PRIORITY 5

Proposal in response to:

RFQ HSE000101
Modeling & Simulation Capability

Company/Vendor Name:	Priority 5 Holdings, Inc.
Company Address:	31 State Street, 3rd Floor
City, State, Zip:	Boston, MA 02109
Telephone number:	617-391-9501
Fax No:	617-248-8655
Email:	chuck.miller@priority5.com
Name of Authorized Agent:	Charles Q. Miller
Signature of Authorized Agent:	Date: 2/22/2010

Addendum No.	Date Received
01	02/11/2010
02	02/17/2010

GENERAL TERMS & CONDITIONS
REQUEST FOR QUOTATION (RFQ) AND REQUEST FOR PROPOSAL (RFP)

1. Awards will be made in the best interest of the State of West Virginia.

2. The State may accept or reject in part, or in whole, any bid.

3. Prior to any award, the apparent successful vendor must be properly registered with the Purchasing Division and have paid the required $125 fee.

4. All services performed or goods delivered under State Purchase Order/Contracts are to be continued for the term of the Purchase Order/Contracts, contingent upon funds being appropriated by the Legislature or otherwise being made available. In the event funds are not appropriated or otherwise available for these services or goods this Purchase Order/Contract becomes void and of no effect after June 30.

5. Payment may only be made after the delivery and acceptance of goods or services.

6. Interest may be paid for late payment in accordance with the ***West Virginia Code.***

7. Vendor preference will be granted upon written request in accordance with the ***West Virginia Code.***

8. The State of West Virginia is exempt from federal and state taxes and will not pay or reimburse such taxes.

9. The Director of Purchasing may cancel any Purchase Order/Contract upon 30 days written notice to the seller.

10. The laws of the State of West Virginia and the ***Legislative Rules*** of the Purchasing Division shall govern the purchasing process.

11. Any reference to automatic renewal is hereby deleted. The Contract may be renewed only upon mutual written agreement of the parties.

12. BANKRUPTCY: In the event the vendor/contractor files for bankruptcy protection, the State may deem this contract null and void, and terminate such contract without further order.

13. HIPAA BUSINESS ASSOCIATE ADDENDUM: The West Virginia State Government HIPAA Business Associate Addendum (BAA), approved by the Attorney General, is available online at **www.state.wv.us/admin/purchase/vrc/hipaa.htm** and is hereby made part of the agreement. Provided that the Agency meets the definition of a Cover Entity (45 CFR §160.103) and will be disclosing Protected Health Information (45 CFR §160.103) to the vendor.

14. CONFIDENTIALITY: The vendor agrees that he or she will not disclose to anyone, directly or indirectly, any such personally identifiable information or other confidential information gained from the agency, unless the individual who is the subject of the information consents to the disclosure in writing or the disclosure is made pursuant to the agency's policies, procedures, and rules. Vendor further agrees to comply with the Confidentiality Policies and Information Security Accountability Requirements, set forth in http://www.state.wv.us/admin/purchase/privacy/noticeConfidentiality.pdf.

15. LICENSING: Vendors must be licensed and in good standing in accordance with any and all state and local laws and requirements by any state or local agency of West Virginia, including, but not limited to, the West Virginia Secretary of State's Office, the West Virginia Tax Department, and the West Virginia Insurance Commission. The vendor must provide all necessary releases to obtain information to enable the director or spending unit to verify that the vendor is licensed and in good standing with the above entities.

16. ANTITRUST: In submitting a bid to any agency for the State of West Virginia, the bidder offers and agrees that if the bid is accepted the bidder will convey, sell, assign or transfer to the State of West Virginia all rights, title and interest in and to all causes of action it may now or hereafter acquire under the antitrust laws of the United States and the State of West Virginia for price fixing and/or unreasonable restraints of trade relating to the particular commodities or services purchased or acquired by the State of West Virginia. Such assignment shall be made and become effective at the time the purchasing agency tenders the initial payment to the bidder.

I certify that this bid is made without prior understanding, agreement, or connection with any corporation, firm, limited liability company, partnership, or person or entity submitting a bid for the same material, supplies, equipment or services and is in all respects fair and without collusion or Fraud. I further certify that I am authorized to sign the certification on behalf of the bidder or this bid.

INSTRUCTIONS TO BIDDERS

1. Use the quotation forms provided by the Purchasing Division. Complete all sections of the quotation form.

2. Items offered must be in compliance with the specifications. Any deviation from the specifications must be clearly indicated by the bidder. Alternates offered by the bidder as **EQUAL** to the specifications must be clearly defined. A bidder offering an alternate should attach complete specifications and literature to the bid. The Purchasing Division may waive minor deviations to specifications.

3. Unit prices shall prevail in case of discrepancy. All quotations are considered F.O.B. destination unless alternate shipping terms are clearly identified in the quotation.

4. All quotations must be delivered by the bidder to the office listed below prior to the date and time of the bid opening. Failure of the bidder to deliver the quotations on time will result in bid disqualifications: Department of Administration, Purchasing Division, 2019 Washington Street East, P.O. Box 50130, Charleston, WV 25305-0130

5. Communication during the solicitation, bid, evaluation or award periods, except through the Purchasing Division, is strictly prohibited (W.Va. C.S.R. §148-1-6.6).

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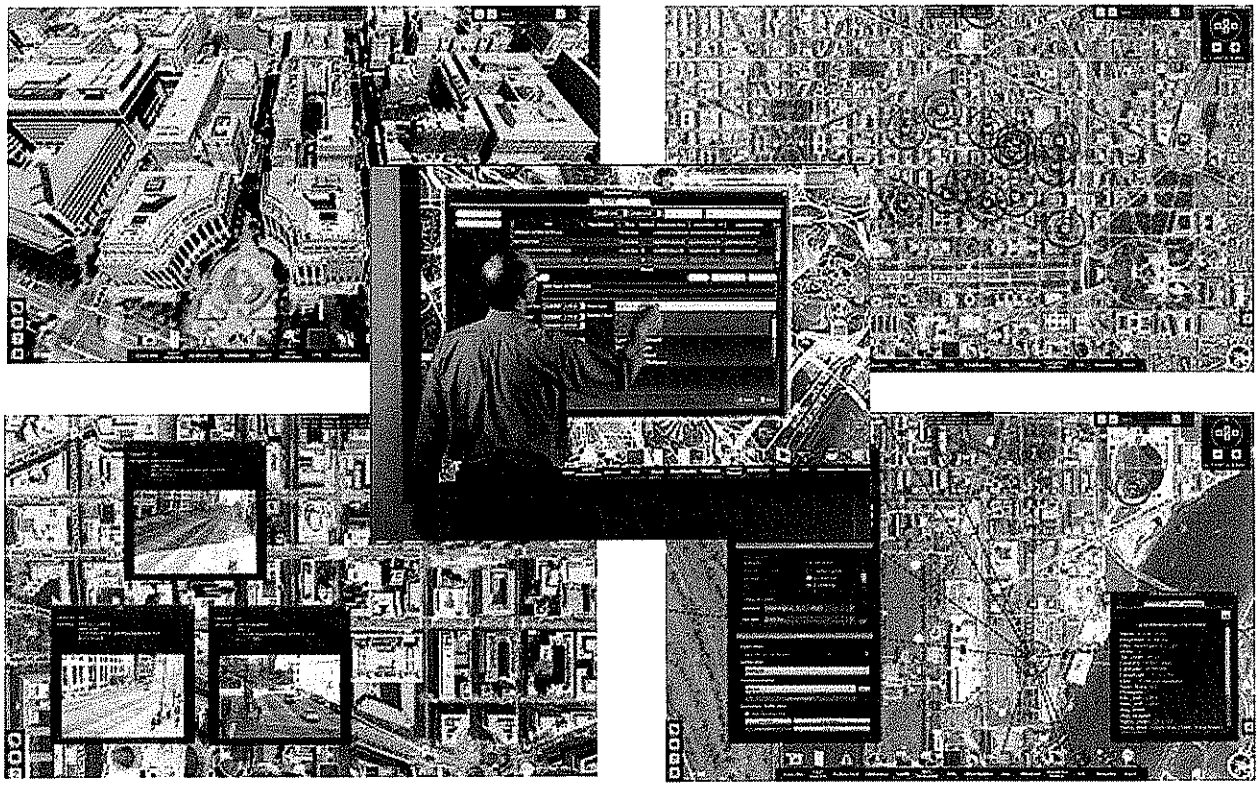
Section I - Introduction and Proposal Overview

Priority 5 will provide the State of West Virginia with the modeling and simulation capability specified in the RFP by developing a plug-in to its Touch Assisted Command and Control System (TACCS™). The plug-in will leverage the plug-in technology previously developed under contracts with DoD and FEMA, and will include a fully integrated ISAVE/KDAS module that will support interoperable communications with the Department of Defense Knowledge Display and Aggregation System (KDAS) and DHS/FEMA Integrated Situational Awareness Visualization Environment (ISAVE) technologies. A brief description of TACCS and the concept of operations (CONOPS) for WVMASS are presented in this Section. The specific requirements of the RFP are discussed in Section II and III. The specific system deliverables, proposed payments, and project schedule are presented in Section IV.

