Cougaar
Software Inc.

February 24, 2010

John Abbott (32)
Department of Administration
Purchasing Division
Building 15
2019 Washington Street, East
Charleston, WV 25305-0130

Subject : RFQ HSE000101 – Cougaar Software Technical Proposal

Dear Mr. Abbott;

Cougaar Software, Inc. (CSI) is pleased to submit the following Technical Proposal in response to RFQ HSE000101. We have carefully reviewed the RFQ, Scope of Work and terms and conditions and have provided the attached response, which is fully compliant with all the mandatory requirements.

Based on our capabilities and understanding, CSI has assembled a world class team for this effort and are able to provide the State of West Virginia with a long-term cost effective and highly scalable and extensible M&S Consequence Management capability. Team CSI is composed of Cougaar Software, Inc. (CSI) as the prime; Information Research Corporation (IRC), a small West Virginia technical services company; and SAIC, a large technology services company.

Attached to this letter are the signed RFQ Cover Sheets for the RFQ and Addendum #01 and #02 as well as the signed Purchasing Affidavit. We have provided our Technical Proposal plus one convenience copy along with a CD containing these documents in electronic form.

In addition, our Cost Proposal is included in a sealed separate envelope within this submitted package.

Should you have any questions concerning this proposal or shipment, please contact Dr. Todd Carrico via email at tcarrico@cougaarsoftware.com or telephone (703) 506-1700.

Sincerely,

// tmc //

Todd Carrico Ph. D
President & CEO

7600 B Leesburg Pike, Suite 105 Falls Church, VA 22043-2004
ofc: 703-506-1700 fax: 703-506-8010
www.cougaarsoftware.com

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)

State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

Request for Quotation

RFQ NUMBER	PAGE
HSE000101	1

ADDRESS CORRESPONDENCE TO ATTENTION OF:
JOHN ABBOTT
304-558-2544

VENDOR
RFQ COPY
TYPE NAME/ADDRESS HERE
Cougaar Software, Inc.
7600B Leesburg Pike
Suite 105
Falls Church, VA 22043

SHIP TO
HOMELAND SECURITY & EMERGENCY MANAGEMENT, DIVISION OF
BUILDING 1, ROOM EB80
1900 KANAWHA BOULEVARD, EAST
CHARLESTON, WV
25305-0360 304-558-5380

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
01/12/2010				

BID OPENING DATE: 02/23/2010 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
0001	1	LS		961-20		$*,***,***.**

MODELLING & SIMULATION CAPABILITY

REQUEST FOR PROPOSAL (RFP)

CONTRACT TO PROVIDE MODELLING AND SIMULATION CAPABILITY FOR CONSEQUENCE MANAGEMENT SERVICES FOR THE WEST VIRGINIA DEPARTMENT OF MILITARY AFFAIRS AND PUBLIC SAFETY, HOMELAND SECURITY DIVISION, PER THE ATTACHED REQUEST FOR PORPOSAL (RFP).

MANDATORY PRE-BID

A MANDATORY PRE-BID WILL BE HELD ON 2/03/10; 10:30 AM - LOCATION LISTED IN THE ATTACHED DOCUMENTATION. ALL INTERESTED PARTIES ARE REQUIRED TO ATTEND THIS MEETING FAILURE TO ATTEND THE MANDATORY PRE-BID SHALL RESULT IN DISQUALIFICATION OF THE BID. NO ONE PERSON MAY REPRESENT MORE THAN ONE BIDDER.

AN ATTENDANCE SHEET WILL BE MADE AVAILABLE FOR ALL POTENTIAL BIDDERS TO COMPLETE. THIS WILL SERVE AS THE OFFICIAL DOCUMENT VERIFYING ATTENDANCE AT THE MANDATORY PRE-BID. FAILURE TO PROVIDE YOUR COMPANY AND REPRESENTATIVE NAME ON THE ATTENDANCE SHEET WILL RESULT IN DISQUALIFICATION OF THE BID. THE STATE WILL NOT ACCEPT ANY OTHER DOCUMENTATION TO VERIFY ATTENDANCE. THE BIDDER IS RESPONSIBLE FOR ENSURING THEY HAVE COMPLETED THE INFORMATION REQUIRED ON THE ATTENDANCE SHEET. THE PURCHASING DIVISION AND THE STATE AGENCY WILL NOT ASSUME ANY RESPONSIBILITY FOR A BIDDER-S FAILURE TO COMPLETE THE PRE-BID ATTENDANCE SHEET. IN ADDITION, WE REQUEST THAT ALL POTENTIAL BIDDERS INCLUDE THEIR E-MAIL ADDRESS AND FAX NUMBER.

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
Scott M. Caruso	(703) 506-1700	02/23/2010

TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE
President	542020473	

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

Request for Quotation

RFQ NUMBER	PAGE
HSE000101	2

ADDRESS CORRESPONDENCE TO ATTENTION OF:
JOHN ABBOTT
304-558-2544

VENDOR
RFQ COPY
TYPE NAME/ADDRESS HERE
Cougaar Software, Inc.
7600B Leesburg Pike
Suite 105
Falls Church, VA 22043

SHIP TO
HOMELAND SECURITY & EMERGENCY MANAGEMENT, DIVISION OF
BUILDING 1, ROOM EB80
1900 KANAWHA BOULEVARD, EAST
CHARLESTON, WV
25305-0360 304-558-5380

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
01/12/2010				

BID OPENING DATE: 02/23/2010 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT

ALL POTENTIAL BIDDERS ARE REQUESTED TO ARRIVE PRIOR TO THE STARTING TIME FOR THE PRE-BID. BIDDERS WHO ARRIVE LATE, BUT PRIOR TO THE DISMISSAL OF THE TECHNICAL PORTION OF THE PRE-BID WILL BE PERMITTED TO SIGN IN. BIDDERS WHO ARRIVE AFTER CONCLUSION OF THE TECHNICAL PORTION OF THE PRE-BID, BUT DURING ANY SUBSEQUENT PART OF THE PRE-BID WILL NOT BE PERMITTED TO SIGN THE ATTENDANCE SHEET.

NOTICE

A SIGNED BID MUST BE SUBMITTED TO:

DEPARTMENT OF ADMINISTRATION
PURCHASING DIVISION
BUILDING 15
2019 WASHINGTON STREET, EAST
CHARLESTON, WV 25305-0130

THE BID SHOULD CONTAIN THIS INFORMATION ON THE FACE OF THE ENVELOPE OR THE BID MAY NOT BE CONSIDERED:

SEALED BID

BUYER: JOHN ABBOTT (32)

RFQ. NO.: HSE000101

BID OPENING DATE: 2/23/2010

BID OPENING TIME: 1:30 PM

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
[signature]	(703) 506-1700	02/23/2010
TITLE: President	FEIN: 542020473	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

Request for Quotation

RFQ NUMBER	PAGE
HSE000101	3

ADDRESS CORRESPONDENCE TO ATTENTION OF:
JOHN ABBOTT
304-558-2544

VENDOR
RFQ COPY
TYPE NAME/ADDRESS HERE
Cougaar Software, Inc.
7600B Leesburg Pike
Suite 105
Falls Church, VA 22043

SHIP TO
HOMELAND SECURITY & EMERGENCY MANAGEMENT, DIVISION OF
BUILDING 1, ROOM EB80
1900 KANAWHA BOULEVARD, EAST
CHARLESTON, WV
25305-0360 304-558-5380

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B	FREIGHT TERMS
01/12/2010				

BID OPENING DATE: 02/23/2010 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT. NO.	ITEM NUMBER	UNIT PRICE	AMOUNT

PLEASE PROVIDE A FAX NUMBER IN CASE IT IS NECESSARY TO CONTACT YOU REGARDING YOUR BID:

(703) 506-8010

CONTACT PERSON (PLEASE PRINT CLEARLY):

Dr Todd Carrico

****** THIS IS THE END OF RFQ HSE000101 ****** TOTAL: $*,***,***.**

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
Todd J Carrico	(703) 506-1700	02/23/2010

TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE
President	542020473	

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

State of West Virginia
Department of Administration
Purchasing Division
2019 Washington Street East
Post Office Box 50130
Charleston, WV 25305-0130

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RFQ NUMBER	PAGE
HSE000101	1

ADDRESS CORRESPONDENCE TO ATTENTION OF:
JOHN ABBOTT
304-558-2544

VENDOR
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TYPE NAME/ADDRESS HERE
Cougaar Software, Inc.
7600B Leesburg Pike
Suite 105
Falls Church, VA 22043

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CHARLESTON, WV
25305-0360 304-558-5380

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
02/11/2010				

BID OPENING DATE: 02/23/2010 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
				ADDENDUM #01		
				THIS ADDENDUM IS ISSUED TO ANSWER QUESTIONS AND CLARIFY THE ORIGINAL REQUEST FOR PROPOSAL SPECIFICATIONS, PER THE ATTACHED DOCUMENTATION.		
				NO ADDITIONAL QUESTIONS WILL BE ACCCEPTED.		
0001	1	LS		961-20		$*,***,***.**
				MODELLING & SIMULATION CAPABILITY		
				****** THIS IS THE END OF RFQ HSE000101 ****** TOTAL:		$*,***,***.**

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
Robert J. Lemos	(703) 506-1700	02/23/2010

TITLE	FEIN	ADDRESS CHANGES TO BE NOTED ABOVE
President	542020473	

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

State of West Virginia
Department of Administration
Purchasing Division
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Charleston, WV 25305-0130

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JOHN ABBOTT
304-558-2544

VENDOR
RFQ COPY
TYPE NAME/ADDRESS HERE
Cougaar Software, Inc
7600B Leesburg Pike
Suite 105
Falls Church, VA 22043

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HOMELAND SECURITY & EMERGENCY MANAGEMENT, DIVISION OF
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1900 KANAWHA BOULEVARD, EAST
CHARLESTON, WV
25305-0360 304-558-5380

DATE PRINTED	TERMS OF SALE	SHIP VIA	F.O.B.	FREIGHT TERMS
02/17/2010				

BID OPENING DATE: 02/24/2010 BID OPENING TIME 01:30PM

LINE	QUANTITY	UOP	CAT NO.	ITEM NUMBER	UNIT PRICE	AMOUNT
				ADDENDUM #02		
				THIS ADDENDUM IS ISSUED TO CLARIFY SECTION 2.2, BACKGROUND OF THE ORIGINAL REQUEST FOR PROPOSAL SPECIFICATIONS, PER THE ATTACHED DOCUMENT, AND EXTEND THE BID OPENING TO 2/24/2010; 1:30 PM		
				REVISED BID OPENING: 2/24/2010; 1:30 PM		
				NO ADDITIONAL QUESTIONS, INQUIRIES, OR COMMENTS WILL BE ACCEPTED OR ACKNOWLEDGED DUE TO THE TIME CONSTRAINTS OF THIS PROJECT		
001	1	LS	961-20	MODELLING & SIMULATION CAPABILITY		$*,***,***.**
				****** THIS IS THE END OF RFQ HSE000101 ****** TOTAL:		$*,***,***.**

SEE REVERSE SIDE FOR TERMS AND CONDITIONS

SIGNATURE	TELEPHONE	DATE
Scott M. Cancel	(703) 506-1700	02/23/2010
TITLE: President	FEIN: 542020473	ADDRESS CHANGES TO BE NOTED ABOVE

WHEN RESPONDING TO RFQ, INSERT NAME AND ADDRESS IN SPACE ABOVE LABELED 'VENDOR'

RFQ No. HSE000101

STATE OF WEST VIRGINIA
Purchasing Division

PURCHASING AFFIDAVIT

West Virginia Code §5A-3-10a states: No contract or renewal of any contract may be awarded by the state or any of its political subdivisions to any vendor or prospective vendor when the vendor or prospective vendor or a related party to the vendor or prospective vendor is a debtor and the debt owned is an amount greater than one thousand dollars in the aggregate

DEFINITIONS:
"Debt" means any assessment, premium, penalty, fine, tax or other amount of money owed to the state or any of its political subdivisions because of a judgment, fine, permit violation, license assessment, defaulted workers' compensation premium, penalty or other assessment presently delinquent or due and required to be paid to the state or any of its political subdivisions, including any interest or additional penalties accrued thereon.

"Debtor" means any individual, corporation, partnership, association, Limited Liability Company or any other form or business association owing a debt to the state or any of its political subdivisions. "Political subdivision" means any county commission; municipality; county board of education; any instrumentality established by a county or municipality; any separate corporation or instrumentality established by one or more counties or municipalities, as permitted by law; or any public body charged by law with the performance of a government function or whose jurisdiction is coextensive with one or more counties or municipalities. "Related party" means a party, whether an individual, corporation, partnership, association, limited liability company or any other form or business association or other entity whatsoever, related to any vendor by blood, marriage, ownership or contract through which the party has a relationship of ownership or other interest with the vendor so that the party will actually or by effect receive or control a portion of the benefit, profit or other consideration from performance of a vendor contract with the party receiving an amount that meets or exceed five percent of the total contract amount.

