ARMY
Environmental Quality
Technology Program

EQT

UXO Technology
National Defense Center for Environmental Excellence (NDCEE) UXO Tasks

Objective: The National Defense Center for Environmental Excellence (NDCEE) was established in 1991, with the directive to serve as a national leadership organization to address high priority environmental problems for the Department of Defense (DOD), other government organizations, and the industrial community.

The NDCEE's mission is to:

- Transition environmentally acceptable materials and processes to defense industrial activities and private industry;
- Provide training that supports the use of new, environmentally acceptable technologies; and
- To support applied research and development, where appropriate, to transition new technologies.

- Overall Program / Description
- NDCEE Task No. 307
  The objective of Task 307 is to expand the Department of Defense (DoD) knowledge base and capabilities while improving mission readiness for safely and cost-effectively remediating UXO. This Task consists of 8 Subtasks.
- NDCEE Task No. 318
  The objective of Task 318 is to research, identify, and report on issues directly related to the identification, management, and remediation of

UXO in order to improve military readiness and range maintenance and sustainability. This Task consists of 12 Subtasks.

- NDCEE Products and Reports
- NDCEE website

Overall Program/Description

Background: The NDCEE was established in direct response to projected environmental technology requirements associated with DOD environmental problems. A trend toward more stringent environment requirements began in 1990 with the passage of the Pollution Prevention Act and the Clean Air Act amendments. Following this trend, the President issued a series of executive orders (EOs), which impacted environmental activities at federal facilities. As a landowner, operator of facilities, and user of weapon systems, the DOD recognized the potential impact on readiness that environmental problems can create.

There was also a strong need for an integrated environmental program to allow DOD to coordinate all environmental activities for the individual services. In addition, it was recognized that private industry had significant experience in addressing very similar environmental problems, and this knowledge could be brought to bear on DOD needs through a coordinated program. Finally, technology that could provide cost-effective solutions would play a key role in meeting DOD environmental problems.

Today, the NDCEE supports the DOD by:

- Providing an integrated program to address DOD-wide environmental technology and management systems needs
- Implementing methodologies for developing, manufacturing, and maintaining environmentally compliant weapons systems
- Leveraging existing organic and external capabilities to meet requirements
- Independent, unbiased evaluation of technologies to select the best technical solutions
- Demonstrating technologies through an approach that rapidly validates and reduces the risk of transitioning technologies
- Establishing a link to industry, where technology advances are rapidly occurring
- Providing an easy-to-access capability for the DOD to address environmental requirements in all pillars
- Supporting international environmental technology activities.

National Defense Center for Environmental Excellence (NDCEE)
Task No. 307

This Task provides the technical, management, schedule, and cost data associated with the NDCEE Contract DAAE30-98-C-1050, Task No. 307 entitled "Unexploded Ordnance (UXO) Task." It describes the approach, resources, and processes by which the principal contractor, *CTC*, will perform the efforts outlined in the SOW.

CTC has reviewed the SOW and has developed a proposed Contract Work Breakdown Structure (CWBS) that includes on subtask dedicated to program management and seven technical subtasks, as follows:

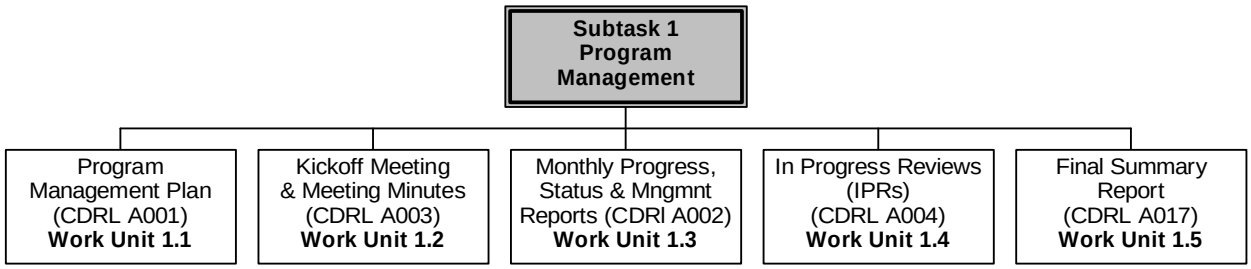
- Subtask 1: Program Management
  Subtask 1 Program Management provides dedicated personnel with commensurate experience and the accepted financial and management control activities required to properly manage the NDCEE UXO Task. It is divided into five work units to accomplish the required functions.
- Subtask 2: Identification of UXO Neutralization Technologies and "Render Safe" Procedures/Technologies
  The results of Subtask 2 will provide in-depth and consolidated information on UXO neutralization technologies and render safe procedures and technologies to enable the Government to identify data gaps in those technologies, and to better focus and direct future UXO RDT&E efforts. It is divided into five work units to accomplish the required objectives.
- Subtask 3: Identification and Evaluation of UXO Remediation Technologies
  The results of Subtask 3 will provide comprehensive, in-depth and consolidated information on state-of-the-art UXO remediation technologies, including remote and robotically operated technologies, to enable the Government to better focus and direct future UXO RDT&E efforts. The information will improve the Government's ability to remediate UXO sites more efficiently with respect to time and cost considerations and with reduced safety hazards to EOD personnel. This subtask is divided into four work units to accomplish the required objectives.
- Subtask 4: UXO Recovery Database
  The results of Subtask 4 will provide adequate and readily accessible UXO and environmental information in an advanced UXO recovery database. This will allow for improved Government decisions affecting the timeliness and cost-effectiveness related to OE restoration projects. The database can be used to evaluate and summarize important environmental and UXO information, which could improve predicting UXO recovery depths, making OE risk predictions, conducting OE sampling, as well as improving OE sweep efficiencies. By expanding the UXO recovery database and allowing easier accessibility to the data, the Government can gain an understanding regarding munitions historical penetration nature and use this enhanced

understanding to identify the best UXO detection technology for restoration related projects. This subtask is organized into six work units to accomplish the required objectives.

- Subtask 5: Develop Quality Control Protocols for UXO Technology Operators
  As part of Subtask 5, a stakeholder group focused on QC controls for UXO technology operators will be established to facilitate consensus building among the different services and their perspective organizations for QC Protocols for UXO operators performing UXO detection and/or removal activities. A comprehensive technical report that outlines recommended consensus approach, and subsequent stakeholder feedback regarding the recommended approach, will be made available for Government decision-makers regarding QC Protocols for UXO Technology Operators. This subtask is organized into five work units to accomplish the required objectives.
- Subtask 6: Land Use Controls as a UXO Response
  The results of Subtask 6 will provide relevant information to DOD Components for use in making decisions affecting the timely and cost-effective implementation of LUCs as a UXO response. This subtask will be organized into five work units to accomplish the required functions.
- Subtask 7: Active EMI Effects on Electronic Fuzes
  The results of Subtask 7, Active EMI Effect on Electronic Fuzes, will provide information to allow Government decisions affecting the areas of range safety, range clearance processes, range response planning, and procurement and research priorities for future equipment. Range safety, response planning, and clearance processes are benefited from the acquisition of quantified data indicating which EMI field strengths may affect which fuzes. Understanding this may drive changes to clearance procedures, which provide a much safer working environment for military operations as well as contractors remediating contaminated sites. Research priorities and baselines may be affected by the data developed under this task on the myriad of projects currently funded by DOD to develop more efficient detection technologies. Procurement decisions may be affected by providing the DOD acquisition community with better data for selecting vendor offerings and if this data is shared with the vendors, it should also equate to better deter detectors being developed. Any best practices identified will be highlighted as they apply to DOD detection and clearance practices for the UXO detection. This subtask is organized into four work units to accomplish the required objectives.
- Subtask 8: Evaluation of UXO Migration
  The results of Subtask 8 will provide information to allow DOD Site and Range Managers and Government decision-makers to better understand the UXO migration. The utility of the data will be to develop a frost heave and heat heave susceptibility models/maps for cold-climate regions and warm-climate regions. The results will be used to validate the best existing model and help DOD Site Managers, Range Managers, and Government decision-makers in the determination of the required depth of UXO clearance. This

subtask is organized into six work units to accomplish the required objectives.

Subtask 1: Program Management



Subtask 1 is divided into the five following work units to accomplish the required functions. The following provides an overview of the five work units:

- Develop a Program Management Plan (PMP) to act as the Technical and Management work plan, in accordance with CDRL A001
- Manage the technical, cost, and schedule approach to accomplish the SOW
  - Systematic interfacing with the Government
  - Management and coordination of all Subtasks
- Complete a kickoff meeting with an experienced Project Team, including Government stakeholders, and submit meeting minutes for review and approval, in accordance with CDRL A003
- Prepare monthly reports, in accordance with CDRL A002, to document project progress
- Conduct and host three In Progress Reviews (IPRs)
- Submit a summary final report, in accordance with CDRL A017.

Work Unit 1.1: Program Management Plan (PMP)

The NDCEE has prepared and developed this Program Management Plan (PMP), in accordance with CDRL A001 (DI-MGMT-81117), which addresses the activities and associated milestones required by the SOW and describes the management approach to executing and controlling this task. It includes and describes specific management plans and controls, technical approaches to be taken, the corresponding levels of effort required for each subtask, a project schedule with milestones, risk management, and a projected expenditure curve. This PMP contains a project organization chart depicting the names, types and the expertise of personnel assigned to each task, including contractor personnel and their involvement in the task.

This PMP includes a Contract Work Breakdown Structure (CWBS) that indicates resources and project tasks, which serve as a basis for program and technical planning, scheduling, cost estimating, resource allocation, performance management, configuration management, and status reporting. A Gantt chart that defines each project phase, schedules, and deliverables will also be included. The PMP will be revised and updated, as required, to correspond with necessary changes in task execution. Any leasing of equipment, or changes in cost, schedule or scope of the SOW that were not included in the approved proposal will require written approval from the

Government prior to initiation. This PMP is considered a working document, subject to change as necessary.

This Draft PMP has been prepared and submitted to the Government within 30 days after contract award (DACA) and the Government will have up to 30 days to review and comment. The Final PMP will be submitted 30 days after receipt of Government comments on the Draft PMP.