TACCS



Imagery by DIGITALGLOBE

3D by RLW modelworks

Priority 5's Touch Assisted Command & Control System (TACCS™) is a unifying framework for data aggregation, event monitoring/tracking, and impact prediction, all in a highly visual 3D-enabled geospatial environment. TACCS™ is first and foremost a command & control system, designed to assist planners and decision-makers in the management and monitoring of key

infrastructure and coordination of response to events affecting that infrastructure. The TACCS™ interface is touch enabled, permitting senior decision makers with limited system training to query the COP display and obtain information using an intuitive interface.

The system facilitates the integration of intelligence obtained from multiple domains without compromising sources, and for the subsequent dissemination of the resulting tactical conclusions to first responders through currently deployed legacy viewers.

Unlike other GIS-based platforms, TACCS has been designed from its inception to be GIS platform agnostic, technology neutral, and compatible with other systems. TACCS does not replace existing workflows or systems; rather, it incorporates them into the TACCS COP. Where possible, the TACCS system is based upon open source technology and standards, building upon the most open and standards compliant systems available.

Key capabilities that differentiate TACCS™ from legacy viewers include:

- The ability to identify assets, aggregate and compare data related to the assets (i.e., layers that display data obtained from static sources), and supplement the results using user-supplied data and data obtained using real-time web searches.
- The ability to assign behavior rules to assets that determine the response of the assets to changes in inputs and environmental conditions.
- The ability to identify and model infrastructure dependencies, interdependencies and policies and introduce all hazards disruption scenarios in real or simulated time.
- The ability to perform cross-layer analytics, i.e., to communicate the impact of changes in environmental conditions or asset status, and present a user-defined common operating picture (COP) that reflects the real-time state of assets of interest.
- The ability to simultaneously perform multiple interdependent simulations that utilize disparate protocols and perform "what if" analyses to determine the impact of potential threats on the COP.
- The ability to identify and isolate related alerts and sensor inputs that might constitute a threat and present them for analysis by the system operator.
- The ability to integrate event response plans from multiple agencies, including "zoom to" event displays, automated placement of temporary facilities, and updating of asset condition based on the event (e.g., road closures).
- A credentialing system that controls user access to sensitive data and the ability to network COPs maintained by different workgroups.
- An open net centric architecture that allows data input from any source that uses generally accepted data transfer protocols.

At the core of the technology is the Unity Simulation Manager (UnitySM) that allows modeling critical infrastructure/key resources (CI/KR) as interactive elements in the environment. More than a simple image on a map, these CI/KR elements are interactive agents, maintaining state/ status, interacting with one another, and responding to natural and man-made phenomena according to physical and cyber vulnerabilities.

Infrastructure is dynamic, and CI/KR elements can be created, moved, and re-aligned on the fly to reflect the reality of the current mission readiness. UnitySM creates an interactive environment into which external simulation tools modeling the evolution of phenomena can be merged into one comprehensive framework. The resulting phenomena modify the state of CI/KR elements according to predetermined vulnerabilities.

Modules for the TACCS™ system can be customized and tailored to fit the specialized mission needs of any organization. Past customizations have included the integration of custom data formats/feeds, specific agency tools, third party applications, field sensors, and agency specific alerts and notifications. TACCS™ is distributed as a client server application under a perpetual licensing agreement and supports multiple modes of distributed workgroup configurations.

TACCS™ Application Areas

- Infrastructure security and reliability monitoring/planning/management
- Security event planning and monitoring
- Intelligence evaluation and dissemination
- Law enforcement alert correlation and tracking
- Emergency management for natural/man made disasters.
- Logistics planning, key asset tracking and management
- Port operations – security and logistics management
- Defense industrial base mission assurance
- Oil and gas – pipeline and logistics tracking
- Environmental impact analysis and tracking

TACCS™ integrates and enhances current tools through aggregation and interaction if a collaborative framework. Specific functionality includes:

- Data aggregation of multiple data source (historical and live feeds)
- Integration of alerts and notifications
- Networked architecture to provide a common operating picture across distributed locations
- Modeling and simulation of natural and man-made events and their impact (direct and indirect) on an organization's mission.
- Integration of live sensor feeds ranging from weather data to security video
- Graphical (3D) representation of key organizational infrastructure elements and the associated relationships
- Blue Force tracking using GPS (customization required)
- Ability to model dynamic response (logistics, vehicles, hazardous plumes, personnel response, etc.)
- Ability to link external data sources including web pages, image data, text files, sensors, external simulations, etc.

WVMASS CONOP

Throughout this discussion, TACCS™ with the West Virginia modeling and simulation plug-in installed will be referred to as WVMASS. The Department of Defense has agreed to make the technologies developed for KDAS available for use by the states, and these capabilities have been incorporated as the basis for WVMASS providing comprehensive modeling and simulation capability using the highly visual 3D TACCS™ environment. Assets of interest in each layer will be represented as icons that are interactive with assets in other layers and the environmental conditions to which they are exposed, resulting in a dynamic common operating picture that can be shared by multiple users.

Figure I.1 illustrates the interface concept for the WVMASS system. Data Layers are accessible from the left for viewing on the canvas as selectable icons. Information and analysis tools are

accessible from the bottom toolbar. WVMASS will be accessible from a TACCS™ workstation or using a web interface powered by AdobeConnect®. The functionality of these two interfaces is described in Proposal Section II, Requirement 3.1.8.

Figure I.1 - WVMASS user interface showing feature layers

In addition to the core capabilities described in Proposal Section II, WVMASS will incorporate the agent-based Lockheed Martin CultureSim™ and CMSim™ mobility simulation software systems. CultureSim™ provides a highly granular urban pedestrian and vehicle evacuation model in which the behavior of pedestrians and vehicles can be individually programmed and displayed. CMSim™ provides a higher level vehicle evacuation model in which the vehicle behaviors are programmed on a block basis and the resulting level of congestion on road segments displayed. While the short proposal turnaround only permitted including these two agent based simulations in the firm fixed price, the open architecture foundation of TACCS™ and WVMASS supports the rapid and low cost integration of evolving technologies (e.g., the traffic modeling systems under development at the University of Arizona) as they become available, assuring that WVMASS remains state-of-the-art.

WVMASS will maintain the real-time state of all assets/conditions that may impact an evacuation. At any time, the user may exit the real-time display and enter a "what if" mode in which the user will have the option to select the appropriate modeling technique and initiate a simulated evacuation. Both CultureSim and CMSim will be fully integrated with TACCS™ UnitySM; vehicles will interact with assets such a fuel locations, and pedestrians/drivers will interact with environmental conditions such as toxic airborne contaminants. In the course of the simulation, the user will receive notifications of accidents, pending fuel/water/shelter issues, and will have the opportunity to initiate corrective action using designated prepositioned assets such as refueling tankers.