EXCEPTION: The prohibition of this section does not apply where a vendor has contested any tax administered pursuant to chapter eleven of this code, workers' compensation premium, permit fee or environmental fee or assessment and the matter has not become final or where the vendor has entered into a payment plan or agreement and the vendor is not in default of any of the provisions of such plan or agreement.

Under penalty of law for false swearing (***West Virginia Code*** §61-5-3), it is hereby certified that the vendor affirms and acknowledges the information in this affidavit and is in compliance with the requirements as stated

WITNESS THE FOLLOWING SIGNATURE

Vendor's Name: Cougaar Software, Inc.

Authorized Signature: _____ Date: 02/23/2010

State of Virginia

County of Fairfax, to-wit:

Taken, subscribed, and sworn to before me this 23 day of December, 2010 February

My Commission expired Sept 30, 2013

AFFIX SEAL HERE

NOTORY PUBLIC _____

OFFICIAL SEAL
COMMONWEALTH OF VIRGINIA
EHAB AWADALLAH
COUNTY OF FAIRFAX
Registration # 361161
My Commission Expires
September 30, 2013

Modeling and Simulation (M&S) Capability for Consequence Management Services

Technical Proposal

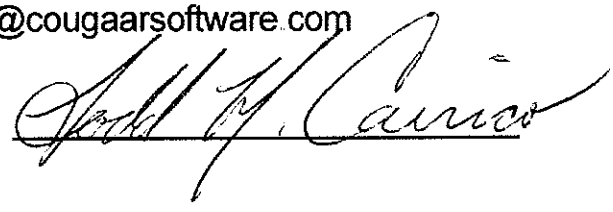
Request for Proposal #: HSE000101

February 23, 2010

Cougaar Software, Inc.
7600 B Leesburg Pike, Suite 105
Falls Church, VA 22043
Phone: (703) 506-1700
Fax: (703) 506-8010

CSI Document #CSI-2010-07

Point of Contact:
Dr. Todd Carrico, President and CEO
tcarrico@cougaarsoftware.com

Signed: 

Contents

1 General Overview

1.1 Project Identification and Significance

Should a major event occur in the Washington metropolitan area, the severity of impacts and implications for the entire region could be significant. Dependent upon the nature of the situation, evacuation routes, medical aid, critical resources such as water and fuel, and other infrastructure in West Virginia could become greatly stressed or overwhelmed if not managed effectively through good situation understanding, dynamic simulation assessment and effective decision support.

The purpose of this project is to provide a prototype Model and Simulation (M&S) capability for Consequence Management for the Regional Catastrophic Preparedness Grant Program (RCPGP) stakeholders (West Virginia, Pennsylvania, Delaware, Maryland, District of Columbia and Virginia). The lead agency for this regional program is the West Virginia Department of Military Affairs and Public Safety (WV DMAPS). Consequence Management takes into account policy, plans and procedures, and calculates the results of simulation decision inputs and the effects of those decisions on the identified resources. The prototype M&S capability will provide the functionality to allow decision makers to plan and run simulations in preparation for a large-scale catastrophic event taking place in the National Capital Region (NCR).

Team CSI, consisting of Cougaar Software, Inc., Information Research Corporation (IRC), and Science Applications International Corporation (SAIC), proposes to develop an extensible consequence modeling, management and simulation capability called Consequence Simulation (ConSim). This powerful decision support capability will leverage the visualization power of the Virginia Interoperability Picture for Emergency Response (VIPER) or other ESRI products for the Presentation (GUI) Layer, and be supported by the Unified Incident Command and Decision Support (UICDS) that enables information sharing and decision support among commercial, government, and academic incident management technologies used to support the National Response Framework (NRF) and the National Incident Management System (NIMS), including the Incident Command System (ICS), in order to prevent, protect, respond, and recover from natural, technological, and terrorist events.

This project has the objective of implementing a simulation-based analysis and decision support capability that will allow decision makers and resource managers to contemplate, analyze and manage such a contingency – both in training and potentially in reality. It will answer a core set of critical questions such as:

- Given the current road conditions and closures, event location, position and movement of the threat, what will be the expected flow of people and vehicles into the region?
- Given the nature and type of the event, where and how can critical resources be accessed?
- Given the additional consumption and stresses on the infrastructure, where should critical resources be moved? If resupply or cross-leveling activities are limited due to traffic issues, what are the magnitudes of shortfalls and expected secondary effects?

- If medical care or shelter is required, what capacities can be called into service? From where and via what routes can injured and displaced persons be moved, or critical first-aid and shelter capabilities be directed?
- If the incident threat is mobile, such as an airborne or close proximity surface contamination, how will the threat manifest and migrate? What resources will be exposed or contaminated, and which resources can be utilized in the response effort?
- Given the evacuation of people via vehicle and foot, how can the egress best be managed while supporting emergency response ingress to the affected region? If specific routes are closed or degraded/modified, how does that impact the flow?
- Given various levels of incidence, where are resource inventories of fuel, water, medical aid, and shelter most vulnerable or most inadequate? What levels would need to be maintained to support an adequate response, and where are those resources best stored?
- Where could secondary sources of critical resources be drawn from in the case of extreme events, and what methods are necessary to obtain them?

These and other key questions, studied before an event and managed during an event can provide key support to decision makers in critical situations. Providing powerful decision support backed with simulation analytics enables the responsible authorities to make better decisions quicker and with more confidence.

The ConSim capability will reside on servers owned by the State of West Virginia and will be accessed through a web-based log-in system. Under this effort, Team CSI will develop ConSim as a consequence management application with supporting interdependency algorithms (reasoners) that will allow users to input assumptions and see the results of their decisions on roadways and selected resources.

1.2 Technical Objectives

The architecture for the ConSim M&S support for Consequence Management will comprise three components: the Presentation Layer, the Consequence Management Layer, and the Data Layer, as shown in Figure 1.

The Presentation Layer provides visualization capabilities for the simulations depicting the regions and resources of interest and their changes over time based on the scenarios and events of interest. The visual rendering is done primarily through the VIPER Common Operating Picture (COP) visualization with portal interface support for loading and managing simulation data, configuration parameters and performance preferences.

The ConSim Consequence Management Layer is the heart of the Consequence Management M&S analysis functionality - augmenting simulation with advanced reasoning and decision support. In this layer, knowledge-based situational representation is maintained and the reasoners and simulation models that operate over the situational representation are managed. This capability utilizes a class of software called cognitive agents and the ActiveEdge Situational Reasoning Framework (SRF) to create a dynamic, intelligent decision support capability that leverages a combination of reasoning, knowledge-based situational representation and simulation analysis to empower decision-makers with information, options and recommendations. This technology has been evaluated and demonstrated to support theater

operations in a number of domains including logistics, command and control and resource optimization/management, and has proven to be highly effective.

The Data Layer depicted at the bottom supports data interfaces providing connectivity to information from the external world. The Data Layer is built upon the ActiveEdge mediation and device interface frameworks that allow easy integration with external data sources, systems, devices and platforms. This layer will support integration with UICDS as well as any non-UICDS data sources required to support the ConSim functionality. The mediation and device interface frameworks, like most of the elements of ActiveEdge, are modular and component based. Information may be consumed in a variety of formats including but not limited to XML schema such as those defined by the National Information Exchange Model (NIEMS), the National Incident Management System (NIMS), and various transportation systems based on the Unified Network-Transportation (UNETRANS) model.

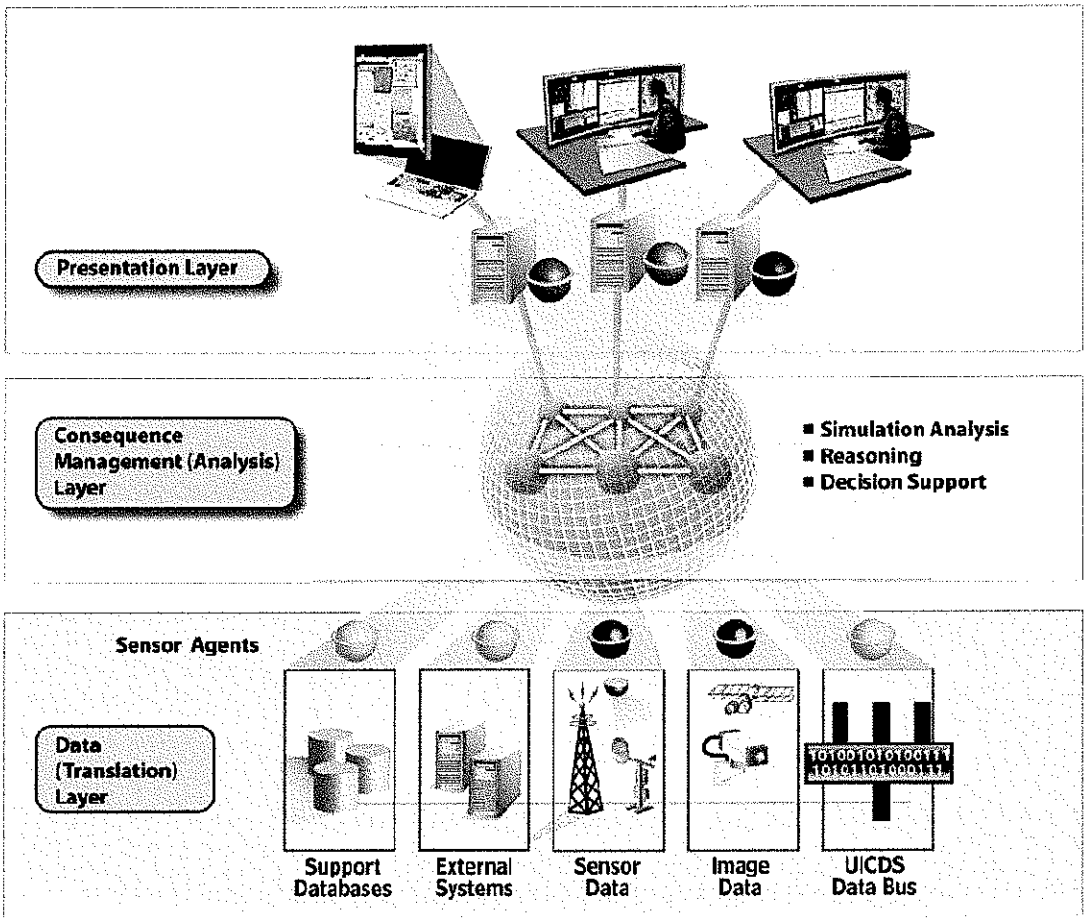


Figure 1: Proposed ConSim Decision Support Architecture

The initial ConSim implementation shall focus on four counties within the region (Jefferson, Berkley, Morgan, and Hampshire) and provide models to support four (4) resource commodities:

- Fuel
- Water
- First-Aid
- Shelter Beds.

As well as simulations for:

- Vehicle Flow
- Pedestrian Flow
- Environmental and Plume model.

The ConSim capability will be extensible, beyond the initial four counties and four resources defined in the RFP so that additional counties, regions, and resources can be added throughout the life-cycle of the capability.

2 Scope of Work

This section describes the scope of the work to develop and demonstrate the ConSim capability. Section 2.1 describes the technical approach for implementing the overall architecture and capabilities. Section 2.2 provides specific insights into the work based on the specific requirements delineated in the RFP.

2.1 ConSim Development Technical Approach

The development and delivery of the ConSim capability will be performed under a Firm Fixed Price contract. Therefore, to manage risk for the customer and vendor, the system engineering process must address requirements and acceptance criteria for the system early in the period of performance. Team CSI will apply a structured engineering process based on industry best practices. So that the system can be designed based on a solid baseline, software requirements and corresponding acceptance criteria will be specified (in the form of a Software Requirement Specification (SRS) document) and submitted for approval by the customer. Once approved, an Acceptance Test Plan will be designed and submitted that defines the necessary and sufficient test results that will demonstrate successful implementation of the ConSim capability. The overall architecture of the ConSim capability will created based upon the approved requirements and documented using DoDAF-compliant products. The software system will be iteratively designed and implemented, the results of which will be presented in Preliminary and Critical Design Reviews (PDR and CDR) to ensure alignment with customer expectations. Software testing will confirm sufficiently satisfied software requirements and will be run on specified platforms before formal demonstrations to the customer stakeholders. Throughout the development effort, weekly progress reports will be shared with the customer, tracking Team CSI's progress and identifying any risks with corresponding mitigation strategies.

The architecture for the ConSim capability will be comprised of three components: the Data Layer, the Consequence Management Layer, and the Presentation Layer. Expanding on the overview in the previous section, the following describes how these components will be implemented.

2.1.1 ConSim Presentation Layer

The Presentation Layer provides the user interface to the system including visualization capabilities for the simulations depicting the regions and resources of interest and their changes over time based on the scenarios and events of interest. Visual rendering is done primarily through the VIPER COP visualization, with portal interface support for loading and managing simulation data, configuration parameters and performance preferences. From the users' perspective, the system looks and operates much like any application, but it utilizes the power of

intelligent agents, distributed computing and situational reasoning to support user understanding, analysis, configuration and decision making.