Work Unit 1.2: Kickoff Meeting

To ensure timely execution of task activities and to accomplish the requirements of the SOW, NDCEE will conduct a task kickoff meeting with Project Team members, including but not limited to, Government representatives from the following organizations:

- U.S. Army Environmental Center (USAEC), Aberdeen Proving Ground, Maryland
- U.S. Navy Explosives Ordnance Disposal (NAVEOD) Technology Division, Indian Head, Maryland
- U.S. Air Force Research Laboratory, Tyndall AFB, Florida
- U.S. Army Corps of Engineers (USACE), Huntsville, Alabama
- U.S. Army Corps of Engineers (USACE) Waterways Experimental Station (WES), Vicksburg, Mississippi
- Technical Support Working Group (TSWG) for NDCEE.

The USAEC Technical Monitor will designate and provide Points-of-Contact (POCs) to NDCEE from the aforementioned organizations, who will be contacted and invited to participate as a member of the UXO Project Team. These subject matter experts, along with the Contracting Officer's Representative (COR) and the USAEC Technical Monitor, will provide guidance and an experienced resource base for accomplishing the requirements of the SOW.

The Kickoff Meeting is to be held at the NDCEE facility in Johnstown, Pennsylvania within 30 DACA. Within 15 days following the meeting, the NDCEE will prepare and distribute minutes of this meeting for review and approval, in accordance with CDRL A003 (DI-ADMIN-81505). Also, the NDCEE will actively participate in UXO related information exchanges, including the 2002 UXO Countermine Forum, the 2002 ESCTP / SERDP Technical Symposium and Workshop, and an ITRC UXO Meeting.

In addition to maximize team communication, the NDCEE will prepare and distribute minutes of all related UXO Task face-to-face meetings and teleconferences conducted during the period of performance (POP). Also, biweekly teleconferences will be held with the UXO Project Team to ensure timely dissemination of task information among the team members.

Work Unit 1.3: Monthly Progress, Status and Management Reports

The NDCEE will prepare and submit to the Government, by the 15th day of each month, a report that describes task activities for the previous month and anticipated activities for the upcoming month, and compares the current status of the actual task costs and progress to the proposed task schedule and resources. This report will specifically contain the following information:

- Schedule, technical, travel and cost status
- Highlights of work planned by NDCEE during this period
- Discussions of any problems or obstacles encountered and the actions taken to remedy the situation
- Highlights of work planned by the contractor for the next reporting period.

The NDCEE will submit this report to the Government, in accordance with CDRL A002 (DI-MGMT-80227), in both hard copy and electronic format using Microsoft Word.

Work Unit 1.4: In-Progress Review (IPRs)

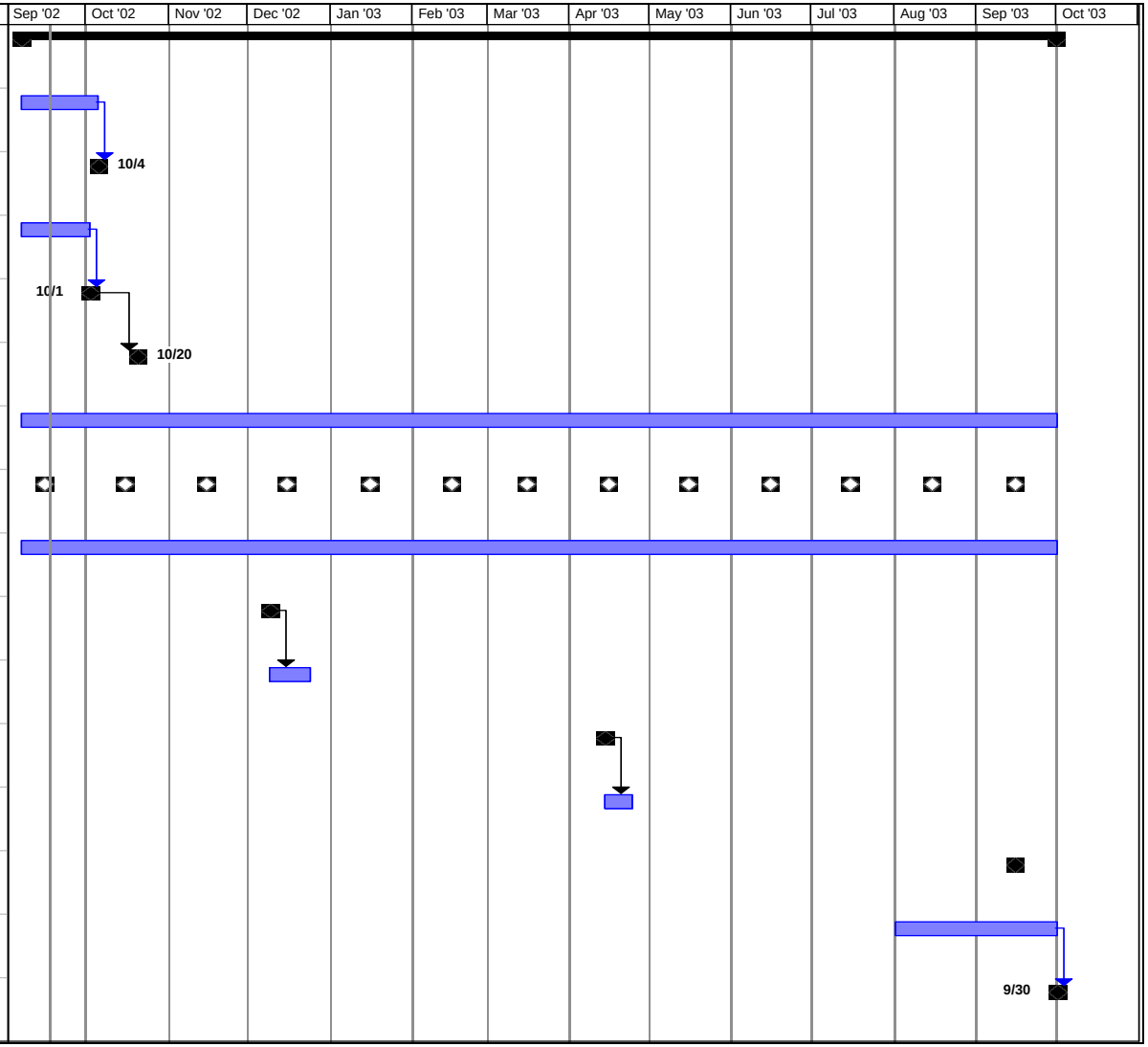
The NDCEE will coordinate three UXO In Progress Reviews (IPRs) during POP of this Task. The first IPR will take place approximately four months after contract award (MACA), the second IPR will take place approximately four months after the first IPR, and the third IPR shall take place approximately five months after the second IPR. The IPRs are scheduled to be held via teleconference / telephone and will allow for the participation of primary technical personnel. The NDCEE will prepare a comprehensive status report for presentation at each IPR, in accordance with CDRL A004. Specifically, quad charts will be prepared for the overall UXO Task and each Subtask, which will be accompanied by additional slides, if necessary, to provide additional information (e.g., resource curves, detailed Gantt charts with subtask work percentage complete, products / milestones, accomplishments, etc.). The UXO Task will also be briefed at NDCEE level 1 and level 3 program reviews.

Point of Contact

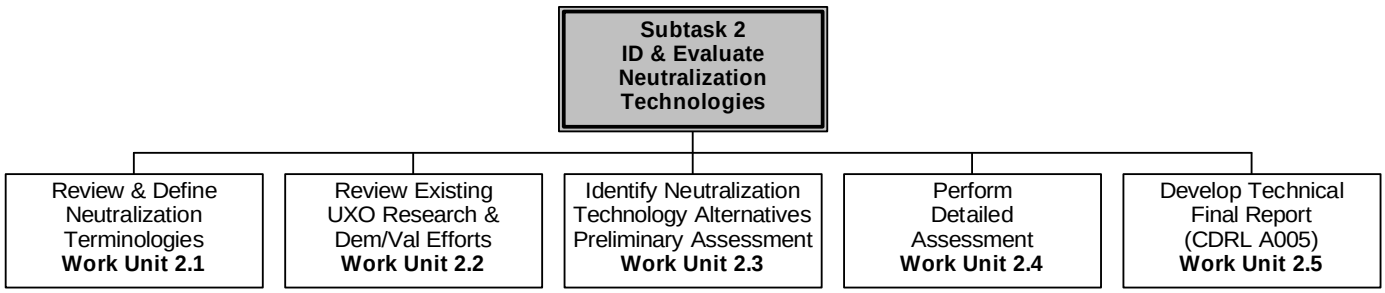
Concurrent Technologies Corporation
(814) 269-6834

Schedule for Subtask 1

Task Name	Duration	Start	Finish
Subtask 1.0 Program Management	**390 days**	**Fri 9/6/02**	**Tue 9/30/03**
Work Unit No. 1.1 Devlop Program Management Plan	29 days	Fri 9/6/02	Fri 10/4/02
Draft PMP (CDRL A001)	0 days	Fri 10/4/02	Fri 10/4/02
Work Unit No. 1.2 Preparation for Kickoff Meeting	26 days	Fri 9/6/02	Tue 10/1/02
Kickoff Meeting	0 days	Tue 10/1/02	Tue 10/1/02
Meeting Minutes (CDRL A003)	0 days	Sun 10/20/02	Sun 10/20/02
Work Unit No. 1.3 Monthly Management of Task	390 days	Fri 9/6/02	Tue 9/30/03
Monthly Reports (CDRL A002)	**365 days**	**Sun 9/15/02**	**Mon 9/15/03**
Work Unit No. 1.4 In-Progress Reviews (IPRs)	390 days	Fri 9/6/02	Tue 9/30/03
UXO IPR No.1 (CDRL A004)	0 days	Mon 12/9/02	Mon 12/9/02
PMP Revision	15 days	Mon 12/9/02	Mon 12/23/02
UXO IPR No.2 (CDRL A004)	0 days	Mon 4/14/03	Mon 4/14/03
PMP Revision	10 days	Mon 4/14/03	Wed 4/23/03
UXO IPR No.3 (CDRL A004)	0 days	Mon 9/15/03	Mon 9/15/03
Work Unit No. 1.5 Develop Final Report	61 days	Fri 8/1/03	Tue 9/30/03
Deliverable Summary Report (CDRL A017)	0 days	Tue 9/30/03	Tue 9/30/03