At the conclusion of the simulation, the user may return to the real-time display, which is not affected by the conditions imposed for simulation purposes, and make changes to strategies such as route selection, location of fuel tankers and road clearing equipment, or pre-staging of emergency supplies. In this manner, the user can evaluate alternative courses of action and experience the results in the same environment that he/she will be faced with in the course of an actual emergency, wherein the notifications will be received form the field via the native WVMASS alert management capabilities.

The WVMASS system will be deployed at the State Capital Complex using hardware supplied by the State and conforming to the specifications set forth in Proposal Section II, Requirement 3.1.18. TACCS™-based systems can be networked to form workgroups that allow real-time collaboration during emergencies. In addition to this native deployment configuration, Web access to the system will be provided using AdobeConnect. In addition to viewing the simulations, the master State user may delegate control to a AdobeConnect user on a case-by-case basis.

The proposed configuration allows the formation of two workgroups in which both workstations and web interface users can collaborate using a shared view of the common operating picture (COP). Eight Workstation licenses will be provided to permit deployment on the two laptops and at the four counties. The system will be configured to permit either workgroup to share their COP with the DoD KDAS or DHS/FEMA ISAVE system using the TACCS™ screen sharing feature. The workgroup configuration is illustrated in Figure I.2.

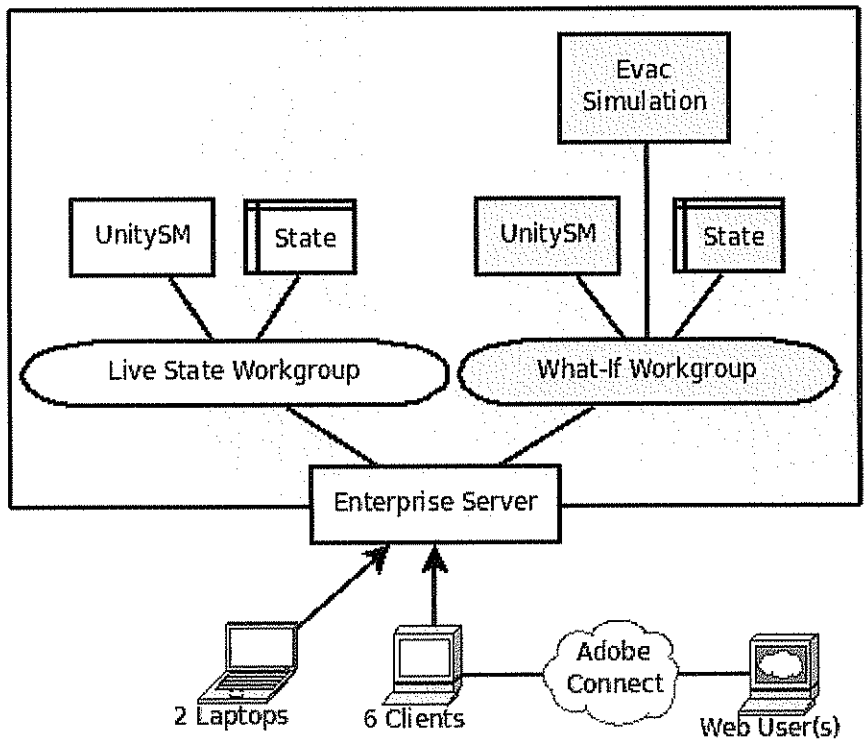


Figure I.2 - Workgroup configuration

Perpetual TACCS™ licenses and one year of premium maintenance for two enterprise workgroups, six workstations, a one hundred user broadcast license, and a Lockheed Martin CultureSim/CMSim license, as well as one year DigitalGlobe and one hundred user

AdobeConnect® licenses, are included in the cost set forth in Section IV. Copies of the software license and maintenance agreements are available on request.

System Description

The native WVMASS environment consists of a geospatial display utilizing DigitalGlobe® satellite imagery upon which the user can manage the set of data layers that are of interest. These layers can contain feature data such as the location of a hospital, imagery data such as satellite images of the current location, and other realtime data feeds such as GeoRSS, etc.; a layer containing 3D imagery will be incorporated if provided by the State. WVMASS will also support live data layers from real-time features such as weather, traffic cameras, etc., and the user can toggle on/ off any configured layer.

TACCS™ supports a wide variety of data feeds including WFS, WMS, KML (basic support), ArcXML, GeoRSS, and many others. WVMASS will support the ability to dynamically add new servers by simply providing the web-service link to the feed. The system then connects to the server and returns a list of all known capabilities. From there the user can select which feeds to add to the system. TACCS automatically creates tags based on the metadata from the servers and feeds that can then be used to filter down to the exact level of data the user needs.

TACCS™ includes the UnitySM dependency modeling and simulation integration system that operates as a hub for all simulation related activites. UnitySM models critical assets in the system using a model of interrelated logical computation units or agents. Each asset contains several related pieces that form the basis of the simulation: state, behavior, dependencies, and vulnerabilities. Asset state is modeled as a list of attributes and values. For example an asset for a gas station may have an attribute called "Gasoline" with a value of "10,000 Gallons". As the simulation evolves, the asset's state is updated to take into account the current conditions and ongoing events.

Asset dependencies model the connectivity of assets from one to another. For example, a gas station asset may be dependent upon the power line that comes into the gas station and that power line may in turn be dependent upon an electrical substation. If the substation goes offline, then the effect propagates to the gas station which loses power. These dependencies can cross multiple infrastructures and by modeling all of the dependencies, highly complex behaviors can emerge from the simulation. This is what allows the simulation to assist users in discovering non-obvious relationships among assets and critical dependencies that may not have been known.

Asset vulnerabilities are also modeled as an interactive component in the simulation environment. Similar to individual asset behaviors, and dependencies, asset vulnerabilities are programmable to for specific assets. Such vulnerabilities are used to model the impact of different environmental effects such as weather, explosive, or cyber events might impart upon individual assets. Vulnerabilities can be modeled at an asset level or at a simulation level. In either case, all effects are tied back to the assets of interest and their impact on the current state of the assets.

The key elements that ties state, dependencies, and vulnerabilities together are the asset behaviors and the interaction between assets. As the simulation executes, UnitySM executes behaviors for each asset. The behavior of an asset specifies how it will respond and how dependent assets will behave based upon the current simulation state. As the asset's state changes, it influences those assets that are connected to it. As the entire network of assets executes in the simulation, the entire system ripples effects through the network leading the the emergent behavior of the system as a whole.

UnitySM supports many ways to define behaviors including custom scripts and behavior tables. Because UnitySM behaviors are fully programmable, it allows power users to create low-level programmed behaviors using programming scripts. These scripts have complete access to an asset states, its dependencies, and the ability to look at the simulation as a whole. Scripts have been created to do everything from simulate the influence of a gas plume on a building, to performing supply chain simulation. This flexibility provides maximum power for simulation, and is configured to be programmable using rule based behavior tables easily understood by subject matter experts.

Evacuation Modeling

The WVMASS simulation model will be based upon the existing capabilities of TACCS, UnitySM, and CMSim. This section describes our current planned model. We expect that this model will be refined through further discussions between the State and our subject matter experts.

Figure I.3 shows an interdependency network reflecting a failure and the subsequent impact on asset state.

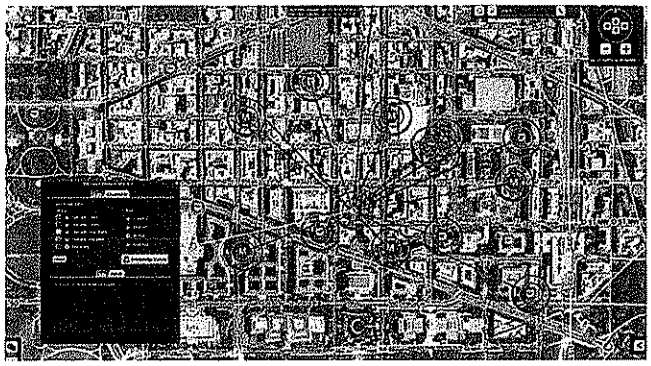


Figure I.3 - Assets and interdependencies

Resources and Assets

WVMASS focuses on the modeling and monitoring of four key dynamic resources and their interdependencies. The four resources are fuel, water/food, first aid locations, and shelter beds. These assets and their resources will be modeled as UnitySM assets. For example, a fuel station would be modeled as an asset with attributes for dynamically changing values such as gallons of gasoline. As with all UnitySM Assets, there will be a reference back to the GIS feature data used as a basis for this asset. That link can be used to get additional details about the asset such as address, phone number, location, and other details available from State-accessible data bases.

