

MTS Technologies, Inc.
Management & Technical Services

REQUEST FOR INFORMATION RESPONSE

Underground Mine Rescue Equipment and Technology

Mine Safety and Health Administration

Regulatory Information Number: 1219-AB44

Submitted To:

Mr. Robert Stone
Mine Safety and Health Administration
Office of Standards, Regulations and Variances
1100 Wilson Boulevard
Room 2350
Arlington, VA 22209
zzMSHA-Comments@dol.gov

Submitted By:

MTS Technologies, Inc.
2800 Shirlington Road, Suite 1000
Arlington, VA 22206
(703) 575-2900
FAX (703)575-2965
www.MTSTech.com

Primary POC:

Mr. Harold J. Guidry
(703) 575-2909



INTRODUCTION

MTS Technologies, Inc. (MTS) is pleased to submit a response to the Request for Information for Underground Mine Rescue Equipment and Technology (RIN 1219-AB44). This response will specifically address communications.

Based in Arlington, VA, *MTS* is a professional services firm specializing in program management, technology insertion, software development, information assurance/information security and engineering services. *MTS* provides and implements innovative solutions to the most complex business problems in the areas of strategic planning, engineering design and analysis, modeling and simulation, integrated logistics support, and process improvement. We have worked in partnership with the Federal Government for many years, specifically the Department of Defense (DoD), and have earned an excellent reputation for program management and engineering solutions critical to mission accomplishment.

MTS has strategically expanded its services throughout the United States in order to provide high quality services to our clients in a timely manner. We currently have major offices in Johnstown, Pennsylvania; San Diego, California; Orlando, Florida; and Troy, Michigan. The *MTS* staff, numbering over 170 employees, boasts combined experience from the military, government agencies, and the commercial marketplace. The staff's combination of education and experience enables *MTS* to blend theoretical and practical considerations to research communications and other rescue technologies. Located in the heart of the Pennsylvania, coal mining country, *MTS'* Johnstown division is strategically positioned to be responsive to the needs of the mining industry.

The Mine Safety and Health Administration (MMSA) has identified a need for improved communications and other technologies to assist with underground mine rescue operations. In July 2002, citizens in the Johnstown, PA region and indeed the nation were captivated by the successful rescue of eight trapped coal miners from the Quecreek Mine in Somerset County, PA, a mere 30 miles south of Johnstown. Recently, more tragic mining accidents in West Virginia have once again focused attention on the many hazards associated with coal mining and the need for state of the art rescue technologies. The recent explosion at the Sago Mine in West Virginia destroyed the surface to subsurface communications system. The current technology for Personal Emergency Devices allows for limited text communications between the surface and trapped miners below ground, but does not provide the robust communications required to facilitate successful rescue operations. Additionally, it is difficult for trapped miners wearing protective equipment to operate the small, digital devices.

DISCUSSION OF RFI QUESTIONS

This document provides information on existing technologies developed by *MTS* that can be adapted to provide communications in underground mine rescue operations and answers two specific questions identified in the RFI:

RFI Question 1: What types of communication systems can be utilized in an emergency to enhance mine rescue?

- a. Multi-path, Reconfigurable Communications. For a complete discussion of this technology refer to the section on “Current Performance” for the *Future Naval Capabilities – Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC)* program, which begins at the top of page 4.
- b. Radio Frequency Identification (RFID) technology to track the movement of miners trapped underground.
 - i. MTS integrated a prototype active tag based RFID system into a military vehicle platform as part of a technology demonstration effort. The concept behind the system was to provide total asset visibility of tagged objects while in transit to their final destination. This system was to operate with a minimum of human intervention. The system utilized dual frequency active RFID tags which are capable of storing up to 16 bytes of user configurable data. The demonstration employed the 16 byte user area of the tag memory to store the tagged objects destination. The active tag system used a low frequency transmitter to awaken the tags which are within range. This range was capable of being adjusted through software which allowed the wake up zone to be adjusted to fit the target vehicle. When awakened, the tags transmitted their serial number, 16 byte user data and tag status data back to the system at the second higher frequency. Software was developed which would allow a load history file to be created which would track tag serial numbers, tag status, load times, unload times and destination data. The software also allowed the hardware parameters to be adjusted to the target vehicle. This technology could be tailored for using wearable RFID tags to track the location of personnel underground.
 - ii. MTS also participated in the Tactical Medical Coordination System (TacMedCS) program. TacMedCS is a wireless communication system that uses radio frequency (RF) devices or systems to capture and display real-time casualty data in the field. The collected data is used to identify, locate, and track casualties and medical resources, providing benefits that are both medical and tactical. Real-time awareness of casualty status and location will allow medical personnel to respond with needed evacuation resources. This information will also help medical personnel plan for incoming casualties by quickly identifying the resources required for specific injury types and severity. TacMedCS also provides users with advanced situational awareness displays of information. Tacticians can use TacMedCS to identify areas with a high incidence of casualties. New personnel and resources may be directed to the identified area to supplement the loss of forces.