Subtask 2: Identification of UXO Neutralization Technologies and "Render Safe" Procedures/Technologies



Subtask 2 is organized into five work units to accomplish the required objectives. The following provides an overview of the five work units:

- Utilizing the POCs, or Project Team, identified by the USAEC Technical Monitor, terminology associated with the various UXO "handling" categories will be reviewed to clarify and differentiate neutralization from remediation.
- Conduct comprehensive and in-depth literature searches, using electronic and hardcopy data and information sources, to identify current UXO neutralization technologies and render safe procedures and technologies. Public and private sector organizations, electronic and hardcopy data and information repositories, technology developers / vendors, and other identified sources will be included in the search activities. The technical approach for the work unit will include: (1) preparation of a literature review plan that will delineate the proposed search strategy to ensure that stakeholder input and concurrence are included in the literature review process; (2) preliminary information gathering will focus on searches of public and private sector libraries and repositories, identification of case histories, telephone interviews with technology developers / vendors and other identified sources, with special attention to collect point-of-contact (POC) information for technologies and case histories; (3) detailed information gathering will involve contacting POCs for each identified UXO neutralization technology or project to help complete the case histories / technology reports, fill information gaps, answer specific questions, and to assess the amount of detailed information and data that is available for technical review and evaluation. Project Team members such representatives from the various branches of the military and NAOC will be contacted to gather information pertaining to current UXO neutralization demonstration / validation efforts being conducted or supported by their various organizations; and, (3) data preparation and presentation will organize the information obtained during the previous steps into a matrix identifying for each technology the factors affecting implementation such as effectiveness, operation costs, safety issues, environmental impact, limitations, etc. This matrix will be summarized and presented to the Project Team and their

feedback will serve as the screening baseline. This feedback will be solicited regarding how well the existing technologies meet the neutralization needs.

- Conduct a similar search to the previous step to identify emerging UXO neutralization technologies. This identification of technologies currently in the laboratory will involve approaching the DOD, federal laboratories, the private sector (especially SBIR/STTR Phase II winners), and universities. Because of the developmental stage of these technologies, some of the data available for currently used technologies in the previous step may not be available. A questionnaire will be developed, with concurrence from the Technical Monitor, to standardize input for each technology and allow comparison. A matrix gathering data based on the questionnaire for up to ten technologies will be presented to the Project Team and their feedback will serve as a preliminary assessment of technologies.
- Prepare a detailed assessment of up to five technologies. The relevant direct and indirect costs, activities and performance characteristics associated with each of the alternative technologies will be characterized. A detailed Environmental, Safety and Occupational Health Review of each of the Technology Alternatives will be performed. Based on all the information collected, a recommendation for the further development and/or demonstration needs, and associated, costs for each selected technology alternatives will be made.
- Prepare a summary Technical Report (CDRL A005) that presents the results of the subtask in a plain language format, but with the requisite technical detail, that will allow the Government to make better informed decisions concerning UXO neutralization technologies. The report will include all documentation concerning terminology clarifications, a summary of all technologies identified in the preliminary assessment, outline those technologies selected for the detailed assessment, and the results of the detailed assessment, including, but not limited to, a description of the technology, its effectiveness, capabilities, and limitations, its most suitable application(s), case studies, cost benefit, certification(s), and any implementation considerations.

A strong requirement also exists for coordination with Subtask 3 Identify and Evaluate UXO Remediation Technologies, with special consideration for information sharing and collaboration during the clarification of neutralization and remediation terminology. Such coordination will be organized through regular monthly information exchange meetings between the teams performing work on both Subtasks, with additional exchanges as required.

Deliverable

Subtask 2 will involve documenting neutralization technologies that are used in the field, as well as those that are still at the laboratory development stage. The primary objectives of the subtask are to identify the current status of technology development, compare and contrast existing technologies, identify emerging technologies, and

identify development needs related to the emerging technologies. In support of meeting the objectives of this subtask, NDCEE will prepare and develop a final summary report to document all data gathered and reviewed, the resulting evaluation of that data and subsequent recommendations. NDCEE will deliver to the Government the draft summary report in both hard copy and electronic format (Microsoft Word). After receipt and appropriate incorporation of Government review comments, NDCEE will deliver the final summary report to the Government in both hard copy and electronic format (Microsoft Word), in accordance with CDRL A005 for this Task.

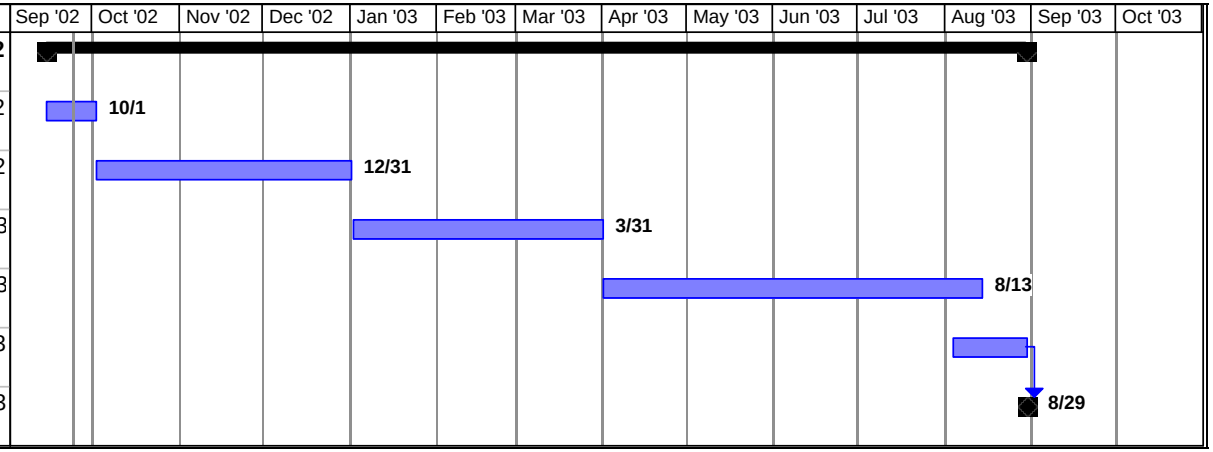
The findings of this subtask will be documented in a technical report. The report will summarize effectiveness of existing technologies, compare and contrast existing technologies, and identify emerging technologies. The report will also include recommendations of those technologies requiring additional development and/or demonstration, with required funding estimate. Such estimates will be based in part upon prior knowledge gained by the Project Team and technology vendors during development of earlier technologies.

Point of Contact

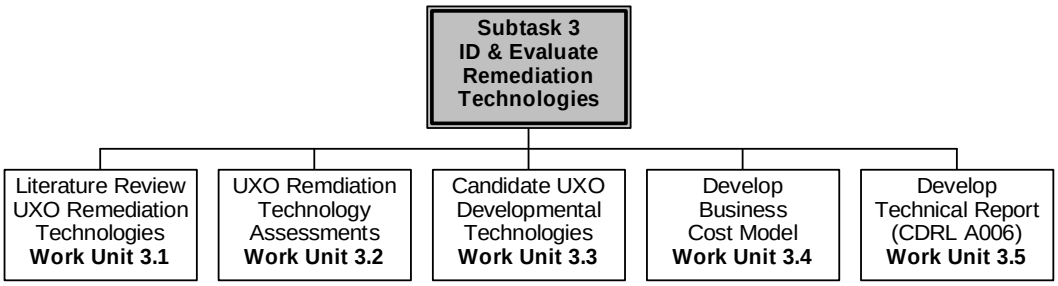
Concurrent Technologies Corporation
1-888-226-5962

Schedule for Subtask 2

Task Name	Duration	Start
Task 2.0 Identify & Evaluate Neutralization Technologies	**350 days**	**Sat 9/14/02**
Work Unit 2.1 Review&Define Neutralization Terminology	18 days	Sat 9/14/02
Work Unit 2.2 ReviewExisting Neutralization Technologies	91 days	Wed 10/2/02
Work Unit 2.3 Identify Neutralization Technology Alternatives, Preliminary	89 days	Thu 1/2/03
Work Unit 2.4 Perform Detailed Assessment	135 days	Tue 4/1/03
Work Unit 2.5 DevelopTechnical Final Report	26 days	Mon 8/4/03
DeliverableTechnical Report (CDRL A005)	0 days	Fri 8/29/03



Subtask 3: Identification and Evaluation of UXO Remediation Technologies



Subtask 3 is divided into five work units to accomplish the required objectives. The following provides an overview of the five work units:

- Conduct comprehensive and in-depth literature searches, using electronic and hardcopy data and information sources, to identify state-of-the-art UXO remediation technologies, including remote and robotically operated technologies. Public and private sector organizations, electronic and hardcopy data and information repositories, technology developers / vendors, and other identified sources will be included in the search activities.

The technical approach for the work unit will include: (1) preparation of an approach to the literature review that will delineate the proposed search strategy to ensure that stakeholder input and concurrence are included in the literature review process; (2) preliminary information gathering will focus on conducting the literature searches of public and private sector libraries and repositories, identification of technology case histories (successful / unsuccessful field projects or demonstrations, bench / pilot scale reports or evaluations) and point-of-contact (POC) information and telephone interviews with technology developers / vendors and other identified sources; (3) detailed information gathering will involve contacting POCs for each identified UXO remediation technology case history to help complete and verify the information included in the case histories / technology reports, fill information gaps, answer specific questions, and to assess the quantity and quality of detailed information that is available for technical review and evaluation; and, (4) data preparation and presentation to organize the information obtained during the previous steps into tables and narrative summaries that will allow easy review and comparison of the identified technologies.