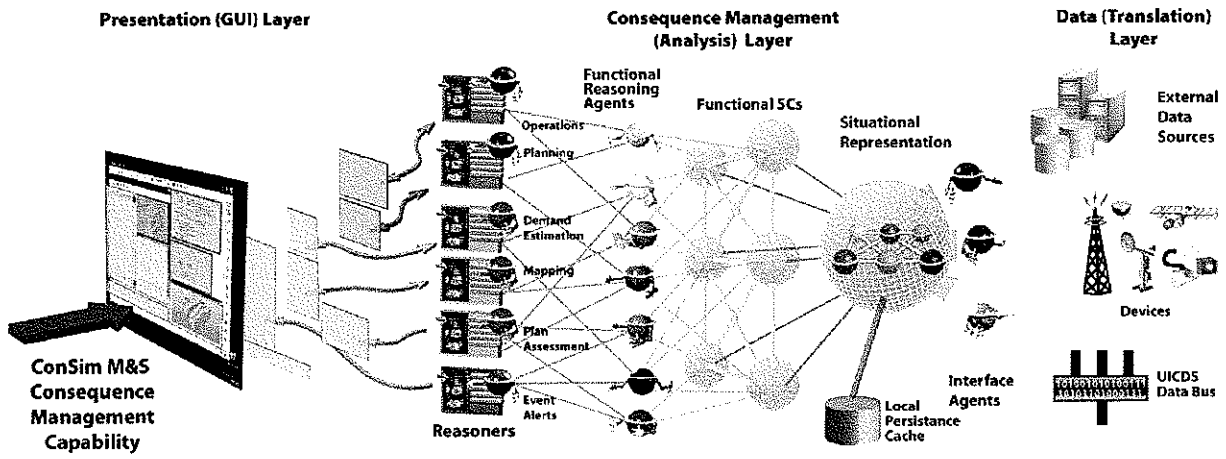


Figure 2: Supporting Information and Presentation for the WV COP through Intelligent Decision Support

As depicted in Figure 2, COP/Console visualization support for M&S information allows the user to perform analysis and simulations in support of the management of one or more events. The visual rendering is done primarily through the VIPER COP visualization, with intelligent agents providing portal interface support for loading and managing simulation data, configuration parameters and performance preferences. Behind the VIPER COP is a set of agents that are managing the interface between the COP and the lower level reasoners and simulation components in the Consequence Management (Analysis) Layer. These agents interface with the Situational Constructs (SCs) and reasoners to support the users' actions and manage the users' information display. If the user performs a task or asks a key question, the agents will invoke the capabilities or components in the appropriate SC to execute and manage that action. In many cases, the agent will configure, run and return a simulation result, or update existing simulation results for visualization to the user. Because of the component-based nature of the architecture, simulation-analysis can be augmented with appropriate types of reasoning and optimization to provide alternatives, options, analysis, assessment and recommendations. Used in conjunction with simulation, these reasoning capabilities empower the user to better understand the problem space and quickly identify the best solution among the alternatives in the solution set.

2.1.2 ConSim Consequence Management Layer

The Consequence Management Layer of the ConSim architecture is the heart of the Consequence Management M&S analysis functionality, augmenting simulation with advanced reasoning and decision support. In this layer, knowledge-based situational representation is maintained, and the reasoners and simulation models that operate over the situational representation are managed. This capability utilizes a class of software called intelligent agents and the ActiveEdge Situational Reasoning Framework (SRF) to create a dynamic, intelligent decision support that leverages a combination of reasoning, knowledge-based situational representation and simulation analysis to empower decision-makers with information, options and recommendations.

Situational representation is more than icons or tracks on a map; it is the union of many aspects of a situation constructed and maintained from the real-time data supporting those aspects, enabling reasoning over the information and their interrelationships. For example, the storage, permissible distribution routes, conveyances, and facilities capable of dispensing fuel can be considered one aspect. With that aspect alone we can reason over inventory levels, resupply schedules, and consumption. In conjunction with other aspects, like Vehicle Flow, we can plan and schedule distribution routes for resupply. As depicted in Figure 3, the ConSim Consequence Management Layer will be designed to address the resources and regions defined in the RFP while being sufficiently flexible to add additional aspects corresponding with other resources and regions in the future. Aspects can be added and removed as other elements of the situation require representation and reasoning. The aspects are linked together to form the total situational representation, which in turn forms the knowledge-network upon which the reasoning and simulation analysis are performed.

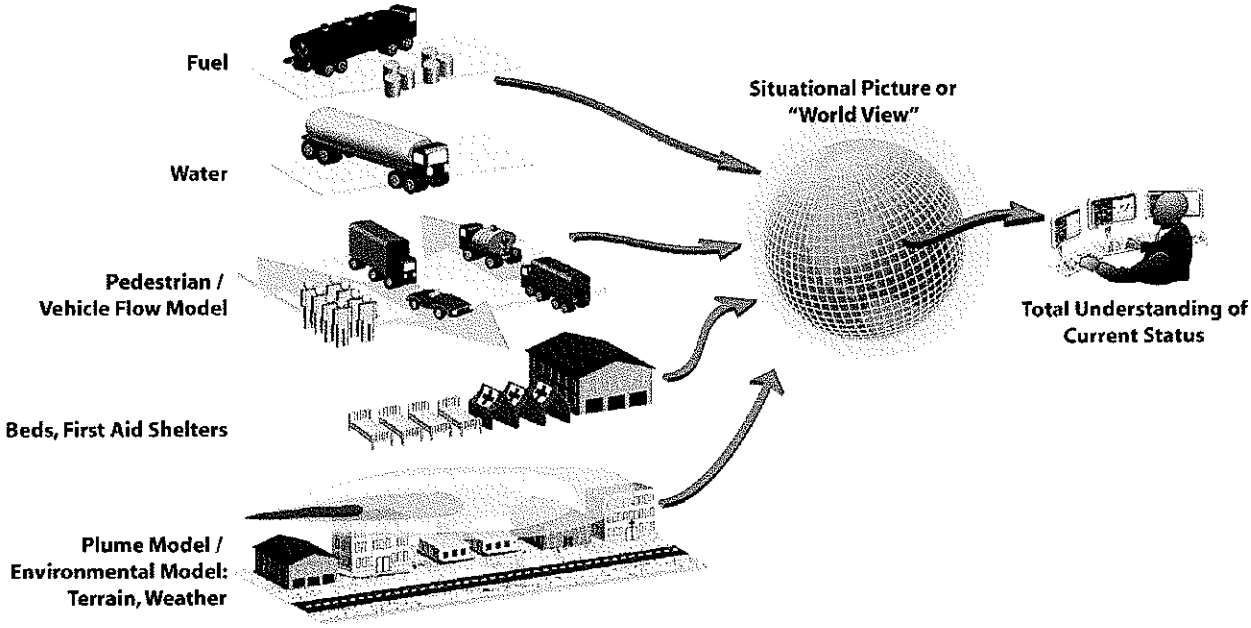


Figure 3: Knowledge-based Situational Representations are composed of interconnected layers of situation aspects

Team CSI will implement each significant aspect of the regional event situation as a Situational Construct (SC) using the ActiveEdge Situational Reasoning Framework (SRF). These SCs are composed of objects, metadata networks of objects and their relationships, and the grounding of objects in corresponding ontologies and semantic networks. This combination of these representations, as shown in Figure 4, creates a dynamic knowledge network that enables in-depth situational reasoning and supports dynamic simulation analysis and projections. The elements in the representation are updated as new data arrives, decisions are made and events occur. This representation is more powerful and more efficient in complex domains than a conventional database. Intelligent agents will be responsible for reasoning over and updating each of the SCs. Common information, constraints and/or logical dependencies among the aspects are modeled with corresponding linkages between the SCs.

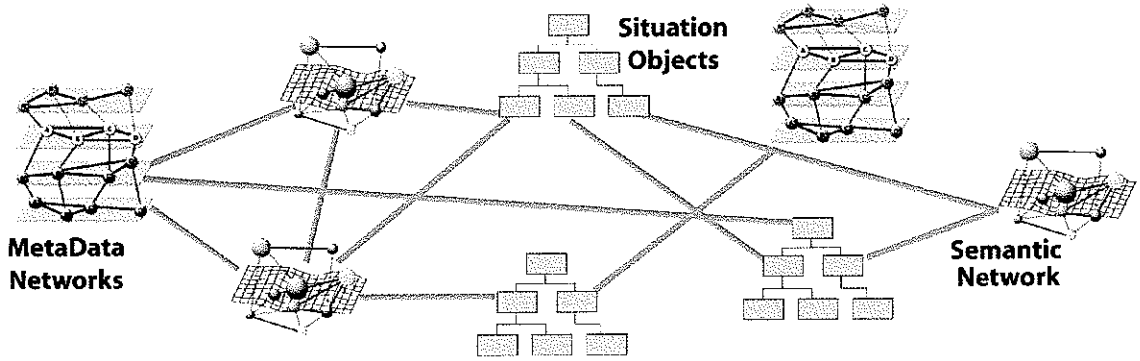


Figure 4: Situational Constructs are aspects of the situation, represented as knowledge networks utilizing objects, metadata networks and semantic networks

These agents managing each SC will perform functions such as:

- Updating the knowledge network when new data is received from the Data Layer,
- Projecting consequences within the simulation model on demand or when incoming data causes the data values to cross specified thresholds (e.g., indicating resources have exceeded expected operational ranges),
- Packaging information for the Presentation Layer for rendering and user interaction,
- Manifesting decision actions and decision events into the SC, as well as determining the implication and effects of those decisions on the situation,
- Maintaining the linkages across SCs where there are constraints, dependencies, allocations or other relationships between elements in different SCs

As depicted in Figure 5, Team CSI will develop and integrate SCs for each of the required resources (Fuel, Water, First Aid, and Shelter Beds) and models for Vehicle Flow, Pedestrian Flow, and Environmental and Plumes. Establishing SCs for each of these aspects permits analyses of their corresponding networks independently and as an integrated view of the situation throughout the simulation for simulation, visualization, decision analysis, and cross-SC linkage. This architecture supports the incremental addition of new aspects (and corresponding SCs) as well as supplemental reasoners to existing situational aspects without the need to completely rebuild or redesign the solution. In this manner, future efforts may add other modes of ingress/egress (e.g., air travel), other material resources such food and key medical supplies, weather, and similar 'layers' to the situation in a clean, modular fashion.

The technologies and general design approach for establishing SCs and managing situational awareness in this manner has been proven by Team CSI in past government systems and programs. For example, the Advanced Logistics Capability Tool (ALCT) [see Past Performance] supported Theater Logistics, incorporating and managing aspects including route management, resource sourcing, and distribution planning while presenting plans and execution status in conjunction with geospatial mapping data. During execution, events can be shown and reason over their impact on the simulation and plans.

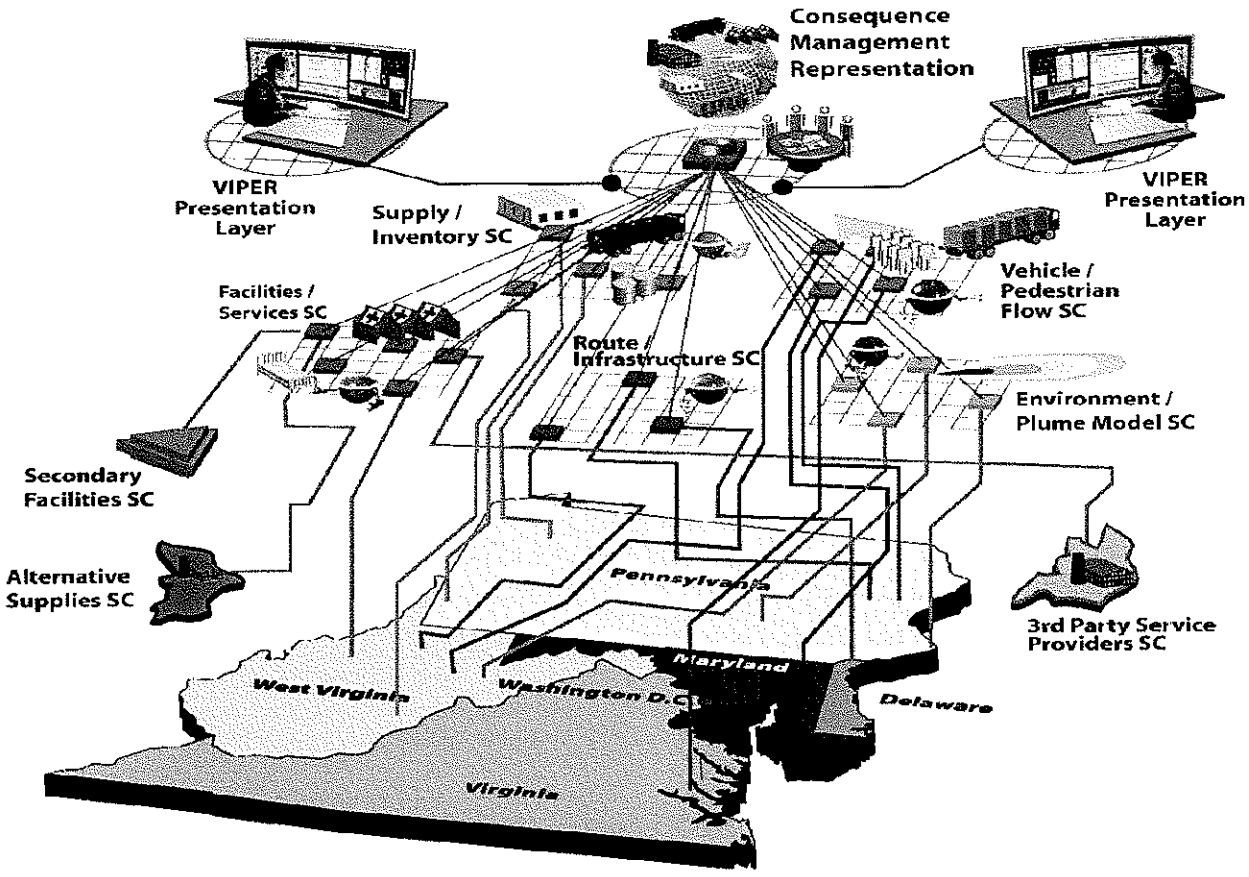


Figure 5: The Modular SC/Reasoner approach allows modeling and analysis of each aspect of the situation

2.1.3 ConSim Data Layer

The Data Layer depicted at the bottom of Figure 1 supports data interfaces providing connectivity to information from the external world via UICDS as well as any non-UICDS data sources required to support the ConSim functionality. The Data Layer is built upon the ActiveEdge mediation and device interface frameworks that allow easy integration with external data sources, systems, devices and platforms. Information may be consumed in a variety of formats including but not limited to XML schema such as those defined by NIEM, the NIMS, and various transportation systems based UNETRANS.