RFI Question 7: How can communications be improved when a rescuer is wearing a breathing apparatus and speaking diaphragm in the mask?

- a. Specialized microphones to allow clear communications while wearing protective equipment such as a breathing mask. *MTS* also designed, developed, and integrated its proprietary throat microphone, which was found to outperform commercial off-the-shelf (COTS) throat microphones and headsets when tested in high noise environments. The *MTS* throat microphone typically achieves over 97% command and control speech recognition accuracy at vehicle noise levels of 105 dBC. Ergonomic design features include user comfort, hands-free flexibility, wireless audio for mobility, and conduciveness to personal protective equipment such as helmets, eyewear, hearing protection, and respirators. We anticipate this technology could be incorporated into personal protective equipment worn by trapped miners.

EXPERIENCE AND QUALIFICATIONS

MTS plays a key role in developing concepts and innovative technical solutions for the DoD and the Department of Homeland Security. We have worked with these agencies on mission critical projects for more than fifteen years.

MTS has diverse experience providing technical expertise and program support for emergency situations such as terrorist incidents, incidents involving weapons of mass destruction, and nuclear and biological threats. We have a long, successful relationship with the Federal Emergency Management Agency (FEMA) in addition to state emergency management agencies.

MTS is playing a critical role in the development of a disaster management information sharing service that allows a wide array of non-Governmental organizations (NGOs), municipal, state and federal organizations to share data during the preparation, response, and recovery from disasters. The Disaster Management Interoperability Services (DMI-Services) system provides the means to bridge the information gap between various levels of emergency management organizations. At maturity, it will enable responders, government agencies, and authorized NGOs to share disaster management information seamlessly. This system provides the means to bridge the information gap between emergency management organizations in a real-time environment as incidents unfold. The system may also be used for training exercises to prepare responders for the future incidents. We feel that with some modifications, “lessons learned” from this effort can be applied to similar applications for MSHA.

MTS is developing technology interfaces and researching new ways to combine and integrate commercial technology to develop prototype communications capability suitable for test in a navy ship for use in a damage control situation. The prototype capability will use three distinct pathways - two carrying voice and data and a third “failsafe” path for voice only.

CURRENT PERFORMANCE

Project Name:	Future Naval Capabilities – Crew Reductions through Improved Damage Control Communications (FNC-CRIDCC)
Name of Contracting Agency:	Office of Naval Research (ONR)

The primary objective of the FNC-CRIDCC Project is to research, prototype, and test a multi-path reconfigurable Damage Control (DC) communications capability that improves communications pathways and data exchange among damage control responders in order to allow reductions in crew size requirements necessary for damage control operations aboard ship. The project involves developing new technology interfaces and researching new ways to combine and integrate commercial technology to develop a prototype communications capability suitable for test in the *ex-USS Shadwell* Damage Control Laboratory. The prototype capability will use three distinct pathways; two carrying voice and data and a third “failsafe” path for voice only.

MTS is developing a prototype “Triad” multi-path communications capability that meets the Navy’s desired requirements of being redundant, reconfigurable and robust in order to mitigate known and unanticipated affects of a DC event on the ship’s internal emergency communications. Improved capabilities will enhance emergency response on ships with proposed reduced crew manning levels such as LPD-17, LCS, and DD(X). The prototype concept identifies three distinct paths for communications among the Scene Leader, Repair Lockers and DC Central. *MTS* continues research and evaluation of voice and data transmission technology to determine the capabilities of currently available systems. *MTS* is working in conjunction with the Office of Naval Research and Naval Research Laboratory to develop a DC communications prototype enabling improved communications and workforce reduction by reducing the Command and Control workload through enhanced data throughput.