- Assess the identified UXO remediation technologies by evaluating technology-specific operational mechanisms, including safety, factors that affect implementation, site-or technology-specific capabilities, costs to operate or purchase, and the limitations, effectiveness and specific applications of each technology, in order to identify technologies that offer a safe and cost effective advantage to the Government over current practices.
- The technical approach for the work unit will include: (1) preliminary assessment of the collected case histories / remediation technologies

information in terms of the quantity and quality of available data to identify UXO remediation technologies or case histories for detailed analysis; and, (2) detailed evaluation of the selected case histories / technologies to understand the science behind the technology, determine how specific characteristics influence technical and economic performance, and identify critical factors for transition to other sites.

- Identify and recommend (including funding estimates) remote and robotically operated UXO remediation technologies that warrant further development and / or demonstration.

The technical approach for this work unit will include: (1) use the results from the previous work unit to prepare a technology selection matrix that will cross-reference critical information on site conditions, UXO characteristics and technology types to enable preparation of a hierarchical listing of promising or emerging technologies; and, (2) prepare recommendations for two candidate technologies, including cost estimates, for further development and / or demonstration.

- Develop a simple business cost model to assess the cost effectiveness of identified technologies for deployment at other sites.

The technical approach for this work unit will include: (1) conducting a thorough review and evaluation of existing cost models, including the U.S. Army Cost Analysis Manual, DOE, *CTC*, and other cost models, as to their ability to compare cost, performance, efficiency and reliability issues of identified UXO remediation technologies; and, (2) developing modifications to existing models or developing a new model that considers site-specific factors, such as UXO characteristics, site characteristics, cost elements and regulatory drivers.

- Prepare a summary Technical Report (CDRL A006) that presents the results of the literature searches, technology evaluations and recommended candidate technologies in a plain language format, but with the requisite technical detail, that will allow the Government to make better informed decisions concerning remote and robotically operated UXO remediation technologies.

The technical approach for this work unit will include integrating the results of the previous work unit activities, Technical Monitor input and other information collected during work unit activities into a clear, concise and user-friendly document that provides a timely presentation of state-of-the-art UXO remediation technologies, including remote and robotically-operated technologies.

Deliverable

Subtask 3 will initially involve conducting a literature search using existing government information and independent research to identify state-of-the-art technologies, including but not limited to remote and robotically operated technologies, to recover and remove UXO, and to recommend candidate technologies for further development

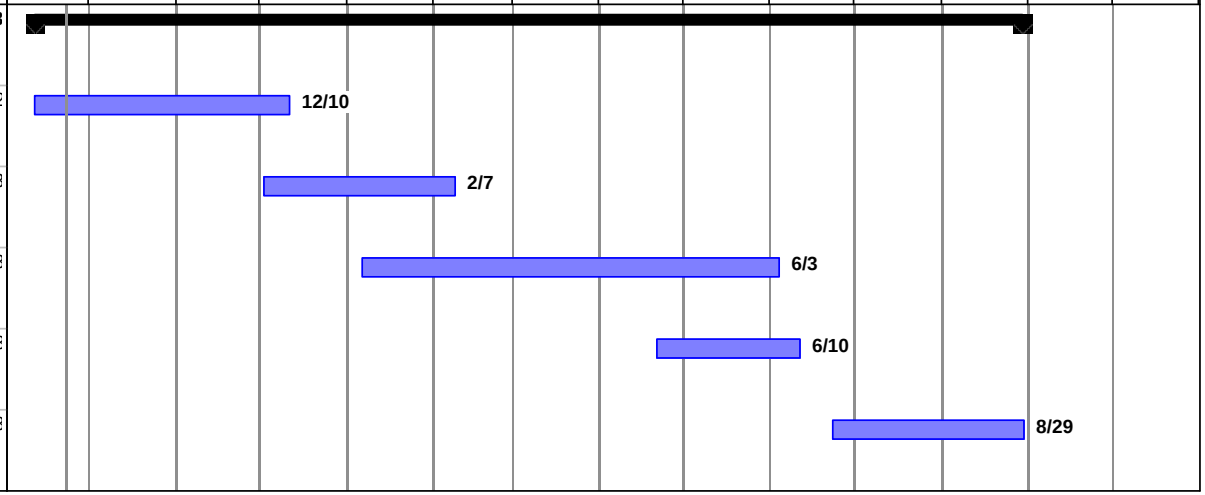
and/or demonstration. In support of meeting the objectives of this subtask, the NDCEE will prepare a final summary report to document all the information gathered and reviewed, the results of the technology evaluations, technology recommendations for further development/demonstration, and a simple business cost model that will allow end users to assess the applicability of specific technologies for use at their sites. Because UXO neutralization and UXO remediation technologies may be closely related or may even overlap, close communication and coordination between Subtask 3 and Subtask 2 activities will ensure that duplication of effort in these subtasks does not occur. The draft summary report will be delivered to the Government in both hard copy and electronic format (Microsoft Word) for review and comment. After receipt and appropriate incorporation of Government review comments, the NDCEE will deliver the final summary report to the Government in both hard copy and electronic format (Microsoft Word), in accordance with CDRL A006.

Point of Contact

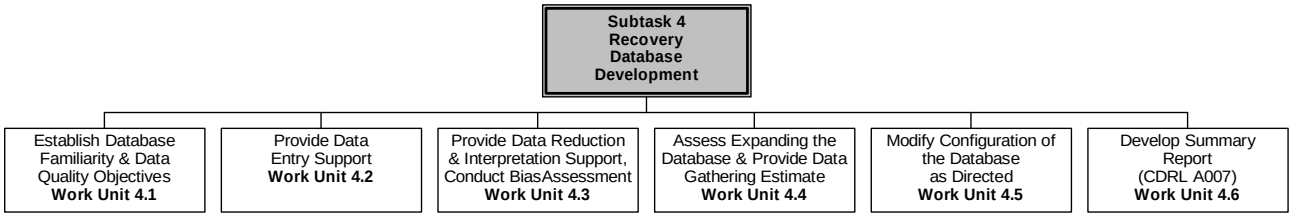
Concurrent Technologies Corporation
(303) 297-0180 ext. 116

Schedule for Subtask 3

Task Name	Duration	Start	Finish
Subtask 3.0 ID & Evaluate Remediation Technologies	**353 days**	**Wed 9/11/02**	**Fri 8/29/03**
Work Unit 3.1 Literature Review of UXO Remediation Techs	91 days	Wed 9/11/02	Tue 12/10/02
Work Unit 3.2 UXO Remediation Technology Assessment	68 days	Mon 12/2/02	Fri 2/7/03
Work Unit 3.3 Candidate UXO Developmental Technologies	149 days	Mon 1/6/03	Tue 6/3/03
Work Unit 3.4 Develop Business Cost Model	51 days	Mon 4/21/03	Tue 6/10/03
Work Unit 3.5 Deliverable Technical Report (CDRL A006)	68 days	Mon 6/23/03	Fri 8/29/03



Subtask 4: UXO Recovery Database



Subtask 4 is organized into six work units to accomplish the required objectives. The following provides an overview of the six work units:

- Establish familiarity with the Recovery Database and establish Data Quality Objectives for the task. The goal of this activity will assure that important aspects of the database are understood and that quality data is entered into the database in a manner that minimizes bias and promotes precision. Moreover, working closely with the developers of the database, this activity will assure that the most appropriate approaches for expediting the data entry process are selected as the data is obtained.
- Provide Data Entry Support. Placing all existing data into the UXO recovery database is the primary focus of this overall subtask. The goal of this activity is to assure that the appropriate methodology identified during the evaluation of the database is implemented and that opportunities for continuous improvement regarding precision and efficiency are identified.
- Provide data reduction and data interpretation support, as well as conduct a bias assessment. The goal of this activity will be to provide expert review of data that supports the development of a scientifically defensible database through data reduction and interpretation of environmental data from relevant OE activities and sites (e.g., Formerly Used Defense Sites, Base Realignment and Closure and Installation Restoration Projects, and other related OE restoration projects). Working closely with the USACE, this activity will assure data are representative of the portion of the environment being investigated and that sample bias and data imprecision is minimized.
- Assess expanding the database and provide an estimate for gathering data on ordnance residue in holes. The goal of this activity is to assess and evaluate options to improve the database through expansion. This may include recommending the deletion or addition of categories of data currently in the database and making recommendations for improving the user interface and for expanding the types of sources that are used to obtain data for the database. NDCEE will consult with potential end-users of the database to obtain input on the desired data generated requirements to ensure useful and desired capabilities are recommended for improving the database. In addition, this activity will lead to the development of a cost estimate for the accurate gathering of data on contaminant residue in holes found at UXO restoration projects to improve decision-making processes related to evaluating UXO environmental risk at U.S. military installations.

- Modify configuration of the database as directed by the Government. The goal of this activity will be to improve the configuration of the UXO recovery database as directed by the government. Specialized support services will be planned for moderate configuration changes on the UXO recovery database and reserved until Government direction is provided through the appropriate contracting channels. It is currently envisioned that the final database will be Internet based, easily searchable, and developed to be readily linked via the Internet to important UXO websites, such as the NDCEE, USAEC and JUXOCO websites for all interested users.
- Prepare a summary report. The goal of this activity is to summarize recommendations for future data collection that improves precision and minimizes bias as well as recommend approaches for expediting the data entry process and expanding the products generated through the recovery database. In addition, the summary report shall include an assessment of the inherent bias in the environmental data due to detection limitations and cleanup goals. The summary Technical Report (Database) will be submitted in accordance with CDRL A007.