Adapter components will be developed to interface the appropriate data channels from UICDS and other required data sources into the ConSim capability. These adapter components will allow data to be transformed, tagged and directed for processing by higher levels of the architecture in support of the situational representation and the consequence management functionality. The Data Layer will also manage data persistence and simulation archive management for replay as needed.

2.2 ConSim Implementation

The architecture design and supporting technologies presented in the previous sections will create a powerful consequence management capability and meet the requirements of the RFP. The following subsections describe how Team CSI will address the specific requirements for the

ConSim Scope of Work described in RFP section 3.1 and map them to the concepts described above. Parenthetical citations in all subsection titles map to corresponding RFP references

2.2.1 Overall capabilities [RFP 3.1 #1]

To maintain the situational representation of the ConSim M&S road network in the Consequence Management Layer, and support the visualization of that network in the Presentation Layer, Team CSI will leverage its existing road network and routing capabilities available from its ALCT program. The ConSim M&S capability will represent and simulate the impacts of road closures on surrounding infrastructure and other resources enumerated in the RFP in the areas of interest in West Virginia, and provide the extensibility to support broader analysis and simulation.

The ALCT route network capability to be leveraged already addresses various transportation network considerations including elements such as grade, maximum speed, average speed, trafficability, congestion and condition. Each link in the route network has time-phased performance characteristics (currently represented in 1 hour intervals) and can be loaded with typical road network data for the region to include elements like rush hour performance to the extent such data is available. The routing capability already supports the ability to plan with degraded infrastructure, handle road events (such as road closures) making roads and regions unavailable, and dynamically replanning when existing routes are impacted by road or regional events (e.g., environmental contamination plumes). This capability already utilizes ESRI E011 road network data and can also utilize US Topologically Integrated Geologic Encoding and Reference (TIGER) system data as required.

2.2.2 Component Structure [RFP 3.1 #2]

The ConSim capability will be architected using three interconnect layers: a Presentation Layer based on the VIPER application, the Consequence Management Layer building on existing logistics analysis and simulation technologies, and the Data Layer utilizing existing mediation technologies and interfacing with the UICDS Data Bus. Each of these layers is described in more detail in the following sections.

2.2.2.1 Presentation Layer

The Presentation Layer of the ConSim architecture will provide the visualization of situation and simulation data from the Consequence Management Layer and support user interaction, analysis and decision-making. Team CSI will leverage the Flex-based VIPER application supported through the ESRI ArcGIS server and map data as the foundation Geospatial Information System (GIS) capabilities. Additional development will be performed to provide specific overlays and information displays within that environment in support of this effort.

Team CSI will implement the Presentation Layer in a manner that will allow the information displays to be configured, enabling or disabling the visualization of layers representing specific data overlays and information displays. As part of the user interaction, select information displays and menu actions will allow the user to enter situation and event information, annotate selected elements, select decision and parameter options from lists, and configure elements of the simulation. The Presentation Layer will have specific controls to support the visualization of simulation results as well as the configuration, start, stop, playback and reset of the simulation capabilities. Simulations can be saved and played back through the simulation controls in the

visualization environment. Some of the data input to the simulation which can be entered through the Presentation Layer will include time of day, weather conditions, incident and evacuation assumptions, and other key data elements which will augment or override the real-time data feeds and influence the baseline situation state or assumptions of the simulation.

2.2.2.2 Consequence Management Layer

The ConSim Consequence Management Layer supports situational analysis and will consist of the situational representation, the simulation models for the various aspects of interest, and the various reasoners that will support the assessment and decision support capabilities. The design of the Consequence Management Layer will be based on the concept of an SC, as described in section 2.1.2 above. As simulated or real-time events occur, the SRF implementation will invoke reasoners to classify that event into a event type, which will be associated with corresponding data inputs and event parameters (e.g., assumptions, effects and constraints). The classification of an event will trigger key configuration tasks in SCs corresponding with particular aspects of the situation in preparation for the reasoning and simulation activities. Whenever applicable, the system will access and update data related to other aspects in the situation corresponding with interdependencies among resources.

The situational representation will be managed in a knowledge network which links together the seven aspects/SCs below (subject to availability), each of which is itself a knowledge network.

- Fuel: Representing the inventory, storage, allocation, routing, pipelining and points of issue for identified fuel infrastructure.
- Water: Representing the inventory, storage, allocation, routing, pipelining and points of issue for identified water infrastructure.
- First-Aid: Representing the capabilities and capacities of the various echelons of fixed and mobile first-aid and secondary care infrastructure.
- Shelter Beds: Representing the capabilities and capacities of the various echelons of fixed and mobile shelter and emergency housing infrastructure.
- Vehicle Flow Model: Representing the routes, capacities, trafficability and traffic flows of vehicle traffic on surface roads over time (both Time-of-Day and Day-of-Week) subject to the availability of data.
- Pedestrian Flow Model: Representing the routes, capacities, trafficability and flows of pedestrian traffic on surface routes over time (both Time-of-Day and Day-of-Week).
- Environmental and Plume model: Representing the simple flow and expansion of surface (ground and water) and air (plume) contaminates for typical classes of contaminates used in determining the time-phased intensity, movement and dissipation.

The linkage within an SC area, and among SC areas, will allow the system to account for the interdependencies of aspects and project effects of simulation inputs on roadways and resources. The reasoners and simulation components will be developed reflecting the current policies, plans and procedures – utilizing human editable representations wherever possible. ActiveEdge makes extensive use of human editable workflows, policies and rules, and these constructs will be key elements in effectively representing the current policies, plans and procedures in the Consequence Management Layer. Based on the event, the reasoning and

simulation components will project forward the effects and identify the key issues and shortages. Through the Presentation Layer, additional secondary events, such as road closings or material inventory changes, can be injected into the situational representation, which will in turn trigger updates to the reasoning and simulation models, providing a continuously evolving set of projections and assessments of the situation. These situational updates, projections, assessments, issues and recommendations, will be passed to the Presentation Layer for display, consideration, and action by the user.

2.2.2.3 Data Layer

The ConSim Data Layer is responsible for loading, transforming, managing, and updating data and information feeding the situational representation of the Consequence Management Layer. The Data Layer heavily leverages the ActiveEdge mediation framework, which supports integration with external systems through standard protocols and interfaces and is extensible with customized data mappings and transformation adapters. For this effort, we will use a customized adapter to connect the UICDS Data Bus into the Consequence Management Layer. We expect a wide variety of situational, OGC compliant geospatial and event temporal data. Any additional support, reference, or execution data not available through the UICDS Data Bus will be accessed through the ActiveEdge mediation framework utilizing standard database, SOA, JMS, HTTP or XML interface adapters as appropriate. The UICDS Data Bus adapter will manage the control and data transactions with UICDS, to include any necessary transformation, tagging, filtering and fusion of the incoming data to make it appropriate for analysis and reasoning at the Consequence Management Layer. We expect the data to come in many standard and specialized forms, and will use the mediation framework to construct adapters to the various formats and structures as required to support the requirements of the project.

2.2.3 Real-time Data Feeds [RFP 3.1 #3]

ActiveEdge supports real-time data feeds and has an integrated complex event processing engine. Data coming in from the UICDS interface, or through other interfaces, will be pipelined through the processing and reasoning as quickly as the hardware and software can manage it. In most cases, the processing delay for incoming data will be in terms of seconds and should be fully fused in the situation within a minute of receipt. ActiveEdge also supports direct feeds from physical devices like sensors and platforms, which provides for future extensibility for the ConSim capability. The ConSim capability will support both real and training incoming 'real-time' data feeds, allowing training, rehearsal and analysis to simulate an active data or event stream. If real-time data for one of the required resources does not become available, Team CSI will simulate that data based on specific assumptions to be provided by the agency.

2.2.4 Service Area [RFP 3.1 #4]

The ConSim capability will be designed to support service to the entire state of West Virginia. The initial reasoning, analysis and simulation for the iterations addressed in this proposal will focus on the West Virginia Counties of Jefferson, Berkley, Morgan and Hampshire. ActiveEdge, the platform upon which the ConSim capability will be built, is a robust large-scale system that can support the entire state of West Virginia as well as the entire region

2.2.5 Dynamic Management of Resources & Extensibility [RFP 3.1 #5]

Team CSI will provide situational representation, reasoners and simulation capabilities for the four mandatory resources (Fuel, Water, First Aid Locations, Shelter Availability) but architect the system to be extensible in order to support the management of other resources with the addition of corresponding data inputs, simulation models, reasoners and visualization components.

For the four resources, Team CSI will develop input mechanisms, representations and display capabilities to support the data specified in the RFP section 3.1. Team CSI will develop corresponding reasoners and models necessary to manage the situational representations for simulating the impact of various conditions and events to create a complete and comprehensive situational representation and decision support capability within the scope of the effort and limitation of available data.

Specifically, the data to be managed and reflected shall include:

- State/County/Local-Owned and Privately-owned Fuel locations (including highway exit numbers; total gallons gasoline, diesel, and kerosene; extendible to address gasoline by grade, consumption rates, delivery schedules, and additional data identification such as address, phone and geo-location, other services, hours of operation, etc.)
- State Fuel Reserves (including highway exit numbers; total gallons gasoline, diesel, and kerosene; extendible to address gasoline by grade, anticipated delivery schedules, etc.)
- Potable Water locations (including location description; quantity in gallons; and purification capabilities; extendible to address dynamic inventories, purification site locations and tracking capability for portable purification equipment)
- First Aid Locations such as Hospitals, Nursing Homes, Urgent Care, and other first aid locations (including highway exit numbers; capabilities applicable to the location as specified in the RFP; total beds versus available beds; extensible to address real-time and reserve staffing, blood supply, and identification/contact information, etc.)
- Shelter Availability such as Hotels/Motels, Private Shelters and State/County/Local Shelters (including total beds versus available beds; numbers of showers and restrooms; first aid capability; square footage, and parking availability; extensible to address hot water capacity and availability to address specific needs of various users such as pets, recreational vehicles and special needs patients as specified in the RFP)
- Camp Sites (including total capacity versus available capacity; number of showers and restrooms; capability to provide first aid, acreage, parking availability; extensible to address hot water capacity, resources to address specific needs of various users such as pets, recreational vehicles and special needs patients as specified in the RFP)

The overall data model and simulation capability will be designed to address additional concepts in the situational constructs such as Non-fueling Grocery/Convenience Stores, Highway Rest Areas, Restaurants, Veterinary Clinics, Retail Stores, and Grocery Stores.

2.2.6 Impact of Construction Projects [RFP 3.1 #6]

The ConSim capability will allow authorized users to manually enter selected real or hypothetical information to include construction projects, road closures, facilities closures, and inventory changes. ConSim will support using this information as a new baseline situation

(reality) or as a simulation excursion for analysis and projection. In both cases, the impacts and implications will be assessed and reported to the user.

2.2.7 Presentation Management by Layer [RFP 3.1 #7]

The ConSim capability will provide most data and information using GIS overlays, with support for users activating or deactivating specific overlays (layers of information) as well as saving their configuration as part of their preferences for automatic reloading on successive login.

2.2.8 User Access and Role-Based Access Control [RFP 3.1 #8-10]

The ConSim capability will utilize the ActiveEdge Authorization and Authentication Subsystem (AAS) that provides user login via unique username and password with Role-based Access Control (RBAC). Access to data, functions and analysis can be controlled on a user or role level. The AAS supports both HTTPS/SSL browser/portal-based remote login and non-browser authentication.