MTS is currently researching and constructing a prototype capability by combining commercial technologies that complement wireless-to-sound-powered-phone interface designed and developed specifically for this prototype. The proposed prototype will integrate the three paths for emergency communications. *MTS* is currently researching and constructing a prototype capability by combining commercial technologies that complement communications interfaces designed and developed specifically for this prototype. The proposed prototype will integrate the three paths for emergency communications.

PAST PERFORMANCE

Project Name:	Army Voice Interactive Device (AVID)
Name of Contracting Agency	U.S. Army TACOM-NAC

In support of the TACOM-NAC, *MTS* developed, integrated, and demonstrated voice-interactive technology solutions for Army tactical vehicles as an alternative to legacy tools and techniques. Building on results from earlier research and development efforts, which resulted in the development of a functional voice-interactive embedded computer prototype system for the FMTV, *MTS* developed a voice-activated, vehicle-mounted, diagnostic computer system. This system was successfully integrated with a Heavy Expanded Mobility Tactical Truck (HEMTT) M1120A2R1 Load Handling System (LHS) vehicle platform to demonstrate the feasibility of Voice-Interactive Diagnostics (VID) technology interface to the vehicle sub systems and also to investigate its potential use as a human-machine interface. The earlier system was enhanced and upgraded for use on the FMTV 1078 A1 to provide a graphical and voice user interface to the vehicle electronic control units to provide near real time situational awareness and operational vehicle status reporting. This status is provided both to the user and also to a back end system via a satellite communications system.

The system design team integrated an *MTS* custom-developed hardware and software with commercial hardware and software components to include RFID technology, a GPS receiver, satellite communications, wireless Ethernet, night vision video cameras, standard video cameras and voice recognition technologies with an automotive-based in-vehicle computer. An interface to the electrical architecture and subsystems of the HEMTT and FMTV is being created through instrumentation installed on the vehicles to include Engine, Transmission, Antilock Braking System (ABS), Centralized Tire Inflation System (CTIS), and Load Handling System (LHS). The *MTS* developed software provides a user interface into these subsystems and allows user access, control and diagnosis using touch screen and voice inputs:

- Voice activation within the vehicle cab
- Wireless, mobile computer for vehicle maintenance and repair
- Navigation map and Global Positioning System (GPS)
- Automatic Identification Technology (AIT) asset tracking system
- Vehicle diagnostics system
- Night Vision and Standard Video

Also as part of the AVID program, *MTS* designed, developed, and integrated its proprietary throat microphone, which was found to outperform Commercial Off The Shelf (COTS) throat microphones and headsets when tested in high noise environments. The *MTS* throat microphone typically achieves over 97% command and control speech recognition accuracy at vehicle noise levels of 105 dBC. Ergonomic design features include user comfort, hands-free flexibility,

wireless audio for mobility, and conduciveness to personal protective equipment such as helmets, eyewear, hearing protection, and respirators.

Project Name:	Tactical Medical Coordination System (TacMedCS)
Name of Contracting Agency	Naval Health Research Center

The Tactical Medical Coordination System (TacMedCS) provides rapid casualty identification, casualty visibility and status from Levels 1 to 3 in theater, maintains an passive electronic (no power required) longitudinal evacuation record with the casualty, utilizes non-physical contact data transmission and storage media, and uplinks casualty information to a web based server.

TacMedCS can be used to display near real-time casualty data in the field. These data provide both medical and tactical benefits. Near real-time awareness of casualty status and location will provide Casualty Visibility including In-transit Visibility (ITV). This information will also help medical personnel direct medical resources for sustainment. TacMedCS will provides in theater situational awareness in the Medical Common Operations Picture (MedCOP) display, and provides stored data files that may be used for planning future operations. Operational Commanders can use the information provided by the TacMedCS to enhance the overall Total Asset Visibility (TAV) and theater common operating picture.

TacMedCS utilizes a passive radio frequency (RF) based storage device placed on the wrist. The casualty information can be uploaded to a medical database using satellite phones or in-theater NIPRNET. Casualty information can be displayed using the graphical user interface Medical Common Operational Picture (MedCOP). MTS is currently supporting the continued development and testing of this technology in conjunction with LCDR Sharon L. Moser MSC, USN, of the Marine Corps Warfighting Lab.

Questions pertaining to this response should be addressed to:

Mr. Joe Ruis
MTS Technologies, Inc.
One Pasquerilla Plaza, 2nd Floor
Johnstown, PA 15901
RuisJ@MTSTech.com
(814) 262-3715