Deliverable

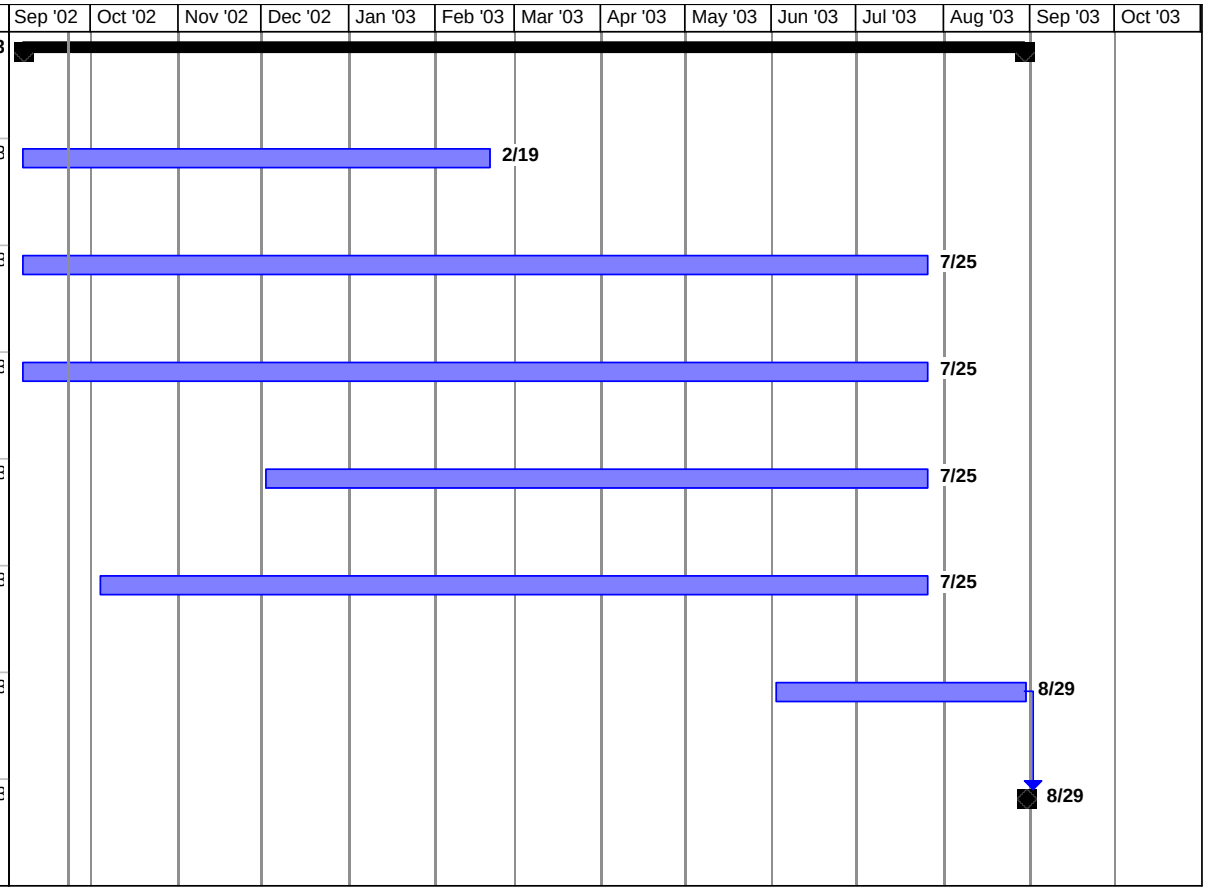
Subtask 4 is a data management and data entry support task using existing data and an existing database, along with specialized independent data interpretation support and environmental expertise to (1) promote the advancement of a UXO technical database, and (2) produce one summary technical report. In support of meeting the objectives of this subtask, NDCEE will prepare and develop a final summary report to document all data gathered, data entry techniques utilized, the new format developed, the data generated, and the calculated data bias. NDCEE will deliver to the Government the draft summary report in both hard copy and electronic format (Microsoft Word). After receipt and appropriate incorporation of Government review comments, NDCEE will deliver the finalized final summary report, including the link to the final database, to the Government in both hard copy and electronic format (Microsoft Word), in accordance with CDRL A007 for this Task.

Point of Contact

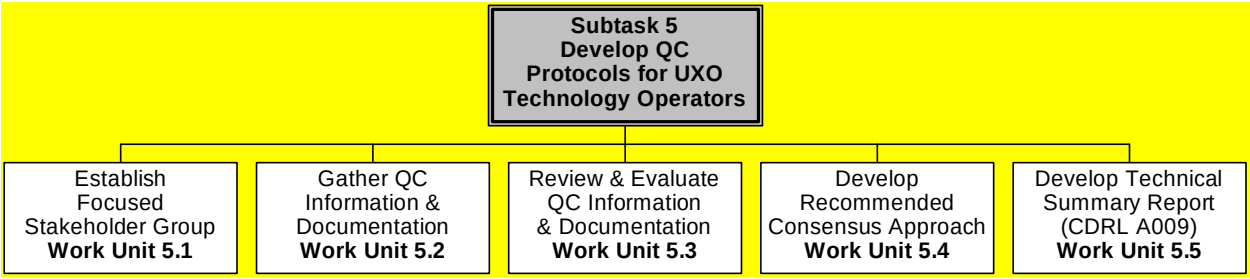
Concurrent Technologies Corporation
(814) 269-6834

Schedule for Subtask 4

Task Name	Duration	Start	Finish
Subtask 4.0 Recovery Database Development	**358 days**	**Fri 9/6/02**	**Fri 8/29/03**
Work Unit No. 4.1 Establish Database Familiarity & DQOs	167 days	Fri 9/6/02	Wed 2/19/03
Work Unit No. 4.2 Provide Data Entry Support	323 days	Fri 9/6/02	Fri 7/25/03
Work Unit No. 4.3 Provide Data Reduction & Interpretation Support, Conduct Bias Assessment	323 days	Fri 9/6/02	Fri 7/25/03
Work Unit No. 4.4 Assess Expanding the Database & Provide Data Gathering Estimate	236 days	Mon 12/2/02	Fri 7/25/03
Work Unit No. 4.5 Modify Configuration of the Database as Directed	295 days	Fri 10/4/02	Fri 7/25/03
Work Unit No. 4.6 Develop Summary Report	89 days	Mon 6/2/03	Fri 8/29/03
Deliverable Summary Report CDRL A007	0 days	Fri 8/29/03	Fri 8/29/03



Subtask 5: Develop Quality Control Protocols for UXO Technology Operators



Subtask 5 is organized into five work units to accomplish the required objectives. The following provides an overview of the five work units:

- Utilizing the POCs identified by the USAEC Technical Monitor, individuals that manage, work, and/or delineate actions associated with UXO will be invited to join the Stakeholder Group.
- NDCEE will prepare an approach to the literature review that will delineate the proposed search strategy to ensure that stakeholder input and concurrence are included in the literature review process. It is the NDCEE's understanding that in the event that relevant and required protocols are not accessible within the public domain that these documents will be obtained and supplied to NDCEE by appropriately identified stakeholders. Preliminary information gathering will focus on searches of public and private sector libraries and repositories, identification of existing protocols and documentation to assess the amount of information and data that is currently available for technical review and evaluation. In addition, identified personnel that are directly involved in the research, development, and acceptance of the aforementioned documentation will be interviewed to capture additional information, lessons learned, and insight into potential future efforts.
- All information collected as a result of work unit 5.2 will be documented, reviewed, and evaluated to determine its use and effectiveness. It is the NDCEE's understanding that the Stakeholder group will provide input regarding their own experience and use in dealing with any of the aforementioned documents.
- As appropriate, stakeholder teleconferences will be held to aid in the development of a recommended approach. In addition upon development of a draft approach, a teleconference will be conducted to discuss the draft recommended approach. Upon completion of the final recommended approach, a face-to-face Stakeholder meeting will be held, at a location designated by the Technical Monitor, for final Stakeholder review and comment.
- The final summary report for this subtask will include a complete list of the members of the stakeholder group, including the agencies/departments they represent, references for all documentation collected and reviewed, a

summary of the evaluation of the information gathered, identified data gaps, lessons learned, and the recommended approach.

Deliverable

Subtask 5 will involve obtaining, reviewing, and evaluating all existing data, information, and QC protocols combined with independent research in an attempt to build an inter-service, consensus approach to a QC Protocol for UXO Technology Operators. Research will not only include reviewing and evaluating all QC documents that are currently available for UXO technology operators, but also will clarify the roles of the agencies providing the guidance in an effort to develop an all-agency encompassing approach to QC requirements for future application at UXO sites. A focused stakeholder group, consisting of individuals as identified by the Technical Monitor, will be established to aid in these efforts.

- Potential participants, as delineated by the USAEC Technical Monitor, will be invited to be active participants in a focused stakeholder group in support of this task. The goal will be to develop support and representation from all the services and their respective agencies that manage, work, or otherwise interact or delineate actions associated with UXO in the stakeholder group.