The assets will be connected via dependency links to other related assets and these assets will in turn be connected to other infrastructure assets. This connection network can be expanded to whatever level of detail is determined to model the dynamics of the evacuation sufficiently. Note that this will allow the system to not only model the assets called out in the proposal, but also to model the assets that these assets are dependent upon. Similarly the assets will model their vulnerabilities to environmental and procedural influence (e.g., floods or mandated temporary closures to redirect traffic). The system is designed to model any number of such dependencies

across all infrastructure areas. By creating a full model of dependencies, the system will be able to model non-obvious system consequences.

Each asset will be modeled using defined asset types that determine the behavior of the assets. For example a gas station may have a "gas station" asset type. This behavior would model the consumption of gasoline based on traffic density, how dependencies effect the output of the asset, and how the asset responds to it's vulnerabilities. The behavior will be modeled through the use of simulation tables that allow for preset customizations (e.g., modeling the gas station with a backup generator or backup gasoline reserve). The complexity of the behaviors modeled will be determined by State subject matter expert feedback for the given asset types.

Once all asset types are defined, the system will assist in creating modeled assets from the available GIS data. The WVMASS system will provide a user interface to automatically create asset en-mass from GIS feature data. The user can select a source of feature data of a given type (ex: all gas stations in WV) and through a guided user interface tell the system that every item from this source should be modeled with a given type. The guide will then assist in mapping static data from the GIS (ex: number of pumps, gasoline storage) into attributes named in the form expected by the asset behavior model. Once the user is satisfied with the conversion, the system will load the assets and take care to find previously migrated assets from the same source and simply update their data. In this way, a single user could keep a large number of assets up-to-date and consistent for a model.

Transportation

In establishing the transportation model WVMASS will utilize both the CultureSim and CMSim models. Initially, CultureSim will be used to determine the best staging for population assembly points and vehicles that will be used for mass evacuation. This approach will support the degree of granularity required to determine the number of vehicles and human support elements required under various scenarios.

Once the best staging for mass transportation vehicles has been determined, WVMASS will use a transportation model based upon CMSim. CMSim model will be given population models as input to specify the starting location of all simulated agents that will include mass transportation. Once an evacuation is initiated, CMSim will model the evacuation of those agents along the working roadways. Before and during the simulation, the user will be able to modify the state of the road network to influence the simulation. For example a user could close a road, modify the direction of flow, shut down road lanes, or any of a number of other parameters. These will immediately influence the simulation and the behavior of the individual agents in the simulation.

During the evacuation, the agents will be attempting to reach a destination shelter or residential location. As the simulation progresses, the shelters and residential areas will fill and thus cause the agents to evacuate further before finding shelter. We propose that the current simulation system not tie a given agent (person) in the NCR to a specific destination but instead we model the evacuation in the aggregate and show the competition for and consumption of shelter resources. To model residential areas, the simulation will automatically create virtual shelter locations that represent that local population. These residential shelters will be derived from the population density information known for a given location.

As the evacuation progresses, the transportation model will influence and be influenced by the dependency model through the use of transportation flow rates. CMSim provides details of the current traffic flow rate for each road segment. This flow rate will be used to influence the

behavior of assets that are close to it and determine their resource consumption. The exact rates of consumption related to flow will be a parameter of the asset and/or the simulation. As the resources approach exhaustion, the user will be notified and have the opportunity to take corrective action. Failure to do so in a timely manner will result in a notification that the existing strategy has failed so an alternative approach can be formulated.

System Walk-Thru

In this section we will walk through a potential use case for WVMASS.

When the user first starts the system, they will be placed into a pre-configured workgroup. In TACCS™ , the concept of a workgroup refers to a series of networked based TACCS™ workstations that allows users to view the same screen location while utilizing the TACCS™based tool sets and sharing data in 'real-time.' The workgroup creates the basis for multi-user collaboration to generate a common operating picture.

From the workgroup a user can than use any of the many data aggregation, viewing, and analysis capabilities to setup their canvas as they wish for their working session. All of the base capabilities of TACCS are available for them to use including whiteboard, screen shot, and report generation to name a a few. For the remainder of this walk thru we focus on the modeling and simulation workflow of WVMASS.

The controlling user moves into simulation mode. When they enter simulation mode, they are presented with a panel that shows all initial simulation parameters for all currently active simulation systems. In the case of WVMASS this panel will show the settings for UnitySM and CMSim.

At this point, the user sets up the initial conditions for the simulation. Each of these settings can be adjusted through the simulation panels and can vary from one simulation to the next. Once the conditions are set for a given simulation and the simulation begins, they become fixed. This provides a way to evaluate and measure the impact various assumptions may have on a simulation. For example, what impact does an increase of 1 mpg in the average gas mileage for a car make in the evacuation.

Recommended initial parameters are listed below; additional parameters can be added to the simulation as determined by State subject matter experts:

- Evacuation settings
    - Select the population model and evacuation region
    - Designate evacuation routes and
    - Initial settings for roads (closed, open, direction, lanes, etc)
- Staging settings
    - Select assembly points
    - Designate shelters
    - Preposition support vehicles (fuel tankers, wreckers, etc.)
- Resource assumptions
    - Set initial inventories and rules for consumption rates
    - Set statistical basis for accidents, medical, etc.
- Initial asset settings
    - Set initial state of modeled assets (e.g., operable, inoperable)
    - Initial resource counts and values of any other asset parameters

After the initial settings are entered, the user starts the evacuation. They can use the simulation controls that are part of TACCS. These controls provide start, pause, and reset controls. While the simulation is running, the system displays a time clock showing the current simulation day and time. As the simulation unfolds, the user can select any simulation component (asset, road, flow, etc) and drill down to see additional details. For example while the simulation is running a user may click on a gas station and see the details of that asset and the current real-time values of the resources being monitoring such as remaining fuel. As dependencies are perturbed, the system immediately ripples those changes through the network to cause the corresponding change in asset state. This provides instant feedback to any asset changes.

The road network can be adjusted live to simulate changing conditions (ex: an event commander decides to close a roadway). This capability can be used to dynamically try various scenarios. If the user wants to see what would happen if a road is closed or its direction altered, he/she can simply select that road and change it to see the immediate impact. All of this happens live while the evacuating agents respond to the changes.

As the simulation continues to execute, the system will notify the user when events of note occur (e.g., low fuel inventory). The user can also initiate queries regarding matters of interest such as inventory levels, or the location of human resources such as police or emergency equipment. The entire simulation is live and fully editable in real-time. It is a human in the loop simulation where any adjustments or feedback made the the live user will immediately be reflected in the running simulation. This allows the user to game a wide variety of scenarios live as they monitor the event.

Once the simulation reaches an end point, the system provides extensive support for viewing reports and outcomes from the simulation. First, the system keeps a full log of all asset state changes: the change that occurred, the time it occurred, and why the change happened. By going back through this list the user can determine when assets exhausted their resources, what caused dependencies to fail, and what adjustments need to be made to the current response plans. These reporting capabilities build upon the inherent capabilities of TACCS to create situation reports based upon the current alerts, incidents, and state of the COP. All reports can be customized to meet whatever reporting requirements and formatting are needed for a given agency.

Section II – Response to Scope of Work Requirements

The capabilities of the WVMASS system to support the integration requirements set forth in RFP Section 3.c are described in this section. The Division of Homeland Security & Emergency Management shall be responsible for satisfying the interface criteria described for each integration element. Unless specifically noted, third party costs, data entry, and associated programming services are not included in the scope of this proposal.

