – Kutta has created a multitude of Unmanned Aerial Systems (UAS) products that solve many of the issues facing our warfighters today.

3. **Visualization** – One of Kutta's core competencies is creating custom, user-centric, visualization tools that represent data in new and innovative ways.
Project History

• Purpose: Develop a 3D visualization system to show First Responders and assets within building structures in urban areas that improves situational awareness.

• Awarded a DHS Phase I and Phase II STTR (topic: H-SB06.2-005, PM: Jalal Mapar)
Project Team Members

• Kutta Technologies (Prime Contractor)

• Arizona State University (Teaming Partner)

• Tempe Fire Department
Goals of Project

• Main objective is to develop 3D visualization capabilities of multi-story buildings.
• Provide fully electronic planning and tracking tools to Incident Commanders.
• Eliminate the need for paper or “whiteboard” incident planning and tracking.
• Develop and utilize an open communications protocol to First Responder (FR) tracking systems.
• Provide simple to use tools that FR’s can utilize to construct buildings for use during an incident.
• Utilize an open XML schema to define the scene, buildings, and sectors stored in a pre-built database.
• Monitor and display all available location, health, and equipment status information on tracked FR’s.
Situationally Aware Visualization Environment (SAVE) for Incident Commanders

• Features
  - Display 2D/3D representations of the scene, buildings, and sectors.
  - Allow the IC to annotate the scene with FEMA symbology using real-time reports from the FR’s.
  - Monitor and track FR health and their equipment status.
  - Track FR positions on the maps.
  - Provide independent multiple points of view of the scene.
  - Supports an abstraction to tracking systems.
SAVE Subsystems

• Primary Map Region
  - Can display geo-referenced Scene/Building/Sector (SBS) views in both 2D or 3D.
  - Represents the main interface for the user

• Scene Manager
  - Shows categorized FRs for tracking and planning.
  - FRs organized by building, sector, and company or group.
  - Allows IC to plan FR assignments, track currently locations, and maintain ready teams.

• Secondary Map Region
  - Displays a reduced detail version of the SBS views.
  - Allows the user to visually maintain situational awareness of a second incident region.

• Annotation Manager
  - Allows the user to drag & drop various reported incidents, operations, hazards, and structural elements.

• Health Monitor
  - Tracks and displays available health information on the FR and any status information on their equipment
SAVE Layout

Secondary Map Region
- Reduced detail version SBS views.

Map Button Bar
- Provides access to map controls: pan, rotate, zoom, center, measure, tilt, info, and etc.

Health Monitor Display
- Provides information on a First Responder

Primary 2D/3D Map Region
- Can display a geo-referenced scene/building/sector (SBS) views.
- Represents the main interface for the user.
- User translates/rotates the map by grabbing and dragging a point on the map.

Information block
- Sector name
- Address

Compass

Map Scale

Scene Manager
- Shows categorized FR's for tracking and planning

Annotation Manager
- Drag & Drop various incidents/operations/hazards/structural conditions that are reported

Filter Menu
Designed to Assist Situational Awareness

• Incident Commander can be overwhelmed with volumes of data.
• Must organize to maximize situational awareness while still providing a simple yet effective GUI.
• Reduce the amount of information that must be observed at any given time.
• Approach utilizes three different map views:
  – Scene view maps
  – Building view maps
  – Sector view maps
Scene View of the Incident

- Visualization of a scene has the following features:
  - Ground is represented by satellite imagery.
  - Buildings within a loaded scene are visible.
  - User is able to load different pre-modeled scenes.
- User is able to drag & drop annotations (fire engines, police cars, barricades, etc) onto surrounding area of the scene.
- Any assets, with tracking devices, outside of buildings will be visible.
Building View of the Incident

- Provides a view of the exterior of a building.
  - Only exterior walls are visualized.
  - Above ground sectors are white.
  - Below ground sectors will be brown.
  - Annotations of exterior structural elements are displayed.
  - Will allow user to slide up or down the outside of the building.
- User is able to drag & drop annotations onto the exterior of the building.
- Any assets, with tracking devices, outside of building will be visible.
Sector View of the Incident

- Provides an interior view for a section of the building.
  - Exterior and interior walls related to the sector are visible.
  - Exterior walls of all sectors at or below the viewed sector are visible.
    - Provides better situational awareness of sector’s location relative to building.
- User is able to drag & drop annotations onto the sector.
- Any assets, with tracking devices, inside of the sector will be visible.
ArchUp Features

• Standalone tool used to pre-generate scenes and floor plans.
• Features
  ▪ Construct buildings using a simple to use 2D floor plan mode and a 3D overview.
  ▪ Generate a scene XML format file for visualization in SAVE.
  ▪ Annotate structural elements of buildings (e.g. standpipes, electrical boxes, gas shutoff valves, and etc.)
  ▪ Load an image of a floor plan that can be “traced” or extruded to assist in construction of sectors.
Scene Generation and Visualization

Scene developer creates or edits a scene (buildings and sectors) prior to an incident.

ArchiUp saves scenes as an XML data file that would be stored in a database for retrieval.

Database could be on the local computer or at a central repository.

During an incident the IC selects and loads scene data from database for display in SAVE.
Scene Construction

- Identify the buildings that will make up scene.
- Create the buildings in ArchiUp or import from CAD drawings.
- Define sectors and construct floor plans.
- Annotate all known structural elements (lock boxes, stand pipes, shutoff valves, etc).
- Define the geo-referenced position of scene.
- Save the scene using the XML format.
Floor Plan Construction

- Create the sectors that will make up the building.
- Load a floor plan image then generate a model based on that image.
  - Use scanned images
  - Or use CAD files
- Annotate relevant structural elements (lock boxes, stand pipes, shutoff valves, etc).
Product Future

• Refine the features of the user interface
• Implement complete NEMA symbology.
• Integration with hardware tracking system
  – Requires creation of interface between systems
• Field test system utilizing real tracking hardware and buildings.
• Further develop Scene Manager and Health Monitor.
• After-Action-Review support
• Scalable Scene Support
• Scalable distributed Architecture