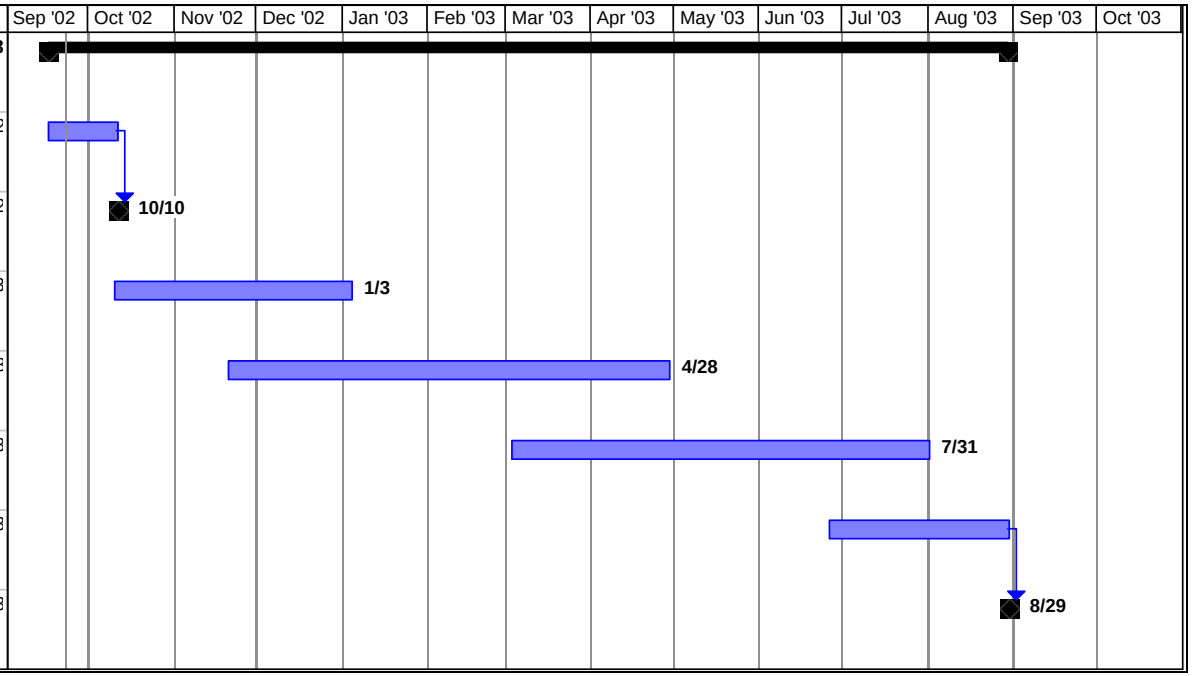
Working and coordinating with the QC stakeholder group, the NDCEE will evaluate the effectiveness of existing protocols. NDCEE will be provided all existing protocols and access to all relevant government personnel, including the Corps of Engineers personnel currently involved in the ESTCP Standardized UXO Test Sites Program. NDCEE will review all reports and interview relevant personnel concerning past, current, and potential future actions. To achieve the objectives of this subtask, NDCEE will prepare and develop a final summary report to document all data gathered, reviewed, and evaluated, data gaps identified, and definition of the proposed QC protocols for UXO Technology operators. In addition, the summary report will document efforts to obtain stakeholder consensus on the developed protocols including all comments as provided by the QC stakeholder group and efforts to remediate outstanding issues. NDCEE will deliver to the Government the draft final summary report in both hard copy and electronic format (Microsoft Word) within 420 DACA. After receipt and appropriate incorporation of Government review comments, NDCEE will deliver the finalized final summary report to the Government in both hard copy and electronic (Microsoft Word) format, in accordance with CDRL A009 for this Task.

Point of Contact

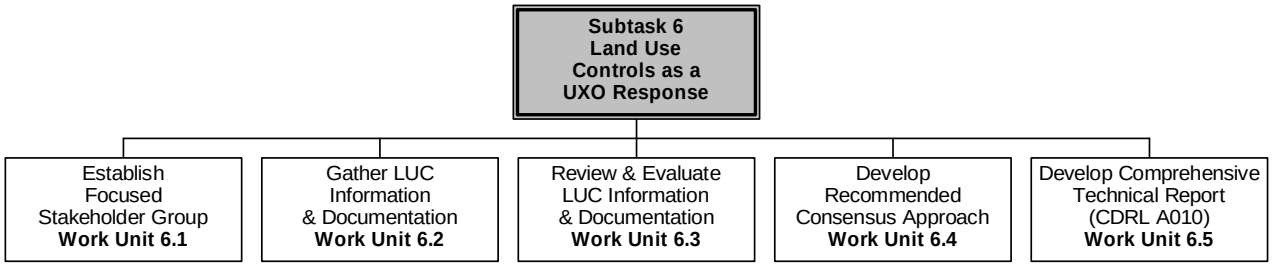
Concurrent Technologies Corporation
(814) 269-6255

Schedule for Subtask 5

Task Name	Duration	Start	Finish
Subtask 5.0 Develop QC Protocols for Uxo Technology Operators	**348 days**	**Mon 9/16/02**	**Fri 8/29/03**
Work Unit No. 5.1 Establish Focused Stakeholder Group	25 days	Mon 9/16/02	Thu 10/10/02
Stakeholder Meeting	0 days	Thu 10/10/02	Thu 10/10/02
Work Unit No. 5.2 Gather QC Info. & Documentation	86 days	Thu 10/10/02	Fri 1/3/03
Work Unit 5.3 Review & Evaluate QC Info. & Documentation	160 days	Wed 11/20/02	Mon 4/28/03
Work Unit No. 5.4 Develop Recommended Consensus Approach	151 days	Mon 3/3/03	Thu 7/31/03
Work Unit No. 5.5 Develop Technical Summary Report	65 days	Thu 6/26/03	Fri 8/29/03
Deliverable Final Report (CDRL A009)	0 days	Fri 8/29/03	Fri 8/29/03



Subtask 6: Land Use Controls as a UXO Response



Subtask 6 is organized into five work units to accomplish the required functions. The following provides an overview of the five work units:

- Assemble a Stakeholder Group consisting of POCs identified by the USAEC Technical Monitor.
- NDCEE will conduct a literature review to gather information on current methods of LUCs (physical, legal, or administrative), case studies of engineering and or institutional controls that have been implemented at DOD sites, requirements and impediments to implementation, and lessons learned.
- The data gathered will be evaluated to identify data gaps in the current knowledge base of engineering and institutional controls and failure analysis will be conducted to determine why breakdowns have occurred.
- A recommended consensus-based approach will be developed for use in implementing LUCs. Recommendations for further legislative restrictions that can be applied to locations where UXO presence has been identified will be provided.
- A Technical Report (Survey Report) will be prepared in accordance with CDRL A010. Included in this report will be a Technology Transfer Package that includes a consensus-based approach to implementing LUCs.

Deliverable

The purpose of Subtask 6 is to document the current state-of-the-art for engineering and or institutional controls intended to protect human health. For the purpose of this subtask, engineering controls include the installation of physical barriers or other means of limiting access to property. Some examples of engineering controls are:

- Posting signs
- Building fences
- Removal actions

Institutional controls are legal or institutional mechanisms that limit access to or use of property, or warn of a hazard. An institutional control can be imposed by the property owner, such as use restrictions contained in a deed or by a government, such as a zoning restriction. Some examples of institutional controls are:

- Affirmative / negative easements

- Affirmative / restrictive covenants
- Equitable servitudes
- Notices (deeds and newspapers)
- Zoning
- Education constituents
- Permit requirements
- Regulatory agreements

NDCEE's approach to accomplish this subtask will consist of performing a comprehensive survey of the current state-of-the-art for engineering and or institutional controls. The survey will include visits to DOD sites, literature reviews, telephone interviews, and face-to-face meetings with members of the project team, regulatory agencies, and other interested stakeholders. As part of the survey, NDCEE will determine the requirements for long- and short-term implementation of engineering and / or institutional controls, impediments to successful implementation; assess the effectiveness, and failures or shortcomings of existing controls and perform failure analysis. Based on the results of the survey, NDCEE will recommend if additional LUCs need to be developed and also determine if there is a need for legislation to amend / enforce institutional controls, such as deed restrictions, and projected future requirements.

Building upon its experience with LUCs, such as air-sparging and classification exemption area at Camp Pedricktown, New Jersey, and knowledge of consensus efforts, such as the Interim Final Management Principles for Implementing Response Actions at Closed, Transferring, and Transferred Ranges Report, which was developed jointly by DOD and EPA, NDCEE will use a consensus approach for implementation of LUCs with DOD, state and federal regulatory agencies, and other interested stakeholders. NDCEE will develop this consensus on a generic basis so that it can easily be made site specific. NDCEE will integrate experiences and information gained under Subtask 6 into a technology transfer package of the consensus approach.

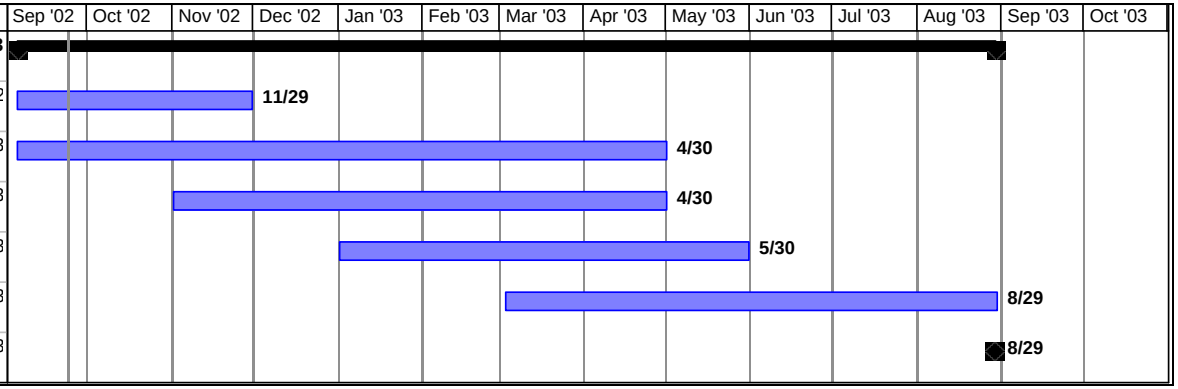
The status of Subtask 6 will be presented at three IPRs to be held via teleconference with the UXO Project Team.

NDCEE will compile the resultant documentation and technology transfer package into a technical report. NDCEE will deliver to the Government the draft technical report in both hard copy and electronic format (Microsoft Word). After receipt and appropriate incorporation of Government review comments, NDCEE will deliver the final technical report to the Government in both hard copy and electronic (Microsoft Word) format, in accordance with CDRL A010 for this Task.