Requirement 3.1.1 - Impacts of Road Closures

Overview

WVMASS will be capable of simulating the impact of road closures in one of two ways depending on the population density. Beyond the ability to model specific attributes of transportation availability, the WVMASS will relate the change in population mobility and the availability of throughways to other infrastructure components. For example, road closures affect the availability and transportability of resources confined by that segment of road. Likewise, the loss of a segment of road may detail the need to take alternate routes for resource delivery. The impact of the road closures will thus be visualized through the immediate impact on traffic, but also upon dependent lines of infrastructure. On the WVMASS display this will be manifested with visual cueing of changes in road conditions, but also through an event log that can be viewed or downloaded into a .csv format for further analysis.

Lockheed Martin's agent-based evacuation capabilities, which ar currently deployed in the FEMA ISAVE plug-in software, will be utilized to simulate the behavior of evacuating agents. The evacuation simulation will be integrated with the environment and interdependency agent behavior controls provided by TACCS™ UnitySM.

Capabilities

- Road segments are viewed by WVMASS as assets with the following functionality characteristics: open lanes (including the option to designate complete closure), speed limits (including degraded speeds), and permitted direction(s) of travel (allowing temporary conversion to one-way during emergencies).
- The level of functionality can be manually inputted by the user or determined by pre-established road segment attributes (i.e., open/closed, number of lanes, and speed limit). The level of functionality of the roads will in turn impact the traffic behavior as appropriate.

Interface Criteria

- The road datasets provided must be in a form that provides the details needed for road characteristics. In particular, the road data must provide the number of lanes, direction of the road, road type (interstate, motorway, major trunk, primary, secondary, residential, service, etc) , and speed limits.
- In order to support mass evacuation simulation, the system may limit the roads modeled to major road ways
- The road data must be available in an open format that can be consumed as a web service. (ex: OGC WFS, ArcXML, etc)

Requirement 3.1.2 - M&S Capability Layer Design

Overview

The existing TACCS™ architecture provides support for presentation, consequence management, and data processing.

Capabilities

- The DVE viewer provides the presentation layer that fuses the various data feeds, simulations, analytics, and other extension modules into one view.
- The UnitySM provides a central broker for all consequence management and simulation functionality. It manages the interdependency model for all modeled assets and synchronizes their state with any simulations being executed.
- The TACCS™ Asset Information Management System (AIMS) manages the storage, processing, and ingestion of all data needed for the system.

Interface Criteria

- All input data must be provided via an open OGC compliant web-services interface (ex: WFS, WMS). Data layers must be preconfigured in accordance with the TACCS data configuration settings.
- Assets of interest must be created as full simulation assets and have simulation behaviors assigned based upon asset type.

Requirement 3.1.3 - Ability to ingest real-time data

Overview

The cross-layer analytical capabilities of TACCS™ supports both the ingestion of real-time data and simulated data. Examples of real-time data used within a TACCS™ based system include: XML for live traffic camera feeds via Trafficland.com, SOAP calls for CAPWIN events (real-time transportation event information and chat capabilities with field operators) and RITIS traffic information, and WFS data for receiving roadway construction updates.

Capabilities

- The status of all assets designated by the State will be maintained in the WVMASS Live State COP. This display will not only reflect the condition of individual assets as determined by real-time data, but the cascading impact that the condition of each asset has upon dependent assets (e.g., a loss of power to a substation will render stop light powered by that substation inoperable). This real-time COP will be controlled by a single user at any given time. The controlling user may delegate control to another WVMASS workstation.
- The impact of simulated conditions on the Live State COP may be determined by entering the What If mode of operation and initiating simulations, or changing asset or environmental conditions. While in the What If mode, control of the simulated conditions

may be transferred to either another WVMASS workstation user or to an Internet user. Once the simulation is concluded, the controlling user can return to the Live State display.

Interface Criteria

- The real-time data must be available using an open web-service interface such as OGC compliant interfaces (ex: OGC WFS, ArcXML, KML, etc)

Requirement 3.1.4 - Extensibility

Overview

The ability to model the entire state will be provided. The limitation to implementation will be the availability of data and the computer processing capability. In this regard, the system will be designed to permit modular expansion of processing capability.

Capabilities

- The initial deployment will support evacuation modeling for the 4 specified counties as follows:
    - CultureSim models will support up to 50 thousand agents
    - CMSim models will support up to 800 thousand agents
- The expected number of agents that can be supported can be increased by the addition of simulation blades:
    - CultureSim - 25 thousand agents per blade
    - CMSim - 400 thousand agents per blade

Interface Criteria

- The minimum hardware configuration recommended for the initial deployment is as follows:
    - 6 client workstations
        - 4+ CPU cores. Recent Intel Xeon or equivalent
        - 8+ GB RAM
        - 1TB RAID disk
        - FX4800 1.5GB Graphics or equivalent
        - OS - Windows 7 x64 (Optional : Windows XP x32)
    - TACCS Server systems
        - One Enterprise Server:
            - 4+ CPU cores. Recent Intel Xeon or equivalent.
            - 8+ GB RAM
            - High performance RAID disk subsystem
            - OS - Red Hat Enterprise Linux 5 x64
        - Three Simulation Blades
            - 8+ CPU cores. Recent high-end Intel Xeon or equivalent
            - 32+ GB RAM

    - OS - Red Hat Enterprise Linux 5 x64
- No software changes will be required to extend the M&S capability to the entire state, but additional compute capabilities may be required depending upon the level of granularity desired for the model. We estimate that it would take no more than four additional blades. The exact compute requirements will depend upon the level of modeling detail and the exact performance needed for the models developed during the scope of this work.

Requirement 3.1.5 - M&S impact on key resources

Overview

The resources cited in this requirement (and resources added in the future) will function as agent-based assets with behavior rules that permit interaction with other assets, including vehicles in the evacuation simulation. The behavior tables will be programmable to permit evaluating fuel consumption and alternative strategies with respect to allocation of shelters and non-fuel related consumables. The inclusion of pre-programmed replenishment schemes will be supported.

In the case of fuel consumption, inventories of retail locations will be adjusted based on agreed upon algorithms that reflect the traffic patterns predicted by the evacuation model. Replenishment from reserves will be based on state/local distribution procedures and will allow for human interaction to adjust. Fuel shortages will result in notifications, giving the user the opportunity to provide replenishment for alternate sources or reroute evacuees. In the case of shelters and non-fuel related consumables, inventories will be reduced based on proximate traffic and increased based on the availability of emergency replenishment source. Emergency facility utilization and the inventory of medical supplies will be adjusted based on agreed upon statistical data using similar proximate traffic measures.

Because rerouting in case of an actual emergency would need to be initiated manually (either by signage or dispatching a police officer), automatic responses to fuel shortages and support facilities/supplies will not be initiated by the simulation. Rather, the operator will be notified and may take appropriate actions such as closing roads or redirecting supplies. The operator will be notified of non-fuel related shortages with messages of increasing urgency.

Capabilities

- The user will stipulate the initial evacuation parameters based either upon the live state data currently stored in the system or by altering the initial conditions as desired.
- Asset behavior rules will be pre-programmed in a manner that permits the operator to vary statistical assumptions.

Interface Criteria

- All base data and attribute data for the given resources will be provided by the customer.
- All base data must provide data with consistent naming and attribute data fields in order to facility automated processing.
- Priority 5 subject matter experts will assist the State in creating behavioral models for all basic asset types (ex: fuel station, fuel depot, water depot, etc)

Requirement 3.1.6 - Inclusion of construction projects

Overview

Construction conditions (i.e., road or lane closures) will be reflected in the evacuation model using the asset interdependency modeling capabilities of UnitySM.

Capabilities

- As noted in the response to Requirement 3.1.1, road segments are able to be viewed and controlled in WVMASS. This functionality provides a method for users to modify the roadway settings to determine the impact of road construction projects.

Interface Criteria

- It is assumed that notifications will arrive in the form of alerts, and the users will manually modify affected roadway states as appropriate.

Requirement 3.1.7 - Layer management

Overview

This is a core capability of TACCS™.

Capabilities

- Configured data layers can be toggled.

Interface Criteria

- All layers must be available in an open standard format such as OGC.
- Data layers are used to display feature and vector data.
- Coverage layers are used to display imagery and coverage data sources.