2.2.9 Leveraging Previous Investments [RFP 3.1 #11]

Team CSI is expecting to leverage a wide variety of previous investments in the development of the ConSim capability. Investments identified by DHS, FEMA and the States. In addition to others identified by the customer, Team CSI will leverage technologies and standards including Virginia's VIPER, DHS's NIEM and related XML standards and tools, DHS's UICDS, DARPA's UltraLog, Army LIA's ALCT, US NOAA Area Location of Hazardous Atmospheres (ALOHA) Model and other components and capabilities, some of which may be drawn from Open Source.

2.2.10 Standards Compatibility [RFP 3.1 #12]

Team CSI will utilize best engineering practices, methodologies and standards in the design, development and testing of the ConSim capability to include the Department of Defense Architecture Framework (DoDAF), The Open Geospatial Consortium (OGC), the NIMS, the NIEM, and the UNETRANS.

- DoDAF defines standard models to ensure effective communication of basic elements of the architecture design. The other standards establish compatible foundations for information modeling and exchange.
- OGC is an international industry consortium that provides standards that empower technology developers to make complex spatial information and services accessible and useful with all kinds of applications across the web.
- NIMS provides a consistent nationwide template to enable Federal, State, tribal, and local governments, nongovernmental organizations (NGOs), and the private sector to work together to prevent, protect against, respond to, recover from, and mitigate the effects of incidents, regardless of cause, size, location, or complexity. NIMS represents a core set of doctrines, concepts, principles, terminology, and organizational processes that enables effective, efficient, and collaborative incident management and can be the basis for a Concept of Operations (CONOPS) for the simulations and models in ConSim.
- NIEM is designed to develop, disseminate and support enterprise-wide information exchange standards and processes that can enable jurisdictions to effectively share critical information in emergency situations, as well as support the day-to-day operations of agencies throughout the nation. Team CSI has members of the NIEM IT partners.

NIEM defines key core, domain, and standard conformant XML schemas that may be essential to successful ConSim implementation including those for Emergency Management; Infrastructure Protection, Census, the Emergency Data Exchange Language (edxl) and Common Alerting (edxl-cap), hospitals, services and resources (edxl-have); and standard definitions for States (FIPS 5-2) and Counties (S 6-4).

- UNETRANS defines a data model of essential transportation information establishing standard models for transportation networks. The UNETRANS model was developed as a generic object-oriented model in standard UML and XML export.

2.2.11 Detailed Integration & Development Schedule [RFP 3.1 #13]

As designated in the Milestones and Deliverables defined in Section 3.3, Team CSI will develop and provide a detailed integration & development schedule within ten days of contract award.

2.2.12 DoDAF Products [RFP 3.1 #14]

As designated in the Milestones and Deliverables defined in Section 3.3, Team CSI will provide DODAF products to model the architecture to complement the content of the PDR. Team CSI includes architecture experts that not only have extensive experience with DoDAF, but also have contributed to the evolution of the DoDAF framework. The DoDAF documentation will include at a minimum the following products. The Overview and Summary Information document (AV-1) will catalog all of the key architecture attributes, concepts and documentation. The Integrated Dictionary (AV-2) provides a single integrated dictionary of terms to support a consistent view of the solution across all of the other architecture views. One or more High-level Operational Concept Graphics (OV-1) will be developed to illustrate the overall concepts of operations for the ConSim and/or the scenarios to be used for simulations. The interaction among operational nodes in the system (or actors in a scenario being simulated) will be modeled using Operational Node Connectivity Descriptions (OV-2) and the corresponding information exchanges will be documented in an Operational Information Exchange Matrix (OV-3). An Operational Activity Model (OV-5) will be used to describe the operational activities and their interrelationships in a hierarchical manner. From a solutions perspective, the system components and their interrelationships (including interfaces) will be modeled in the form of System Interface Descriptions (SV-1). Finally, the technical standards being applied and planned for the evolution of the ConSim will be summarized in the Technical Standards Profile (TV-1).

2.2.13 Design Reviews [RFP 3.1 #15 - 16]

As designated in the Milestones and Deliverables defined in Section 3.3, Team CSI will present PDR and CDR reviews at the location to be determined by WV DMAPS.

2.2.14 Simulations Storage and Playback [RFP 3.1 #17]

The ConSim capability will save key simulation data and results to support playback of selected simulations.

2.2.15 Hardware/Software Platform Specifications [RFP 3.1 #18]

DMAPS and the OT will provide specifications for all required hardware and software to run the ConSim capability. The capability will be installed and run on the State of West Virginia servers. Team CSI will provide training and an installer so OT staff can perform future installations.

Team CSI will provide two fully-configured laptops in accordance with the OT's specifications containing the necessary software to run a remote demonstration of the M&S capability through a browser interface and good network connection. It is not expected at this time that a fully standalone capability will be possible using a one or two-laptop configuration.

2.2.16 ConSim Capability Demonstrations [3.1 SOW #19]

Team CSI will support three demonstrations as part of this effort:

- The **Evaluation Board (EB) Demonstration** that is anticipated to occur on September 28th, 2010 in the State of West Virginia. The Project Planner and EB shall evaluate the end product before it is shown to WV DMAPS. Team CSI will support refinement of the presentation based on feedback received.
- The **WV DMAPS Demonstration** that is anticipated to occur on October 26th, 2010 in the State of West Virginia. This second demonstration will be used as the final acceptance of the M&S capability by the State of West Virginia.
- The **FEMA Technology Showcase** that is anticipated to occur on November 30th, 2010 in the State of West Virginia.

Team CSI will work with the Government to establish a functional scenario for the demonstration and an appropriate demonstration script and presentation. Prior to each demonstration, Team CSI will perform integration and testing of the ConSim functionality against the demonstration scenario and functional test plan.

2.2.17 Period of Performance

The period of performance of this effort is expected to be 12 months after contract award, with contract award expected no later than 1 April 2010 and the final demonstration completed no later than the FEMA Technology Showcase scheduled in November 2010. All work will be completed and deliverables provided to the government in accordance with the contract deliverable requirements no later than 31 December 2010. Per this proposal, Team CSI does not expect to be performing any development activities or working on any deliverables after the final milestone date.

2.2.18 Place of Performance

All tasks will be conducted at contractor locations with the exception of the specified PDR/CDR meetings (Section 2.2.13), and the preparation for and execution of three demonstrations (Section 2.2.18), which will be held at West Virginia government facilities at the discretion and guidance of the Government.

2.2.19 Government Provided Equipment, Material, Data and Facilities

In support of the proposed effort, the Government shall provide:

- Sample code for the integration of the individual components of the M&S capability.
- Source code for the Virginia Interoperability Picture for Emergency Response (VIPER) to support integrating with the presentation layer.
- UICDS Software Development Kit (SDK). The data layer for the M&S capability shall be UICDS complaint.

- Census data or assumptions to be used if census data is not available.
- Previous data collected and assembled for the Catastrophic Evacuation (CATEVAC) M&S demonstration tool, to include source code.
- Access to required information regarding the selected resources or assumptions to be used in the creation of representative data sets if that data is not available.
- Detailed specifications for the State of West Virginia servers, and use of those servers for testing, preparation for demonstrations, and demonstration.
- Copies or live access to all required data sources to support the development and acceptance of the Consequence Management M&S capabilities.

3 System Requirements

This section describes how Team CSI addresses the ConSim system requirements by building upon the detail provided in the previous section, addressing all of the System Requirements described in RFP section 3.2. Parenthetical citations in all subsection titles map to corresponding RFP references.

3.1 System Solution: M&S for Consequence Management

3.1.1 Graphical Information Systems (GIS) [RFP 3.2.1]

The ConSim capability will render information to the user through VIPER as well as the simulation control portal, both in the Presentation Layer. VIPER is the primary GIS component. As there is a fair amount of supporting information and capabilities that do not lend themselves to a pure GIS environment, Team CSI will augment the GIS capability with a portal-based display, configuration and simulation control capability. Simulation status and support data can be best represented as a running status log identifying system events and model outputs for the operator through a portal, as opposed to an overlay in the GIS. In addition, many of the simulation parameters and assumptions may be more effectively managed through well-designed web-based forms. Team CSI will work with the customer to get the right information integrated into the GIS layers and utilize the support control portal where needed for other operational requirements.

The ConSim GIS capabilities will utilize OGC-conformant GIS capability based on VIPER, utilizing ESRI map data, and specifically being able to display all of the mandatory required information called for in the RFP requirements set. With the exception of select fixed data, Team CSI will separate all of the non-map-based features and data into overlays to allow them to be selectively displayed or hidden. The default configuration for operators will be with the 'Base-Map' requirements as defined in the RFP enabled and displayed.

The ConSim Presentation Layer will support linkage of key assets, infrastructure, and regions to additional supporting information, which when activated will show details available on the element. For example, selecting a hospital will present a transient information display which provides any information available and in the ConSim situation representation on the hospital. This will be built as a general-purpose capability, so any discernable element that has supporting information can be activated. The team will develop an appropriate visual cue to differentiate if additional information is available. In a similar fashion, the alerts and

recommendations will contain linkages to additional information on elements referenced in the dialog for both issue elements as well as solution elements. The transient information displays will be 'pinnable' to keep the information displayed. 'Pinned' transient displays will be periodically updated should new information become available, thus providing a status or tracking display for the element (for example, available hospital beds that are updated periodically).

The Presentation Layer will also support the display of major county, state and federal routes; state fuel locations and depots; mass care facilities including shelters, feeding sites, comfort stations, and points of distribution; all fuel locations; all K-12 schools; all responder headquarters and areas of operation; all border state ingress points; all communications assets; all potable water locations; all public utilities locations. All required infrastructure elements and supporting infrastructure data will be supported subject to the availability of data.

Select GIS layers will utilize data acquired from applicable data owners using Service Oriented Architecture, accessed through the Data Layer and integrated into the Situational Representation of the Consequence Management Layer. The GIS layers will have a coordinate unit of measure in meters, be geo-referenced, and have a maximum allowable geospatial error of ten (10) meters. The Presentation Layer Base map configuration will include an optional layer for conveyance of demographic metrics for the display of key demographic information.

The Presentation Layer Base-map capabilities will include detailed response infrastructure data by population center: location of all hospitals and triage sites; expansion capacity; location of all first responder organizations and capacity/capabilities; location of all potable water storage, reservoirs, and key water access and storage sources; locations of all National Guard Armories and other state government facilities; locations of all Federal facilities; locations of all motels, hotels, camp grounds; location and capabilities of all Red Cross chapters; location of all grocery stores, location of all clothing stores; location of all trucking and construction companies and capabilities; location of all automobile/truck dealerships; location of all gas stations.

The Presentation Layer Base-map data layers will be secured in accordance with ANSI INCITS 359-2004. The Presentation Layer will allow the user to switch between satellite, topographic, aeronautical, and street maps for regions where such data is available

3.1.2 User-Resource Capabilities Assessment [RFP 3.2.2]

The situational representation shall maintain data and models on inventory quantities, locations and allocations of the identified resources. The ConSim capability will operate over this representation to permit authorized users to update and maintain inventories, allocations and locations in a NIMS-compliant manner as the situation evolves, decisions are made and actions are implemented. The situational representation will support the assessment and aggregation at the local, county, and state levels corresponding to the role of the user. All of the key data, assessments and actions will have appropriate user and role-based access control capabilities and will be secured in accordance with ANSI INCITS 359-2004. The ConSim capability will provide a set of key information reports which show current, scheduled and projected inventory, usage and availability information on the each of key resources, and to present them in the simulation view. As the reports are dynamically generated, a number of parameters will be supported to scope, filter and manage the data used in the generation of the report.

3.1.3 User-Feedback & Reaction to On-Going Situation [RFP 3.2.3]

The ConSim capability will utilize the situational representation, reasoners and simulation components (micro-models) to maintain a running assessment of the state of the situation over time. As key parameters in the situation deviate from expected norms or allowable thresholds, ComSim will provide that feedback, assessment, and potentially recommendations to the user through the Presentation Layer of where to obtain additional resources to address the shortfalls based on business rules and heuristics within the system. ComSim will support the user in building specific decision points when key resource issues are encountered. Where available, ComSim will identify resource owners, corresponding contact information and how to obtain those resources. A global view will be offered in the simulation showing where current issues are or are not arising, with drill-down capabilities to display the details associated with those issues. This will include the ability to recommend allocation of additional resources and their placement.

3.1.4 Simulation [RFP 3.2.4]

The ConSim capability will be built on the situational representation, and support simulation of events, actions and decision in the area of interest. The simulation components will be implemented to operate within a SC, with support for linkage and dependencies across situational constructs. The ConSim situational representation will support the injection of events and their parameters through a VIPER or portal-based Simulation Control Console, as well as support receiving certain classes of events from the UICDS data feeds. The simulation will support real-time and limited faster than real-time execution (the precise faster-than-real-time rate cannot be estimated at this time). The simulation will account for the population and traffic at specified time intervals, and be able to reflect environmental/plume models for floods, chemical releases and fires.