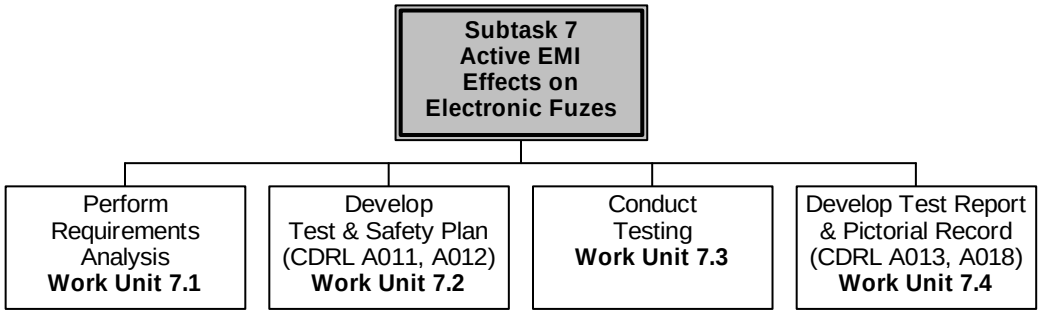
Point of Contact
Concurrent Technologies Corporation
(814) 269-6455

Schedule for Subtask 6

Task Name	Duration	Start	Finish
Subtask 6.0 Land Use Controls (LUCs) as a UXO Response	**257 days**	**Thu 9/5/02**	**Fri 8/29/03**
Work Unit No. 6.1 Established Focused Stakeholder Group	62 days	Thu 9/5/02	Fri 11/29/02
Work Unit No. 6.2 Gather LUC Information & Documentation	170 days	Thu 9/5/02	Wed 4/30/03
Work Unit No. 6.3 Review & Evaluate LUC Information & Documentation	129 days	Fri 11/1/02	Wed 4/30/03
Work Unit No. 6.4 Develop Recommended Consensus Approach	108 days	Wed 1/1/03	Fri 5/30/03
Work Unit No. 6.5 Develop Comprehensive Technical Report	130 days	Mon 3/3/03	Fri 8/29/03
Deliverable Technical Report (CDRLA010)	1 day	Fri 8/29/03	Fri 8/29/03



Subtask 7: Active EMI Effects on Electronic Fuzes



Subtask 7 is organized into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- Conduct a Requirements Analysis to determine a baseline for testing of electronic fuzes for their susceptibility to EMI, through research, gap analysis of the knowledge base, identification of parameters, and creation of a test matrix.
- Develop Test and Safety Plans to ensure quality assurance and data validity and to ensure the safety of both personnel and equipment.
- Conduct scientific, repeatable, quantifiable, and is safe tests on pre-identified fuzes, which are suspected of being vulnerable to the effect of EMI emissions.
- Produce effective communication of the results of the EM/Electronic Fuze Testing Program in the formats conducive to meeting government needs to translate the data to the user community.

Deliverables

An initial Internet search on this subject produced an indication that some work to determine the effect of EMI on fuzes has already been accomplished on older weapon systems in relation to higher levels of electro-magnetic energy. However, this data was not tested using EMI signatures similar to those produced by technologies currently fielded or planned specifically for UXO detection and characterization. Obviously, the same applies to similar technologies used to produce ground characteristic studies such as those used in environmental studies. Quantified information is needed in a format conducive to make recommendations concerning the use of detection equipment on potentially live fuzes whether still attached to unexploded ordnance or alone, as these devices present a thermal and explosive hazard even when not still attached to ordnance.

This first requirement to accomplish this task is the need to identify the data gaps (i.e., what is not known), which will be met by work unit 7.1, Perform Requirements Analysis. Filling those knowledge gaps will be accomplished by the second major work unit, testing. Identified gaps in the available data will be met by applying accepted scientific testing to fuze types that are identified as having the potential to be affected by EMI.

Subtask 7 is a research and testing task to produce a detailed technical report:

- EMI Affect on Fuzes, per CDRL A013

The information developed by this report and pictorial information gathered during the testing will be used to develop:

- Pictorial Record of EMI Testing Procedure, per CDRL A018
- EMI Affect on Fuzes Presentation, per CDRL A018.

In support of the testing, two plans will be necessary to ensure the safety of the program and the validity of the data:

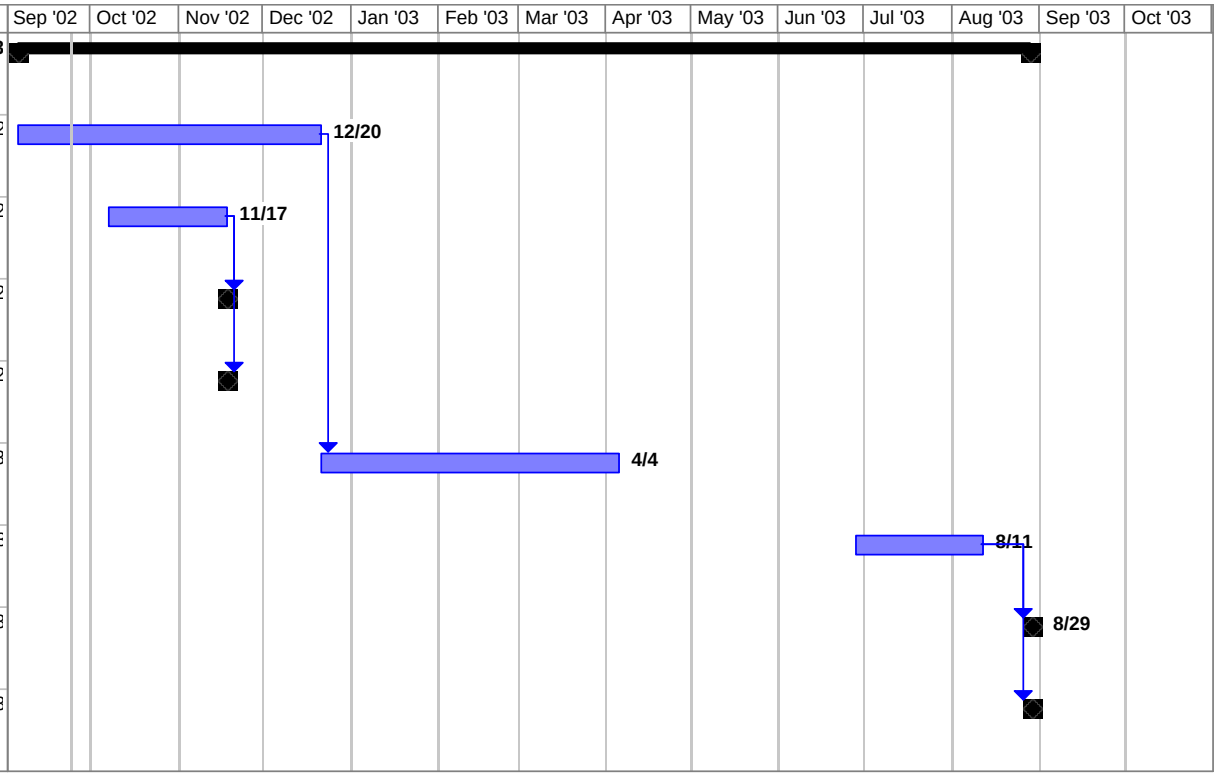
- EMI Testing Plan, per CDRL A011
- EMI Testing Safety Plan, per CDRL A012.

Point of Contact

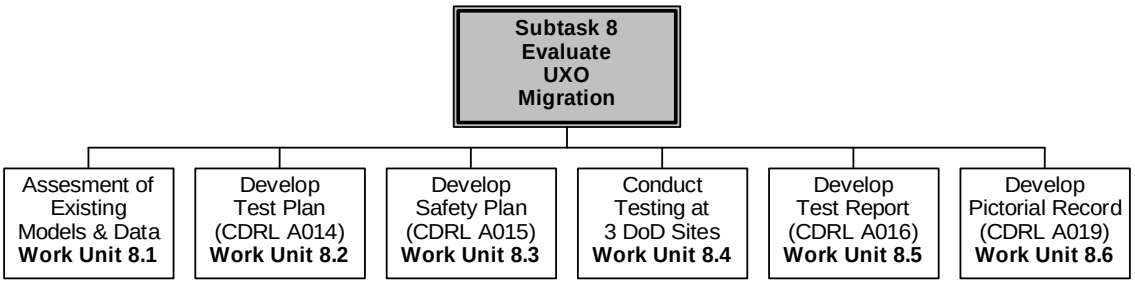
Concurrent Technologies Corporation
(843) 744-2829

Schedule for Subtask 7

Task Name	Duration	Start	Finish
Subtask 7.0 Active EMI Effects on Electronic Fuzes	**358 days**	**Thu 9/5/02**	**Fri 8/29/03**
Work Unit 7.1 Perform Requirements Analysis	107 days	Thu 9/5/02	Fri 12/20/02
Work Unit 7.2 Develop Test & Safety Plan	42 days	Mon 10/7/02	Sun 11/17/02
Deliverable Test Plan (CDRL A011)	0 days	Sun 11/17/02	Sun 11/17/02
Deliverable Safety Plan (CDRL A012)	0 days	Sun 11/17/02	Sun 11/17/02
Work Unit 7.3 Conduct Testing	105 days	Sat 12/21/02	Fri 4/4/03
Work Unit 7.4 Develop Test Report & Pictorial Record	45 days	Sat 6/28/03	Mon 8/11/03
Deliverable Final Report (CDRL A013)	0 days	Fri 8/29/03	Fri 8/29/03
Final Video Record/PPT Pres. (CDRL A018)	0 days	Fri 8/29/03	Fri 8/29/03



Subtask 8: Evaluation of UXO Migration



Subtask 8 is organized into six work units to accomplish the required objectives. The following provides an overview of the six work units:

- Conduct an assessment of applicable models, existing data, and recommended guidelines concerning UXO migration. This assessment will identify potential UXO migration parameters and allow for the development of a test matrix of parameters. Per the Government's directions during the Task Kickoff Meeting on 03 October 2002, the feasibility of using environmental chambers for conducting the UXO migration tests will be investigated.
- A Test Plan will be developed to ensure through preparation, quality assurance, and data validity. The Test Plan will be tailored to each site delineating the test execution process, ensuring appropriate data, meaningful data is collected, retained and archived with an emphasis toward validation of existing models.
- A Safety Plan will be developed and tailored to each site ensuring the safety of both personnel and equipment while meeting all local and DOD safety policies and procedures.
- Conduct scientific, repeatable, and quantifiable tests on inert UXO of differing sizes, shapes and composition at each test site. Each piece of UXO will be fitted as appropriate with devices that will allow the monitoring of movement in varying temperature, soil and moisture conditions.
- A detailed technical report will be prepared on the findings at all test sites. The most promising applicable model will be validated using the data obtained from the test sites.
- An effective pictorial record will be maintained throughout the task to ensure each phase is thoroughly documented.