Requirement 3.1.8 - Remote login

Overview

WVMASS will support remote login to the server utilizing an embedded Adobe Connect based collaboration software. A connecting user can view the current workgroup, request control, and manage the canvas as needed.

Capabilities

- Remote users can remote log in via the web, and share the same COP.
- All local desktop functionality will be available to all remote users.

- The system will support wide broadcasting of live state tracking and training scenarios to large numbers of users.

Interface Criteria

- The shared client system must be configured with the Adobe provided software for collaboration.
- The local network must be configured to allow the Adobe collaboration software access to connect to the Adobe sharing services.

Requirement 3.1.9 - Credentialing

Overview

Both Internet-based and Workstation-based login will require a username and password.

Capabilities

- Credentialing for local workstation-based access will be based upon the local workstation credentialing. Users must login to the workstation with valid usernames and passwords. Once they have access to the workstation, they can only run the application if they have valid permissions to execute the application. By making use of standard Windows authentication, TACCS builds upon the existing IT infrastructure instead of introducing a new credentialing system.
- Credentialing for remote access over the Internet is based upon the authentication and accounts setup and managed in Adobe Connect.

Interface Criteria

- Existing IT infrastructure has a credentialing system in place that can be used to manage access to the workstations.

Requirement 3.1.10 - User permissions and priorities

Overview

Permissions for both Internet-based and Workstation-based users to log in as described in the response to Requirement 3.1.9 will be programmable on the WVMASS server. The presenting State user will be the master for the collaboration with Internet users and will control priorities.

Capabilities

- The master user may relinquish or reclaim control at any time.

Interface Criteria

- The master user will be notified of conflicting requests for system control and will determine priority on a case-by-case basis.

Requirement 3.1.11 - Leveraging previous investments

Overview

WVMASS will incorporate the technology investments made by both DoD (KDAS) and DHS/ FEMA (ISAVE), and the prototype unit to be installed in the Arizona Fusion Center.

Capabilities

- Delivered system will include dependency modeling and simulation technology used to monitor the world wide Defense Industrial Base Critical Infrastructure Assets.
- The system can be linked to other TACCS systems for information sharing and COP collaboration.

Interface Criteria

- Interfacing with other TACCS deployments relies upon setting up network connectivity with the other agencies and putting into place information sharing agreements. If this is of interest, Priority 5 can help to facilitate these discussions.

Requirement 3.1.12 - Standards and methods

Overview

The approach proposed for WVMASS to satisfy the requirement to specified standards/ methodologies. The underlying TACCS framework was designed from it's inception to make use of best of breed open standards and open source technologies.

Standard and Capabilities

- DODAF: The **Department of Defense Architecture Framework (DoDAF)** is a reference model to organize the enterprise architecture (EA) and systems architecture into complementary and consistent views. The TACCS technology has been deployed in both the Pentagon for DoD and at FEMA NCR. While the DODAF model was not required in either case, the software design and development conformed to current IEEE standards and met DHS Software Lifecycle Development guidelines. Required DODAF documentation will be prepared as noted in the response to Requirement 3.1.14.
- Open Geospatial Consortium (OGC) - WVMASS and the underlying TACCS technology currently conforms to OGC standards such as WMS and WFS.
- National Incident Management System (NIMS) - Like the related ISAVE plug-in deployed at the FEMA NCR, WVMASS supports the principles of the NIMS. This includes the key concept of local incident management coupled with multi-agency coordination, all executed from within the TACCS netcentric and information sharing environment.

- National Information Exchange Model (NIEMS) - WVMASS will have the ability to both receive and to transmit interagency information. The TACCS system currently has the ability to receive email, Common Alert Protocol (CAP v1.1), and various other alerting messages. Likewise, the system is designed to automatically generate system Situation Reports (STREPS) for rapid dispersal to both field agents and higher level decision makers.
- UNETRANS - The UNETRANS project, funded by ESRI, set out to develop a generic data model for transportation applications utilizing as a base component both point and linear assets as instances of modeling objects. WVMASS uses the same modeling paradigm. The core simulation model is a an agent based simulation that models each component as an individual instance of an an object. Some objects are represented as individual point assets such as a building, but other assets such as a road may be modeled as individual segments that when modeled jointly represent the functional attributes of a road, roundabout, traffic stop, etc....

Requirement 3.1.13 - Integration and development schedule

Overview

As indicated in the schedule, a detailed integration and development plan will be provided within ten (10) days of contract award.

Requirement 3.1.14 - DODAF Products

Overview

The following specified DODAF products will be provided before or during the PDR as indicated in the schedule provided with this proposal.

- AV-1 Overview and Summary Information - Scope, purpose, intended users, environment depicted, analytical findings
- AV-2 Integrated Dictionary - Definitions of all terms used in all products.
- OV-1 High Level Operational Concept Graphic - High level graphical and textual description of operational concept (high level organizations, missions, geographic configuration, connectivity, etc).
- OV-2 Operational Node Connectivity Description - Operational nodes, activities performed at each node, and connectivities and information flow between nodes.
- OV-3 Operational Information Exchange Matrix - Information exchanged between nodes and the relevant attributes of that exchange such as media, quality, quantity, and the level of interoperability required.
- OV-5 Operational Activity Model - Activities, relationships among activities, inputs and outputs. In addition, overlays can show cost, performing nodes, or other pertinent information.
- SV-1 Systems/Services Interface Description - Depicts systems nodes and the systems resident at these nodes to support organizations/human roles represented by operational nodes of the OV-2. SV-1 also identifies the interfaces between systems and systems nodes.

- TV-1 Technical Standards Profile - Extraction of standards that applies to the given architecture.

Requirement 3.1.15 - PDR Requirements

Overview

Priority 5 will participate in the PDR at the specified location.

Requirement 3.1.15 - CDR Requirements

Overview

Priority 5 will participate in the CDR at the specified location.

Requirement 3.1.17 - Data saving

Overview

The ability to record WVMASS simulations on owner supplied storage media for later playback will be provided using the native AdobeConnect capability. Additionally, operators/analysis have the ability to snapshot and save infrastructure conditions that serve as initial conditions, intermediate conditions, or the final results of a simulation run. This allows not only playback, but the modification of previous simulation runs to reflect updated or alternative conditions.

Capabilities

- To record, a Workstation user must select record in AdobeConnect.

Interface Criteria

- Management of the recorded sessions will be the responsibility of the State.

Requirement 3.1.18 - Hardware/software requirements

Overview

Priority 5 will purchase two laptops as agent for the State and deliver them with the software necessary to demonstrate the WVMASS Internet interface. The laptops shall shall meet or exceed the following specifications:

- 4+ CPU cores. Recent Intel or equivalent
- 8+ GB RAM
- 300GB disk
- NVIDIA Quatdro FX 880M 1GB Graphics or equivalent
- OS - Windows 7 x64 (Optional : Windows XP x32)

Priority 5 will support the initial software installation and provide training so that future installations and updates can be done by the State in accordance with the terms of the bundled maintenance agreement provided. An executable of the WVMASS Plug-in will be provided; however, installation of the software on additional hardware will require the purchase of additional TACCS™ licenses in accordance with the pricing schedule provided in Section IV.

Requirement 3.1.19 - Technology demonstrations

Overview

Support for the three specified technology demonstrations will be provided.

Section III – Response to RFP System Requirements

WVMASS meets all general specifications as stated in the RFP Section 4.a. Priority 5's approach in satisfying the performance requirements set forth in RFP Section 4.b are addressed below:

Requirement 3.2.1 - GIS requirements

The GIS requirements are core TACCS™ capabilities. The ability to display the information specified will be a function of the completeness of the data to be provided by the State. For purposes of pricing, it is assumed that all data will be provided to Priority 5 as web-services in one of the following standards: WMS, WFS, or ArcXML. Any custom programming to input non-standard data will constitute a change order to this proposal.