As the simulation components are micro-models that operate on different aspects of the situation, some of the simulation components will support confidence intervals where a range of predictions or potential outcomes can be computationally determined within the performance requirements. As data comes into the system, it will pass through a set of filters and reasoners that, among other things, can detect major deviations and raise alerts and actionable data to the operator. In addition, as the simulation models automatically or manually update, results reasoners will provide similar alerts and actionable data where deviations in expectations or predictions are detected.

The visualization of the simulation through VIPER shall support mouse zoom and scroll functions. The outcomes from the simulation will be analyzed and reduced to information overlays for the Presentation Layer where possible, and made available in the form of an Excel formatted spreadsheet or Comma Separated Values format.

The simulation visualizations will be designed to be extensible to support the non-mandatory display of graphical information regarding location of population centers and densities by square mile at various time intervals around the clock (e.g., 3 hour intervals); along with various demographics including age (i.e, driving vs. non-driving), income (i.e., own vehicles and number), and the special needs of those population centers. Normal non-rush hour and rush hour densities of automobile, bus, mass transit and medium rail traffic will be displayed along with normal pedestrian loading at similar around the clock intervals, based on available data and

simulation analysis. Where possible this information will be graduated and time-phased to allow the changes in key values over time to be visually distinguishable.

As routing, ingress and egress is a key component of the ConSim capability, it will display routing information on primary and secondary commuting routes, road maintenance status, conditions and trafficability, signaling and signal cycling status and pedestrian / bicycle routing.

Using the ActiveEdge AAS, ConSim will provide user access control and segment the key data visualizations and action responses to support the establishment of roles with various levels of awareness, monitoring, oversight, and responsibility based on the operators' configured roles, and will be secured in accordance with ANSI INCITS 359-2004.

3.1.5 Transportation [RFP 3.2.5]

The ConSim capability will utilize and manage transportation information (e.g., geospatial and support data) from various systems, generally assumed to be available through the UICDS Data Bus via the Data Layer. ConSim will use this information to track and reason over the vehicles, routes and associated elements supporting the transportation infrastructure and transportation assets. The transportation data to be managed will be compliant with the UNETRANS data model. Where possible, Team CSI will consider incorporation of other data sources such as Advanced Traffic Management Systems (ATMS), Automated Crash Notification Systems (ACNS), the Advanced Traveler Information Systems, and others. As ActiveEdge has a variety of standard data interface mechanisms and its Device Interface Framework, Team CSI will consider additional data source interfaces where clean standards-compliant interfaces are available for required transportation information.

Using the ActiveEdge AAS, ConSim will provide user access control and segment the key transportation data visualizations and action responses to support the establishment of roles with various levels of awareness, monitoring, oversight, and responsibility based on the operators configured roles and will be secured in accordance with ANSI INCITS 359-2004.

3.1.6 User Administration [RFP 3.2.6]

The ConSim capability will provide user access and role-based access control through the ActiveEdge Authentication and Authorization Subsystem (AAS). This subsystem can support local user authentication through an application Kerberos instance as well as interface with an external Kerberos instance. It will support over 100 user roles (types) and has no practical limit to the number of users in the system. This capability has been integrated with the ActiveEdge Intelligent Portal Framework, allowing authentication and access control in the web environment. Team CSI will work to ensure the AAS meets the requirements to ensure ConSim will be secured in accordance with ANSI INCITS 359-2004.

3.2 Project Management

The following subsections describe the project management strategy to be employed by Team CSI during development and delivery. The following section, 3.3 Milestones and Deliverables, summarizes this information and associates it with a schedule

3.2.1 Project Management Approach

Team CSI will employ a project management strategy that utilizes industry best practices to maximize customer satisfaction and ensure a successful project. The tenets of the team's management approach include:

- Requirements and Acceptance Criteria management – Team CSI will establish and gain approval of the software requirements and acceptance criteria (delivered in the SRS), and establish corresponding necessary and sufficient verification mechanisms.
- Project and technical planning – A project plan supporting the project requirements, work breakdown structures and a schedule of project objectives, activities and milestones will be developed tracked throughout the project. A view of this project plan will be delivered in the form of the Detailed Integration and Development Schedule ten (10) days after contract award (DAC).
- Tracking and oversight of technical activities – The status of the project will be regularly measured against the plan and corrective action taken, as necessary, if deviations or issues are encountered.
- Periodic status reporting – In accordance with RFP requirements, Weekly Activity Reports will be sent to the designated customer representative by close of business (COB) each Friday throughout the period of performance. Additionally, Team CSI will participate in the Montly Integration Product Team Meetings.
- QA review – All deliverables will undergo quality assurance review prior to delivery.
- Verification and Validation (V&V) – Team CSI employs a review and testing program aimed at identifying defects in work products as early in the lifecycle as possible. Peer reviews are conducted throughout the lifecycle and a formal testing program is established during the planning stages.
- Risk management – Risk identification and mitigation is conducted throughout the life of the project. The status of risks will be monitored on a regular basis until they can be closed. Whenever appropriate, significant risks and their mitigation will be shared with the customer during status reporting and reviews.
- Configuration/change management (CM) – All work products and deliverables will be kept under CM control.
- Customer reviews – Team CSI will meet on a regular basis with the customer to review project status and discuss any issues or risks encountered. Specific reviews have been incorporated into the schedule including the Software Requirements Review (SRR), PDR and CDR, as well as the demonstrations described in section 2.2.16

Deliverables: Weekly Activity Reports, Detailed Development and Integration Schedule, Software Requirements Specification (SRS) including acceptance criteria, Software Acceptance Test Plan (ATP), DoDAF Products, Software Design Document (SDD), software executables and source code.

Customer Approvals Required: Review and approval of Detailed Development and Integration Schedule, Review and approval of Software Requirements Specification (including Acceptance

Criteria), Review and approval of the Acceptance Test Plan, and Review and acceptance of software based on demonstrations.

3.2.2 System and Software Development

Software Requirements Analysis

Team CSI will develop the Software Requirements for the ConSim capability. In order to effectively develop the system to meet customer expectations, requirements and measurable acceptance criteria must be established and agreed upon to establish a foundation for design and implementation. Based on the requirements and technical information provided by the customer, Team CSI will analyze and define the software requirements for the system reflecting the functionality identified in the RFP, the data to be managed based on the systems with which to be integrated, the displays required by customer, and other technical aspects to be determined jointly with the customer. The results of the requirements analysis will be documented in a SRS. Included in the SRS will be a set of measurable acceptance criteria to be approved by the customer and will become the basis for the ATP. The ATP will define the necessary and sufficient mechanisms for verifying the completeness of the final system.

System Architecture and Software Design

Team CSI will design the ConSim architecture to meet the system and software requirements established in the RFP and SRS. Team CSI will document the system architecture in the form of DoDAF products as specified in section 2.2.12.

Tthe software design will be depicted in terms of an overall operational concept, its interrelationship to other systems and data sources, the components to be developed, the interfaces among those components, data to be managed by the components, and the layout of user data entry and displays. The software design will be documented in a Software Design Document (SDD) including diagrams, documentation, and technical specifications in sufficient detail to portray the system's characteristics. (The software design to be delivered in the SDD and the system architecture to be delivered in the DoDAF products will be developed in parallel and will complement each other.) Since Team CSI is applying an iterative spiral development approach, the content in the SDD will be maintained under CM and evolve over time.

Included in the SDD will be a Requirements Traceability Matrix (RTM). This is a tool that will be used to ensure all requirements have been addressed in all facets of system development (design, implementation, documentation, etc.). The RTM will list each requirement, and how each is fulfilled in design. Similar traceability matrices will be used to track completion of the code baselines, test procedures, and other documentation as appropriate.

The design of the system will be presented at the PDR and CDR (see section 2.2.13). The PDR will focus on overall system design and traceability to requirements. CDR will focus on the approach for implementing those components using agents, data, reasoners, etc.

Team CSI will leverage its existing capabilities in both SCs and reasoners to realize the ConSim design. The primary leveraged capability will be the Adaptive Logistics Capability Tool (ALCT) which has extensive capabilities for inventory management, sourcing, routing and monitoring against a variety of commodities including Fuel and Water. ALCT has capabilities for managing routing and vehicle flows that may be extended to support pedestrian flows. In addition to ALCT, Team CSI may leverage components of the UltraLog capability which provide service and infrastructure representation and allocation in support of First-Aid and Shelter Beds. Team

CSI will integrate two (2) open source environment/plume models to support the final capability requirement.

The design of the ConSim capability will utilize the CSI design methodology to capture the SCs, agents, data model, interfaces, persistent stores, process flows, policies, rules and reasoner behaviors. The design will be captured in the ConSim design document deliverable, in accordance with our standard company format and structure. The data model will include references to standard data model components as well as any custom internal data elements needed to support the maintenance, reasoning and processing of the SCs.

Software Development and Demonstration

Team CSI will develop the ConSim capability in accordance with the design maintained under configuration management. Team CSI will perform integration testing of all system layers and related components to ensure compliance with stated requirements and conformance with acceptance criteria prior to the three demonstrations defined in 2.2.16. Team CSI will work the Government to establish a functional scenario for the demonstration and an appropriate demonstration script and presentation. Prior to each demonstration, Team CSI will perform integration and testing of the ConSim functionality on the customer platform against the demonstration scenario and Acceptance Test Plan.

3.3 Milestones and Deliverables [RFP 3.2.7]

Team CSI will provide the specified deliverables, described below, per the Milestones and Delivery Schedule in Table 1. All documentation will be prepared in Microsoft Office 2003 or later unless specified otherwise. All presentation material will be prepared in Microsoft PowerPoint 2003 or later unless specified otherwise. Deliverables will be transmitted electronically, except those specified for delivery on CDs or other non-electronically transferable media. Each document deliverable will reference the specific deliverable, date, title, preparing activity, and task number, while the email cover will briefly describe the contents.

Table 1 – Milestones and Deliverables Schedule (assuming contract award on or about 1 April 2010)

DESCRIPTION	Type	DUE DATE
Detailed Development and Integration Schedule	Doc	10 DAC
Software Requirements Specification (Including requirements and acceptance Criteria)	Doc	05/17/10
Software Acceptance Test Plan	Doc	05/31/10
Preliminary Design Review (PDR)	Mtg, Pres	06/20/10
DoDAF Products	Doc	07/06/10
Software Design Document (SDD)	Doc	07/20/10
Critical Design Review (CDR) Presentation	Mtg, Pres	08/17/10
EB Demonstration	Demo, Pres	09/28/10
WV DMAPS Demonstration	Demo, Pres	10/26/10
Processing hardware with required software	HW, SW	11/30/10
Demonstration hardware with required software	HW, SW	11/30/10
Executable for installation on a Server	SW	11/30/10
Executable for installation on a demonstration laptop	SW, Doc	11/30/10
Source code for final M&S capability (See IP Restrictions)	SC	11/30/10
FEMA Technology Showcase	Demo, Pres	11/30/10

DESCRIPTION	Type	DUE DATE
Detailed Development and Integration Schedule	Doc	10 DAC
ConSim M&S capability	SW	11/30/10
Monthly Integration Product Team Meetings	Mtg, Doc	2nd Wed Monthly
Weekly Activity Reports	Doc	Weekly by COB Fri
Other deliverables as required	TBD	TBD

[DAC = Days after Contract Award, Doc=Document, Mtg=Meeting, Pres=Presentation, SW=Software, HW=Hardware, SC=Source Code, Demo=Demonstration]

3.4 Intellectual Property [RFP 3.2.8]

In the development of the ConSim capability, CSI will utilize the commercial ActiveEdge development platform, a framework for building large-scale distributed intelligent decision support systems. CSI will also utilize software, data, concepts and capabilities from its library of applications, projects and engagements. CSI will provide these components under an Enterprise Application License for the State of West Virginia and project stakeholders, including 2 years of software maintenance. This license is a perpetual software license and does not incur any additional charges with its continued use. Continued maintenance beyond the two years is optional and at the discretion of the Government. All rights, ownership, and claims to ActiveEdge and all library components, including any extensions or modifications performed in support of this project, shall remain the exclusive intellectual property of CSI and its affiliates.

All of the software developed above the ActiveEdge and library component level shall be provided to the Government with non-exclusive government use rights. This will enable any Government or any Contracted party to build upon, extend and revise the ConSim functionality for the Government without limitations or royalties.

To facilitate the development on and extension of the ConSim capability, CSI will contribute 7 ActiveEdge Developer Site Licenses, one for each member of the project team. We endorse and encourage the Government to consider integrating additional capabilities, data sources, data visualization, decision support, reasoning and simulation capabilities into the ConSim framework we will provide. As discussed throughout this proposal, the core technology is highly scalable, and the ConSim application was implemented with extensibility and evolution in mind. It is our express intent no not create a proprietary environment in which specific contracts must be utilized to implement changes and enhancements. We further hope that the parties involved will establish the means and processes to share among themselves enhancements and innovations, allowing everyone to continue to improve, expand and refine the ConSim capabilities. While Team CSI will be available should the Government choose to engage us in additional capabilities development, that engagement should be based on trust, experience and quality rather than proprietary limitations on software.