Metadata about given assets or areas may be pulled from the source GIS information or may be supplemented with per asset information. (ex: The reports of typical airline loading at airports could be loaded as pdf files or web links tied to the asset notes and attachments for the airport asset)

Requirement 3.2.2 - User-resource capabilities assessment

These requirements are core TACCS™ capabilities. WVMASS does not create independent feature data, and the collection and storage of data in a NIMS compliant database shall remain the responsibility of the State. Any simulation assets created in the TACCS system will reference back to the underlying source data for the master data fields.

Requirement 3.2.3 - User-feedback & Reaction to on-going situation

The WVMASS views and decision points will be as described in Section I. Web-based user feedback will be processed using the native alert/event management capability. In summary, this capability provides for receiving information from the field from multiple sources, recording the location and severity of the alert, and creating events that isolate related alerts for operator

action. Multiple events can in turn be consolidated in Integrated COP layers (ICLs) for group consideration and collaboration. These capabilities are illustrated in Figures III.1, III.2 and III.3.

Figure III.1 - Alert processing

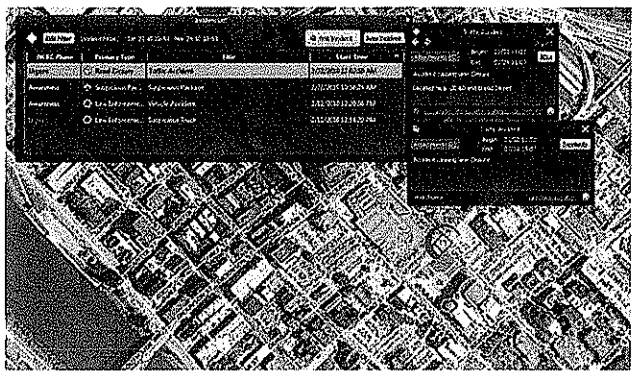


Figure III.2 - Event creation

Figure III.3 - ICL

Requirement 3.2.4 - Simulation

The TACCS system utilizes the UnitySM discrete time stepped agent-based simulation environment for the managing the time sequence of events and coordinating the interaction between multiple simulations. This environment supports the integration of multiple embedded and external simulations and has included both HLA and non-HLA based simulations. The key component of the UnitySM environment is that all simulations are integrated to the base effects that the simulation acts upon a specific asset. Assets thus react to both internal and external stimulus according to prescribe behaviors and vulnerabilities.

Key attributes and components of the the UnitySM framework include:

- Creations and customization of individual asset behaviors from an on screen interface. Assets such as a gas station can be created, programmed, repositioned, all through an intuitive drag and drop interface. Customization of the gas station may include performance parameters such as the number of pumps, size of tanks, and other logistic components.
- Dependent relationships between assets can likewise be constructed, such as, the electrical power supply to a gas station.
- Event management within the simulation can be handled one of three ways. First, the operator/decision maker has the ability to directly manipulate any asset on the canvas in

terms of changing its operational state. This supports the ability of the operator to rapidly integrate field level data into the system for establishing either event conditions or initial conditions for evaluation. Second, changes may be the result of a external simulation. A plume simulation may force the evacuation and thus loss/destruction of an asset.

- The range of possible external simulations that can be integrated is extensive. The CTAnalyst Plume model has interactively been integrated to display the chemical plume dispersion characteristics and impacts in the NCR. Additionally, results from the Aloha Plume model have been integrated as a damage contour. It is up to the customer to specify the specifications for plume modeling and the level of desired interaction as many viable options exist.
- Simulation results are displayed both visually and through a simulation log. Visually, as infrastructure changes occur such as the loss of assets, road congestion, road closure, etc... these are noted as visible alerts on the canvas. Additionally, as key infrastructure events occur, they are added to a running event log. This event log can likewise be exported in standard text formats like .csv in support of further analysis and trending. This information may also be combined with the output logs of the third party integrated simulations.
- The ability to display confidence intervals and probabilistic parameters of performance is strictly based upon the individual simulations. UnitySM can support stochastic modeling, but is nominally operated in a deterministic mode.
- Transportation characteristics (vehicular, and pedestrian) are modeled and extractable from the Lockheed Martin Models
- The WVMASS system will support both direct networking through a licensed Workstation, and web-based access through AdobeConnect, the leading industry standard. ANSI INCITS 359-2004 requirements must be either through the State's networking policies or addressed by the Adobe Connect infrastructure.

Requirement 3.2.5 - Transportation

Story: TACCS™ is able to ingest real-time data feeds. It has been used to ingest feeds similar to these about real-time information (Port F, CapWin). The system can be extended to support any specific feeds they would like. Current proposal does not include pricing for this as the exact details will be determined with customer.

Requirement 3.2.6 – User administration

This is delivered by the Adobe Connection solution.

Requirement 3.2.7 – Milestones and deliverables

Table of Milestones and Deliverables

Description	Target Date (days from project start)
Detailed Development and Integration Schedule	14
Software Requirement Specification	21

Software Design Document	30
Initial evacuation interdependency modeling complete	60
Initial software installation	90
Processing hardware with required software	120 (Note 1)
Demonstration hardware with required software	120
Executable for installation on a server (if required)	120
Executable for installation on a demonstration laptop	120
Source Code for WVMASS Plug-in	150
DODAF Products	30
Preliminary Design Review	35
Critical Design Review	45
EB Demonstration	(Note 2)
WV DMAPS Demonstration	(Note 2)
FEMA Technology Showcase	(Note 2)
Monthly Integrated Product Team Meetings	(scheduled monthly)
Weekly Activity reports	(prepared weekly)
M&S Capability	150

Notes:

(1) The only contractor provided hardware is the two laptops

(2) All of these demonstrations are anticipated to occur after project completion, but will be supported by Priority 5

Requirement 3.2.8 - Intellectual property

Ownership of the licensed software (TACCS™, CultureSim, CMSim, AdobeConnect) and other software developed by Priority 5 or other third parties (e.g., the P5 Common Library) shall remain the property of the originator. The terms of usage for the licensed software shall be as described in the respective software license agreements. All plug-in software originated and prepared for the State under this contract shall belong exclusively to the State unless ownership is released prior to the beginning of the project; this software may be shared with the Federal Government and partner states as determined by the State.

Appendix A – Company Overview

Priority 5 is a veteran owned small business and the prime contractor under this proposal. Subcontractors are Lockheed Martin Corporation and Adobe.

Priority 5

Incorporated in 2006, Priority 5 entered into a cooperative research and development agreement with the Idaho National Laboratory to develop the award winning Critical Infrastructure Modeling System (CIMS™). In 2007 the company acquired Infiscape, a company with ties to Iowa State University and a leader in architecting real world virtual reality applications and visualization solutions. Later that year, Priority 5 introduced TACCS™, which includes cross-platform data aggregation, automated imagery acquisition, high resolution 3D smart models, interdependency and consequence analysis, automated data aggregation, contaminant dispersion predictive analysis, and agent-based evacuation modeling.

Since its inception, Priority 5 has provided or is currently providing CI/KR analytics and visualization products to DOE, DOD, and DHS (FEMA), and under contract with Amtrak to develop the Special Counter-terrorism Risk and Asset Management (SCRAM) System, and with the Greater Lafourche Port Commission to develop the Port Fourchon Command and Control C-4 Software Solution.

This project will be managed by Joe Kammerman. Joe Kammerman is a seasoned emergency management and transportation executive with expertise in program management, policy development, and emergency operations. Prior to joining Priority 5, Joe served as the Homeland Security Coordinator for the District of Columbia Department of Transportation. In this capacity, he was the department's chief policy adviser for emergency preparedness and managed multiple planned and unplanned special events. Highlights included developing the department's emergency response program, maintaining the District's evacuation plan, and serving on the Washington Regional Threat and Analysis Governance Committee. Before joining the District of Columbia, Kammerman served as a lead consultant member on the development team for Archangel, a critical infrastructure protection program for the Los Angeles Police Department where he helped design the ACAMS prototype.

The project lead simulation subject matter expert will be Don Dudenhoeffer. Donald Dudenhoeffer joins Priority 5 with a wide background in both infrastructure research and operations. Prior to joining Priority 5, he spent nine years leading research at the Idaho National Laboratory (DOE), most recently is serving as the Department Manager of Human Factors and Nuclear Instrumentation and Control. During this time, his research in Critical Infrastructure Modeling and Simulation has been presented internationally and was nominated for an R&D 100 award by the laboratory. A 20+ veteran of the U.S. Navy Submarine Force, he currently holds the rank of Commander in the U.S. Navy Reserves and is the Commanding Officer for NR SPAWAR Det 301.Lockheed Martin.

Adobe

Adobe revolutionizes how the world engages with ideas and information. Adobe's award-winning software and technologies have set the standard for communication and collaboration for more than 25 years, bringing vital and engaging experiences to people across media and to every screen in their lives, at work and at play. The impact of Adobe® software is evident almost everywhere you look. Whether people are collaborating at work, transacting online, or socializing with friends, businesses use Adobe software and technologies to turn digital interactions into richer, high-value experiences that reach across computing platforms and devices to engage people anywhere, anytime. With a reputation for excellence and a portfolio of many of the most respected and recognizable software brands, Adobe is one of the world's largest and most diversified software companies.

Adobe's commitment to innovation is as strong today as it was in 1982, when Chuck Geschke and John Warnock founded Adobe. The two men initially set out to solve a problem long familiar to creative professionals at the time: getting text and images on a computer screen to translate beautifully and accurately into print. A year later, they helped launch the desktop publishing revolution with Adobe PostScript®, a technology that took the publishing world by storm with its radical new approach to printing text and images.

That was just the beginning. From the earliest days, Adobe embraced our role as industry visionary and leader, continuing to solve previously insurmountable problems. The release of two ground breaking applications—Adobe Illustrator® and Adobe Photoshop®—forever changed the quality and complexity of images that could be created for print, and later for content created for video, film, the web and other digital channels. The design industry was never the same.

As computers became more interconnected and people needed to collaborate online using a wide variety of documents, a new problem emerged: sharing this content. Incompatible operating systems and programs hindered collaboration, a problem made worse as the use of e-mail and the web skyrocketed. Adobe's breakthrough Portable Document Format (PDF) technology provided a solution for the problem, enabling businesses to deliver platform- and application-independent files across operating systems and devices. Suddenly, enterprises had new opportunities for—and returns from—document sharing and collaboration. Today, Adobe extends the benefits of dynamic collaboration through web conferencing and enterprise solutions offering powerful document security, process management, and other capabilities.

As the Internet exploded into a viable economic engine, Adobe quickly recognized that static HTML pages could not deliver the end-user interactivity and integration with enterprise systems that businesses required. We again took the lead—first with Adobe Dreamweaver® and Flash®, and later with Flex® and the Flash Media Server—by making cost-effective, reliable development of engaging websites a reality.

Adobe is now leading the next wave of industry innovation, helping companies integrate enterprise technologies and rich media into solutions that solve real-world business problems. With the Adobe Flash Platform, including Flash Player and the Adobe AIR® runtime, businesses are building rich Internet applications (RIAs) that offer vital efficiencies and provide a competitive edge by transforming the quality and reach of their services.

CONNECT OVERVIEW

Acrobat Connect elevates online training, marketing, collaboration, and web conferencing to a whole new level, delivering high-impact communications everyone can access instantly. DISA/ DHS HSIN, FDA, NIH, FHWA STATE OF NC, CA, WI AND OTHERS have all standardized on Connect for its rich and secure web communication system that lets you reach your audience anytime/anywhere with engaging multimedia content. And, because Connect is deployed using Flash Player that is cross platform supported and installed on more than 98% of browsers worldwide, your audience can join online meetings, training courses and on-demand presentations instantly without any plugging. Adobe Connect has been certified by the Catastrophic Planning and Management Institute(CPMI) for disaster planning, response, and recovery operations. (http://www.cp-mi.org/14722.html)

With Adobe's eLearning solutions, subject matter experts can easily develop (within PowerPoint), deploy, track, and manage content and curriculums without abandoning current enterprise initiatives. Given Adobe's SCORM and AICC compliance, organizations like USDA Grad School, National Highway Institute, and NIH can easily integrate the Adobe advantage into legacy learning management systems (LMS).

Lockheed Martin

Lockheed Martin Simulation, Training & Support (STS) is focused on supplying training for military and commercial platforms, as well as staff training. The company is a provider of modeling, simulation, and mission rehearsal tools for military and civilian applications. Military logistics support and test equipment is also a large portion of the business, including machinery controls, logistics management systems, and automated test solutions for air, land and sea.

LM STS has approximately 3,300 employees, half of whom work in Orlando, FL, hub of the largest concentration of training and simulation activity in the USA. Other major LM STS facilities are located in Fort Worth, TX; Huntsville, AL; Akron, OH; Burlington, MA; the Washington, D.C. metropolitan area; La Mesa, Mexico; and the United Kingdom.

In 1984, Lockheed Martin Simulation, Training & Support's (LM STS) Advanced Simulation Centers (ASC) pioneered the development of distributed simulation networking software and technologies that became the lynchpin for DARPA's revolutionary Simulator Networking (SIMNET) project. Ever since, ASC has been in the forefront of the most significant distributed simulation innovations, technical milestones and achievements (Figure 8). Among them are:

- 73 Easting Battle Reconstruction (DARPA, 1991). First use of entity-level distributed simulation for battle reconstruction; used for both soldier training and historical analysis.
- ModSAF (DARPA, 1992). Development of the first modular, easily extensible, entity-level battlefield combat operations simulation.
- Dynamic Environmental Representation (DARPA, 1995-1997). First development of real-time environmental effects (smoke, precipitation, cratering) for distributed simulation. Developed for the Synthetic Theater of War (STOW) ACTD.
- Agile FOM Interface (DMSO, 1998). First development of HLA RTI network interface middleware that enables configurable object model adaptability for a simulation federate.
- JSAF Federation (JFCOM, 2000). First development of a persistent HLA federation in continuous use; supports advanced concept development and experimentation.
- Millennium Challenge 2002 (JFCOM, 2002). First multi-service, widely distributed HLA-based joint experiment.

- CultureSim (JFCOM, 2004). First ultra-highly scalable (greater than 1 million entities) urban populace simulation.
- Deployable Virtual Training Environment (PM TRASYS, 2006). Deployable training environment for USMC Fire Support Teams (FiST).
- Infantry Immersion Trainer (IIT) (PM TRASYS 2008). Mixed reality training environment for Marines deploying to Iraq and Afghanistan.

As the name implies, the Advanced Simulation Centers form an R&D organization solely focused on advancing state-of-the-art simulation technology. Our main customers are DoD and Service technology research organizations (e.g., DARPA, ONR) and advanced concepts development organizations (USJFCOM J9, NWDC). ASC also provides advanced simulation technology R&D for LM STS and other Lockheed Martin companies.

Appendix B - Past Performance

Project Listing and References

Priority 5 has deployed TACCS and client-specific plug-ins at installations for DOE, DoD, FEMA, and has been selected to develop the TACCS™-based Amtrak Special Counter-terrorism Risk and Asset Management (SCRAM) System and Greater LaFourche Port Commission Command and Control C-4 Software Solution. Project references are as follows:

Project References

Project	**Client Representative/Reference**
Office of Assistant Secretary of Defense for Homeland Defense and America's Security Affairs (OASD-HD&ASA) Knowledge Display and Aggregation System (KDAS) (2008-2010)	John M. Downey CACI Support to Defense Critical Infrastructure Program Defense Industrial Base (OASD HD & ASA) (O) 703-602-5730 x168 John.Downey.ctr@osd.mil
Department of Homeland Security (DHS) FEMA National Capitol Region Integrated Situational Awareness and Visualization Environment (ISAVE) (2009-2010)	Nelson E. Torres Associate Director for Technology Integration Interoperability Program Manager FEMA Office of National Capital Region Coordination (O) 202-212-1521 Nelson.Torres1@dhs.gov
Greater Lafourche Port Commission Command and Control C-4 Software Solution (2010	April Danos Director of Information Technology Greater Lafourche Port Commission (O) 985-632-1114 aprild@portfourchon.com