4 Cost Proposal

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Appendix A: Company Overview

Cougaar Software, Inc. (CSI) - Prime

Cougaar Software, Inc. (CSI) is a small, veteran-owned business formed in 2001 to transition a powerful suite of advanced technologies from military research to the commercial market. Since its inception, CSI has been developing a wide variety of planning, service management, information dissemination and situational reasoning technologies for the US Military. CSI developed the ActiveEdge® platform by refining and extending the Open Source Cognitive Agent Architecture (Cougaar) framework, into a total platform for rapid construction and deployment of distributed intelligent decision support capabilities. CSI has successfully applied intelligent agent technologies and ActiveEdge to various C2 and logistics planning, execution monitoring and simulation problems including resource allocation, scheduling optimization, and distributed collaboration and coordination.

ActiveEdge® provides a platform for the development, deployment and experimentation of complex simulation and simulation-enhanced applications, typically to large scales spread over significant numbers of machines. This provides a new way to design and build systems, including simulations, and further affords systems to include simulation capabilities for training, analysis, validation and experimentation as a fundamental component of the system. The key is that the technology allows the same processes to be run in a simulation mode or a real-time execution, depending on the agent context and data streams, enabling high fidelity full and partial simulation analysis.

Unlike any other platform available today, ActiveEdge allows you to build intelligent solutions and distributed applications that automate the complex processes humans do everyday effectively to enable true Enterprise-wide Intelligent Decision Support.

CSI has established a world class team for this effort and are able to provide the State of West Virginia with a long term cost effective and fully compliant solution meeting all your mandatory requirements. Team CSI is composed of Cougaar Software, Inc. (CSI) as the prime; Information Research Corporation (IRC), a small West Virginia technical services company; and SAIC, a large technology services company. CSI and SAIC have worked together on various military logistics planning and decision supports systems. CSI and IRC have worked together in previous engagements, developing military planning and situational reasoning solutions for the US Military.

The following two pages provide Company overviews for IRC and SAIC.

Information Research Corporation (IRC) - Subcontractor

IRC provides IT solutions for federal, state, and local governments, federal civilian agencies, and commercial clients. IRC works in areas such as information systems integration, enterprise hardware and software solutions, training and simulation, and specialized scientific, engineering, and technical support. As one of the top IT development and integration firms in West Virginia, IRC is a trusted partner to deploy mission critical solutions quickly, effectively, and on budget. IRC is a key participant in numerous DOD, DHS and civilian agency initiatives. Whether its supporting the development of advanced decision making modeling and simulation tools, or helping our military, government and civilian forces sharing information, IRC provides effective information and business process re-engineering in support of critical missions.

During 2009, IRC worked with CSI on a Joint Forces J4 project to demonstrate a Logistics Decision Support Tool through a Non-Combatant Evacuation Operation (NEO) scenario. Based on operational level logistician's procedures, this project demonstrated a decision support capability that provided visibility to critical operational requirements and their priority, identified critical resources and their status, ascertained if operations plans are logistically feasible, and recommended courses of action.

IRC has also worked previously with SAIC as team partner supporting the Office of Secretary of Defense (OSD) and both as prime and subcontractor on a US Navy effort. IRC and SAIC developed the Future Logistics Enterprise/Environment for the Logistics Plans and Programs office within OSD. The effort included enterprise architecture development, DoDAF support, modeling and simulation, and software development. IRC served as a subcontractor to SAIC's prime support of the Navy's Advance Technical Information system (ATIS) program by providing software and systems engineering support. IRC then became the prime of the Navy effort and subcontracted a portion of the program to SAIC.

Science Applications International Corporation (SAIC) - Subcontractor

SAIC is a FORTUNE 500® scientific, engineering, and technology applications company that uses its deep domain knowledge to solve problems of vital importance to the nation and the world, in national security, energy and the environment, critical infrastructure, and health. The company's approximately 45,000 employees serve customers in the U.S. Department of Defense, the intelligence community, the U.S. Department of Homeland Security, other U.S. Government civil agencies and selected commercial markets. SAIC had annual revenues of $10.1 billion for its fiscal year ended January 31, 2009.

SAIC delivers scientific and engineering professional services and systems integration to solve our customers' most important problems in areas such as information systems; modeling and simulation; command, control, communications, computers, intelligence, and reconnaissance (C4ISR); logistics and product support; geospatial and earth sciences; information and cyber security; and weather and oceanographic services. The table below lists key markets and solution areas.

Markets	Solution Areas
◆ Federal Civil ◆ Federal Defense ◆ State and Local Government ◆ Commercial ◆ International	◆ Critical Infrastructure ◆ Energy ◆ Environment ◆ Health ◆ Information Technology ◆ National Security ◆ State and Local

SAIC's Key Markets and Solution Areas

SAIC is a recognized leader in domains such as the following:

- Information technology (IT), including software development, systems engineering and integration, outsourcing, and service-oriented architecture (SOA)
- National security, including defense systems development and support; defense information infrastructure; operations, research and simulation; C4ISR; intelligence; and critical infrastructure protection
- Advanced technology, research and development (R&D), and product development
- Cyber security, including defense against network attack and exploitation
- Logistics and supply chain support, including automation, information systems, training, test and evaluation, and simulation
- Environment, oceanography, and meteorology, including environmental impact studies, remediation, and prediction and response to weather events

SAIC is recognized as one of the United States' most respected science, engineering, and technology application companies, as indicated by recent rankings and awards.

SAIC's role as the developer of UICDS (Phase I and Phase II projects) gives Team CSI the knowledge and experience to assure an efficient and technically correct implementation of the Data Layer and the Presentation Layer for the West Virginia project. During the UICDS Phase II demonstration at the Virginia Department of Emergency Management, SAIC developed a UICDS adapter for the VIPER tool to be used in the West Virginia project.

Appendix B: Past Performance

CSI Past Performance

Sense and Respond Logistics (S&RL)

CSI has been working with the United Stated Army, Logistics Innovation Agency (LIA) over the past three (3) years on two specific related initiatives under the Sense and Respond Logistics (S&RL) programs begun in the 2003-2004 timeframe by the Department of Defense Office of Force Transformation. LIA has been exploring S&RL concepts and techniques to link Battle Command/Command and Control (C2) domain information, such as Commander's Intent, to the logistics supply chain.

The first, Adaptive Logistics (AL), has created demonstrations and prototypes in the different disciplines of Logistics, Distribution, Maintenance and Supply and created automated decision support tools using CSI's commercial ActiveEdge platform.

The Army's Adaptive Logistics (AL) project integrates the use of intelligent agent technology and cognitive decision support tools as key drivers of Sense and Respond Logistics (S&RL). The intelligent agents monitor and synthesize large volumes of data from disparate sources to improve situational understanding and rapidly provide COAs to facilitate decision-making. The AL project demonstrates how the net-centric decision support capabilities and intelligent agent technologies can be extended to the strategic level. CSI was the technical lead on this effort and achievements included the development of the following two key capabilities targeted for transition into operations.

The Adaptive Logistics Capability Tool (ALCT)

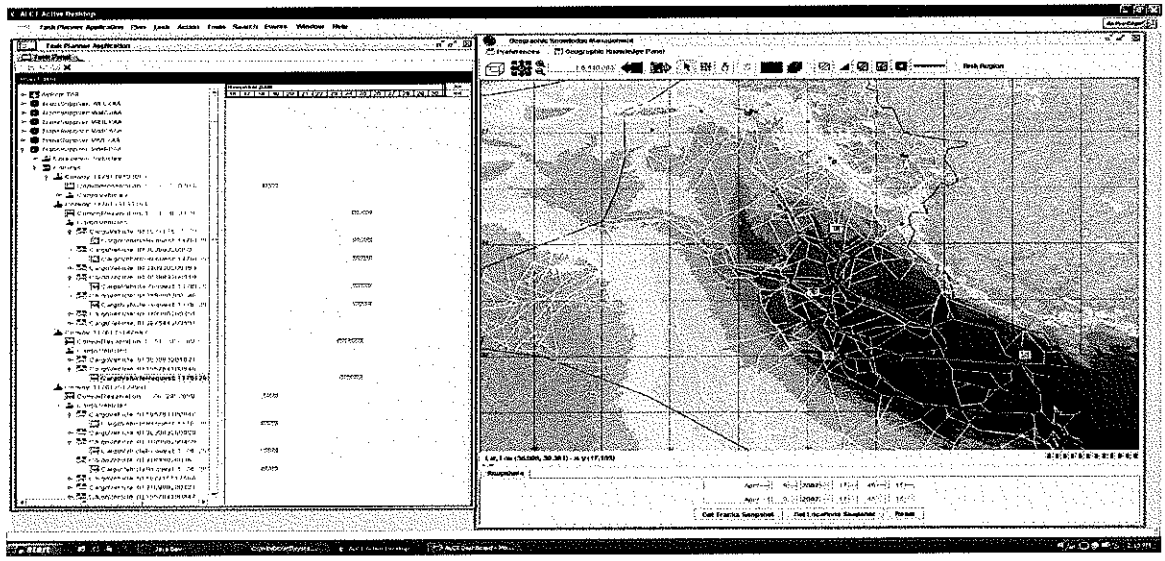

Figure 6: ALCT Task Planning & GIS Display

ALCT was developed by CSI using the ActiveEdge software and integrates intelligent decision support capabilities into the Battle Command Sustainment Support System (BCS3). ALCT is focused on the Theater Support Command level and can provide theater distribution plans,

monitor those plans, and dynamically change them as the situation evolves such as changes in Commander's intent, new or revised operations and intelligence information, or unforeseen events arising during planning and execution. Figure 6 shows a screen capture of the presentation layer used in the ALCT.

ALCT – ASC (MyProduction Planner Spiral III)

MyProductionPlanner (MPP) tool has been developed by LOGSA for Army Sustainment Command (ASC), Distribution Management Center (DMC). Under the LIA S&RL contract CSI was awarded the development of MPP Spiral III to provide intelligent maintenance estimation and recommendations on optimal allocations, capabilities and performance analyses, "What if" simulations, and dynamic monitoring and alerting. The Figure below depicts the MPP Sprila III process flow. LOGSA and ASC are in the final stages of user testing of the MPP Spiral III and then are expected to be transitioned into operational use.

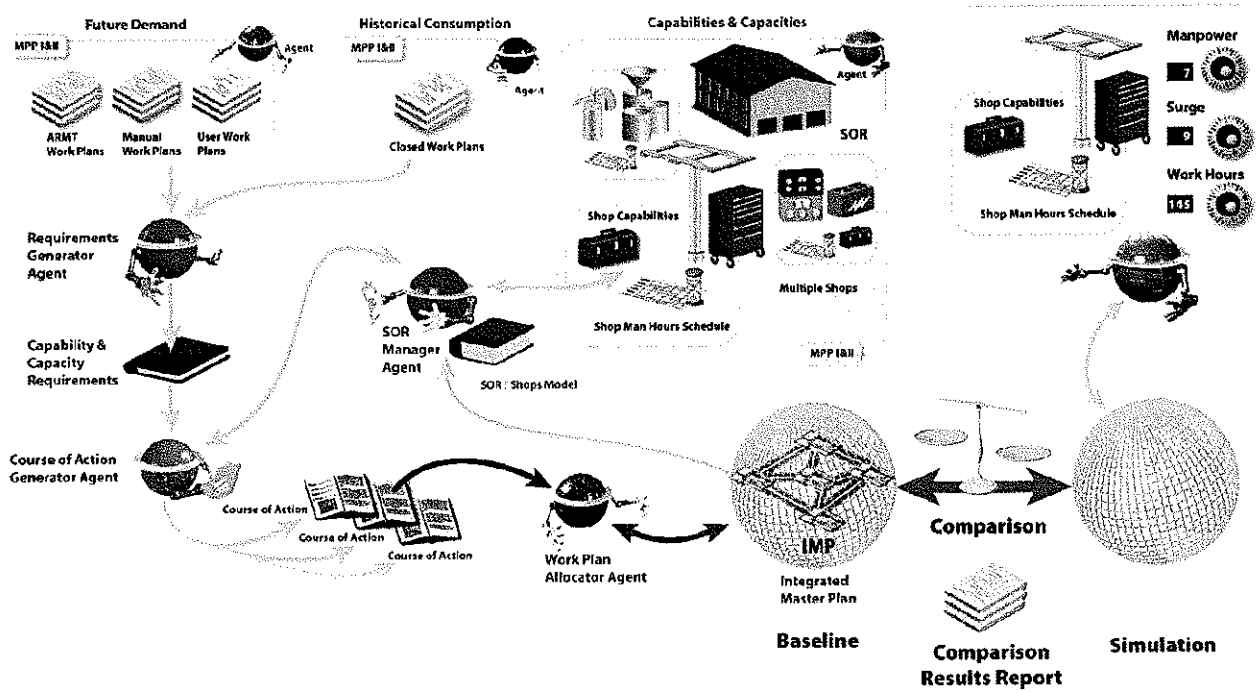

Figure 7: MPP III Process Flow

The second, Enterprise Based Approach to Logistics (EBAL) project, which has tested the hypothesis that a logical association between supported commander's intent and multiple logistics and decision-making events can be established and maintained throughout the life-cycle of the requisition: requesting, sourcing, delivery, and the closing-out process.

The EBAL project is a multi-year, multi-phased U.S. Army Logistics Innovation Agency (LIA) initiative that employs Sense and Respond Logistics concepts and network-centric technologies to demonstrate how the command and control (C2) domain can be coupled to the supporting logistics domain. EBAL focuses on the ActiveEdge software to monitor, analyze, synthesize, and evaluate large volumes of logistics and operational data from disparate sources and

present various logistics options to commanders as they relate to proposed Courses of Action (COAs) or current operations.

The COA development and assessment capabilities are based on military planning doctrines that have strong potential for application in civil and multi-organizational operations. These advanced tools ensure that COA development, selection, and refinement are grounded on and reflect the Commander's Intent and support the automated population of standard and specialized mission-essential tasks necessary to achieve that intent. Capabilities exist for distributed, collaborative, and adaptive planning and assessment as well as automatic re-planning based on situational changes in the area of operations. COAs can be autonomously assessed based on a weighted set of priorities and considerations, resulting in a ranked set of alternative actions. These alternatives can be automatically incorporated into an updated plan or can be offered for consideration to the decision maker.

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Joint CSI / IRC Past Performance

JEXP Logistics Modeling & Simulation

The objective of the JEXP Logistics' Modeling and Simulation Program was to build decision support capability based on procedures operational level logisticians use to ascertain if operations plans are logistically feasible.

Project tasks included:

- Literature Review & Baseline Collection Assessment on current systems
- Develop a Logistics Decision Support Tool Capability (LDST) / Demonstrator
- Implement an intelligent agent based solution using rapid collaboration support tools
- Assessment and develop of metrics for the logistics decision support operations
- Development of support computer -based training (CBT) for the LDST
- Development of maintenance and support packages for LDST tool
- Final report and recommendations for next phase of program/tool development

Of specific relevance to the West Virginia M&S Capability is the fact that IRC and CSI have prior experience working together in developing and demonstrating decision support capabilities. The initial Logistics Decision Support Analysis Tool (LDST) was developed using the CSI commercial ActiveEdge platform with a third party presentation layer, in this case VirtualAgility web portal. The resulting capability and demonstration was based on a specific NEO Scenario and required business rules and data such that the resulting LDST demonstrated analysis of proposed joint logistics support plans through modeling and simulation.

The LDST was built upon the ActiveEdge architectural framework, a dynamic distributed agent-based decision support system to establish and facilitate collaboration and planning. Figure 8 below depicts how operators at every level are participating in developing the plan or the execution of the plan in some way. They see their part of the plan, as projected from the situation, based on role and user access controls. Each operator uses a planning console, either portal or desktop, with tools appropriate to their responsibilities to build, review, validate and execute the plan. Each command console has access to local and remote analysis resources , which automate the detailed planning processes (called Expanders), and automated assessment processes (called Assessors). Operators use a suite of tools, in conjunction with automation support, to quickly and collaboratively build a high-quality detailed plan that meets the objectives with acceptable risks and resource constraints in accordance with the overall mission plan (OPlan or OpOrd). Some of the tools focus on synchronous collaboration, like shared maps, video, voice and text tools – typically human to human collaboration; while others support asynchronous collaboration for activities like task delegation, log support reviews, and resource deconfliction. One such asynchronous tool is the Task Planner, which allows a commander or planner to quickly assemble a plan using a drag and drop paradigm.

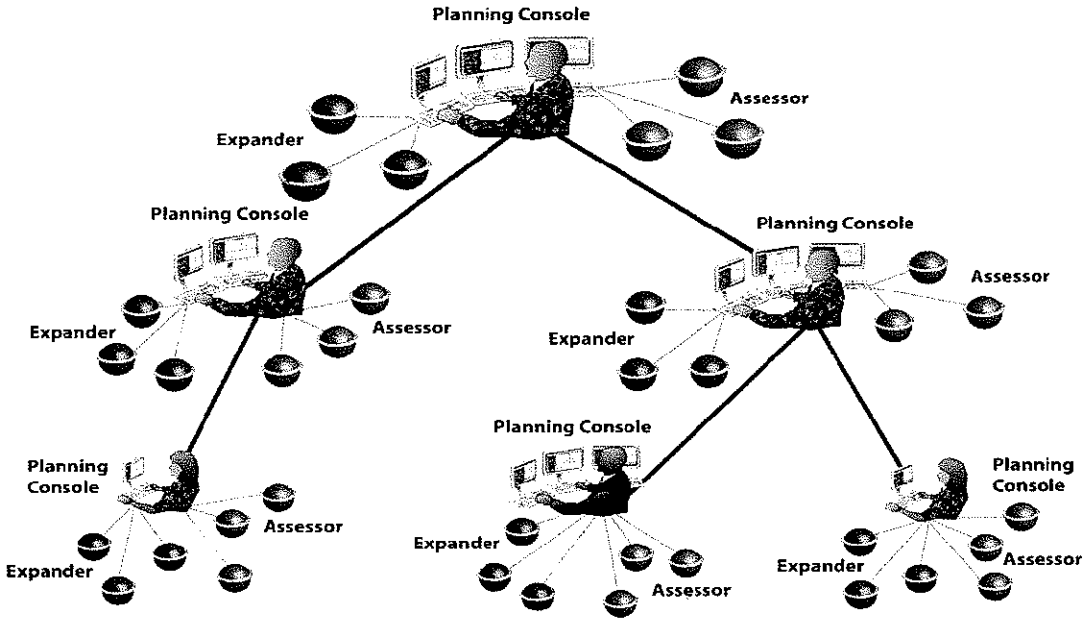

Figure 8: The CSI Distributed, Collaborative Planning Topology

In contrast to traditional systems with predetermined workflows, the topology for the collaborative planning environment is dynamic, establishing the interactions and collaborations based on the particular needs of the engagement. At each stage and echelon of the planning process (e.g., in each Command and Force structure), intelligent agents are spawned to create and rank alternative force configurations by autonomously evaluating situational conditions and availability of forces, and then evaluating the corresponding implications and options; the results of which will be presented to operators to answer queries and to support decisions. Alternative force and support strategies can be coordinated across commands to resolve interdependencies and implications by agents communicating via the SRF and the shared COP; as potential commitments are made by an agent working on one part of the force generation, other agents can correspondingly reflect them as a consideration in their processing.

The behavior of an entity (or an organization) in the context of a situation is commonly referred to in military and commercial domains as "business rules" or behavior. As illustrated in Figure 9 below, this framework defines "business rules" in terms of a combination four basic elements: workflow (i.e., processes), policies (i.e., constraints and parameters), business rules (i.e., if ... then...), and appropriately associated activities/behaviors. In this environment, the intelligent agents' behavior are composed of "plug-ins" which determine and execute their logic based on business requirements and situational conditions. Data requirements based on the "business rules" are used to generate mappings between the processing logic and the data streams and sources (e.g., the shared COP, sensors, or data streams). Distributed intelligent agents are continually monitoring changes to the environment. As significant events are detected (e.g., status changes to force structures or elements in a plan), agents can be spawned to respond to the situation based on business processes, policies and rules (e.g., to identify alternative forces with appropriate capabilities). Additional agents can evaluate the potential effectiveness of the

resulting plan, further adding to the knowledge base that can be used to adapt the policies and rules so that their efficacy can be continually improved.

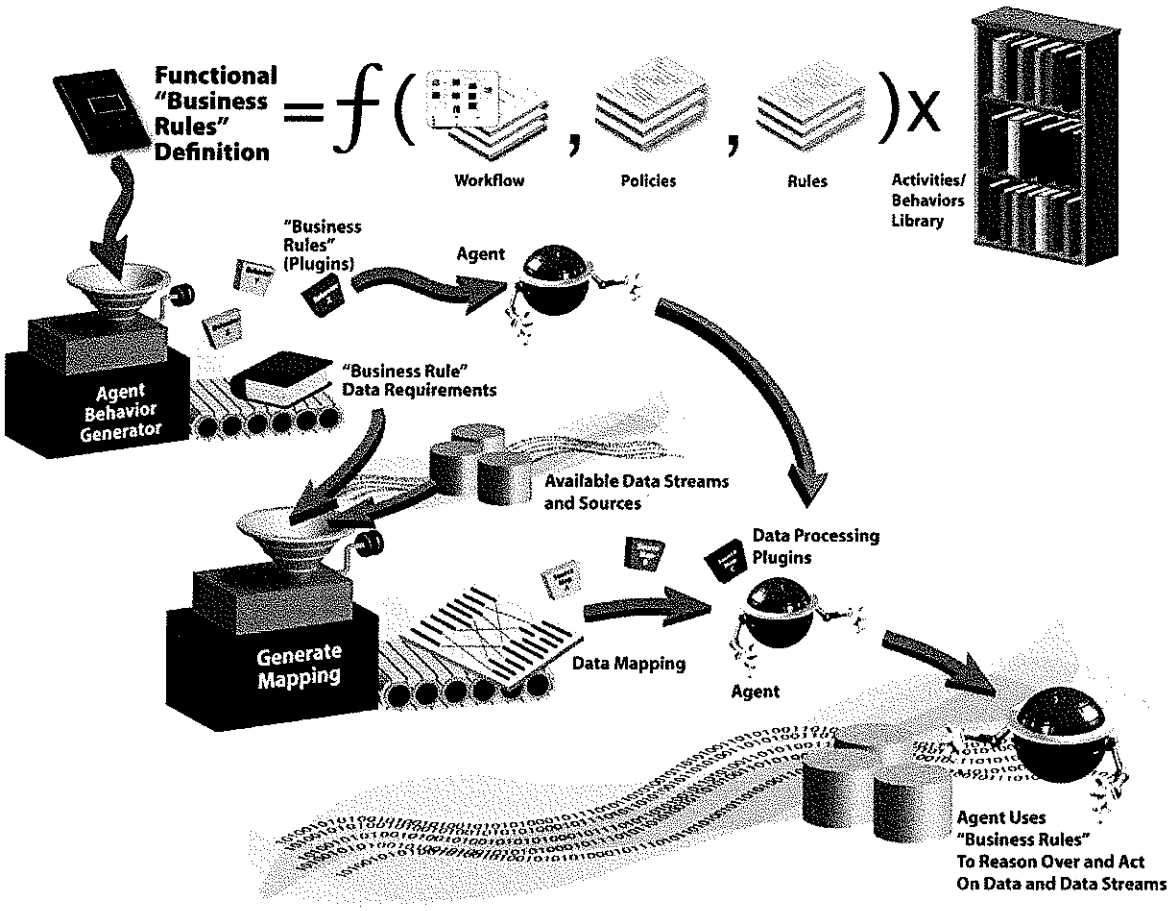

Figure 9: Autonomous Agents Determine Business Processes based on Situational Understanding

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SAIC Past Performance

UICDS Phase II

SAIC was the prime contractor on the Phase II of Unified Incident Command Decision Support (UICDS) program. DHS S&T was the sponsor of the multi-phase UICDS program developing a standards-based solution to information sharing presented by the doctrine of the National Response Framework (NRF). The UICDS Phase II effort resulted in

- Delivery of the draft UICDS Architecture Specification
- Implementation of the prototype UICDS middleware, successfully demonstration at the Virginia Department of Emergency Management
- Creation of a vibrant UICDS Outreach program that currently involves over 200 vendors and academic organizations

The UICDS Architecture Specification describes the "middleware framework" designed to support the National Response Framework (NRF) and the National Incident Management System (NIMS), including the Incident Command System (ICS). UICDS is built around data standards and the National Information Exchange Model (NIEM) to enable information sharing and decision support among commercial, academic, volunteer, and government incident management technologies used across the country. UICDS enables diverse emergency management applications to exchange data with one another seamlessly, thereby improving real-world operations during all phases of natural, technological, and terrorist events. UICDS bridges the language and technology gaps between applications, because it incorporates nearly a dozen existing data exchange standards.

SAIC developed the prototype implementation of the UICDS middleware and demonstrated it at the Emergency Operations Center of the Virginia Department of Emergency Management (VDEM) to illustrate the interoperability that UICDS brings to emergency management and first-responder end-user applications. The UICDS team, in conjunction with technology providers, VDEM personal, and DHS S&T SME's, developed six vignettes that depicted specific incidents that could arise from at large storm in the Mid-Atlantic region. These vignette illustrated how three cooperating jurisdictions: the city of Richmond, the city of Virginia Beach and the commonwealth of Virginia could share information during incidents through the use of UICDS. Each jurisdiction was represented by a UICDS core, integrated with their typical emergency management applications, such as VIPER.

UICDS Phase II created open architecture specification and reference implementation that is modular, scalable, and evolutionary to meet the emerging needs of first responders and emergency operations centers with decision-support aids for the Incident Command.

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