Deliverables

Subtask 8 is a research task, using existing data and information combined with independent research, to produce technical data that will allow an assessment of UXO migration and movement toward the soil surface over time as a result of frost or heat heave (lifting). The test plan will describe the design of test plots and equipment to measure soil parameters contributing to frost heave and heat heave at the selected locations. The goal is to quantify the movement of buried UXO. The design will

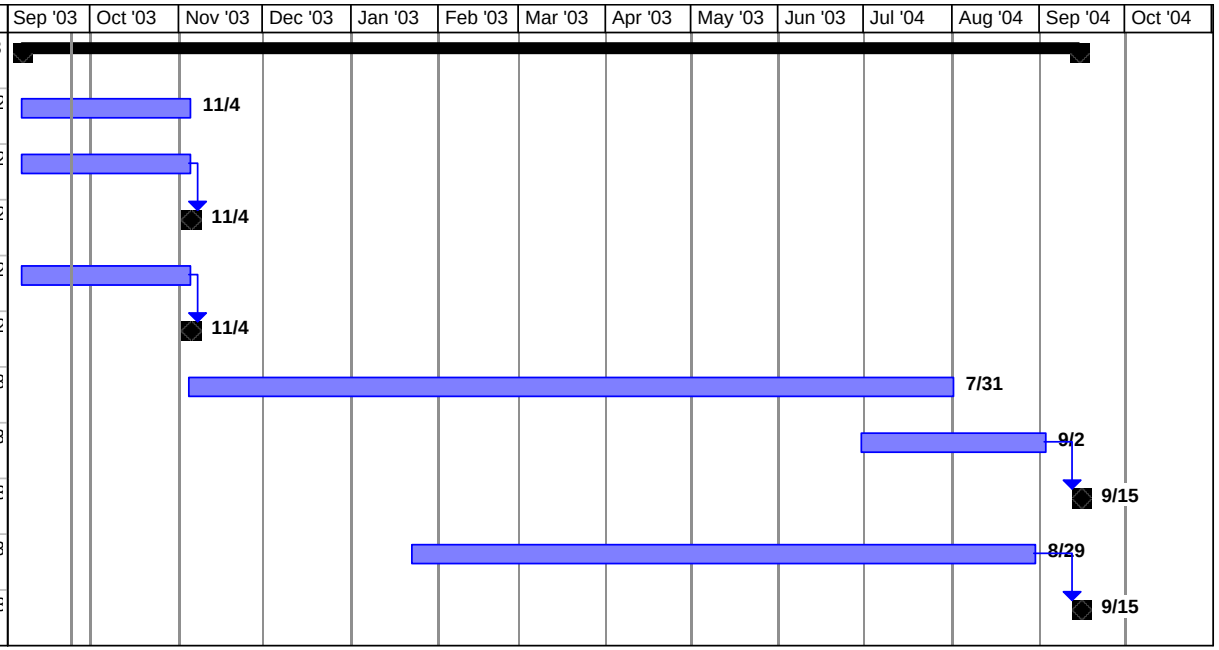
include methods to measure movement of buried UXO to coincide with freeze-thaw temperature cycles in cold-climate sites and heat-chill temperature cycles in a warm-climate site. Factors such as snow cover and vegetation will also be included in the test plan. Results from this study will quantify the frost heave and heat heave displacements of buried UXO and validate the best-available predictive model.

Point of Contact

Concurrent Technologies Corporation
(619) 725-5014

Schedule for Subtask 8

Task Name	Duration	Start	Finish
Subtask 8 .0 Evaluate UXO Migration	**374 days**	**Fri 9/6/02**	**Mon 9/15/03**
Work Unit 8.1 Assessment of Existing Data, Models, &	60 days	Fri 9/6/02	Mon 11/4/02
Work Unit 8.2 Develop Test Plan	60 days	Fri 9/6/02	Mon 11/4/02
Test Plan Deliverable (CDRL A014)	0 days	Mon 11/4/02	Mon 11/4/02
Work Unit 8.3 Develop Safety Plan	60 days	Fri 9/6/02	Mon 11/4/02
Safety Plan Deliverable (CDRL A015)	0 days	Mon 11/4/02	Mon 11/4/02
Work Unit 8.4 Conduct testing at three DOD Sites	270 days	Mon 11/4/02	Thu 7/31/03
Work Unit 8.5 Develop Technical Test Report	65 days	Mon 6/30/03	Tue 9/2/03
Deliverable Technical Report (CDRL A016)	0 days	Mon 9/15/03	Mon 9/15/03
Work Unit 8.6 Develop Pictorial Record	220 days	Wed 1/22/03	Fri 8/29/03
Deliverable Pictorial Record (CDRL A019)	0 days	Mon 9/15/03	Mon 9/15/03



National Defense Center for Environmental Excellence (NDCEE)
Task No. 318

The UXO Task is divided into one program management subtask and eleven technical subtasks. The primary objectives of the technical subtasks are outlined below, with further detail outline:

- Perform a comprehensive survey using existing data, former reports to Congress by the Services, and document the real extent of non-tidal and tidal shallow water on ranges, and tidal wetlands and emergent wetlands on ranges. The goal is to assess the extent of the UXO problem on some specific ranges, and infer and identify technical issues in the remediation of similar ranges, and associated regulatory issues, both State and Federal. Successful accomplishment of this subtask depends upon gaining access to Government data, draft and final reports, surveys, and other information that contributes to the objectives of the SOW. After completing a comprehensive survey, the effort will result in a survey (technical) report.
- Perform a comprehensive survey of both active and former ranges to: 1) compile location and real extent of ranges; 2) determine range hydro-geologic conditions (underlying soil types and strata) using existing data, maps, and surface geophysical methods; 3) determine water / vegetation proportions and interspersion on ranges; 4) determine type and extent of vegetative cover; 4) determine wetlands types and wetland / watershed ratio (if applicable); and, 5) determine topography. The data will ultimately be used to assess if a need exists for additional types of standardized UXO test site(s), and to make recommendations to the Government. The task will result in a technical report and database.
- Develop a dual-mode navigation tool for hand-held or man-portable sensors. The first mode will implement maximum absolute accuracy attainable in areas inaccessible / inappropriate for DGPS for logging / locating of anomalies in search mode and would permit efficient reacquisition. This will include reviewing work to date characterizing various systems and selection of an appropriate technology, and additional development work of existing systems to meet the objectives. The second mode will be a local positioning mode with highly accurate relative positioning to create local maps of single anomalies with the operator being able to toggle between the two modes. The development effort will also include data management. This will be an incentive for hardware development effort with a series of go / no go decision points, and implementation of a technology transfer plan as part of the effort.
- Demonstrate a field-deployable application that would allow recording of UXO data in the field using a Personal Digital Assistant (PDA) or standard laptop computer, which then can be directly uploaded into and synchronized with the UXO Recovery Database to improve the accuracy of data collection, reduce costs, and also provide a framework for real-time UXO data management. The objectives of this subtask include: 1) using a commercially

available off-the-shelf application or develop a software application for entering UXO recovery data in the field using a PDA / laptop and uploading directly (in synchronization) to the UXO Recovery Database; and, 2) demonstrating operation of application by entering "canned" data into a PDA and a laptop and downloading into the UXO Recovery Database.

- Assess and evaluate the potential for "surface migration" of buried UXO using an environmental test chamber, and to compare the results from the chamber tests to results from actual field-testing conducted as part of NDCEE Task No. 307 (UXO).
- Coordinate, analyze, and report on past and ongoing studies regarding UXO corrosion under various environmental conditions, in order to understand what factors influence the rate of UXO corrosion as an important element in evaluating UXO environmental risk at U.S. military installations. It is critical to DoD to understand the rate and mode of UXO corrosion as a basis for predicting when chemical constituents may be released from UXO. This information will provide prioritization capabilities and enable cost effective management with the limited resources available. The subtask will focus on metal and manufacturing processes for munitions over time and will lead to describing how the effect of changes in munitions manufacturing over time will effect corrosion of specific types of ordnance in wet soils. The various types of munitions will be assessed for their potential for corrosion susceptibility and those which are most prone to corrosion identified while describing why the munitions are prone to corrosion and what mechanisms may be responsible for such corrosion.
- Gather information on the influence of environmental variables on dud rates as well as calculate and model as necessary to evaluate the impact analysis of 120-mm HE and 120-mm M-931 (non HE filled practice round) to assess the conditions that cause these rounds to split open.
- Evaluate technologies that might be used to make future DOD UXO more detectable. Research and evaluate the potential of a low-cost, simple, light weight component(s) that could be attached or inserted into future DoD munitions before they are fired to aid in detection in the event that they do not detonate.
- Estimate dud rates and low order detonation rates for a variety of ammunition types. This effort is a follow-on effort to two previous studies on dud and low order rates from ammunition. Previous efforts relied solely on the Ammunition Stockpile Reliability Program; this effort includes munitions used on a regular basis (taken from Annual Expenditure Reports), and from estimates of the expected use of legacy ammunition and war reserve ammunition in the future. This subtask will also find other avenues for researching the duds and low order rates, and will also identify any data gaps or any limitation of the data. The subtask will assess dud and low order detonation rates for a variety of subsets of the total set of ammunition items for which data was gathered. The subtask includes preparation of a database

used to produce the data; this database will allow the user to determine dud and low order detonation rates as an item, in combination or a subset.

- Assess the extent of the UXO "dud" problem associated with the use of old inventory by the U.S. Department of the Interior (DoI) for avalanche control in mountainous regions in order to determine if there is a better solution. Specifically, determine what type of rounds, type of gun being used to fire these rounds, cost of these rounds, cost of the gun (replacement), number of rounds fired a year by location, number of Dud rounds, and input from the DoI and commercial sources for possible replacement(s) guns / shells. A survey of two different areas will be undertaken to determine the number and type of UXO at these two sites. The information gathered will be assessed to determine if new fuzes for the rounds will reduce the UXO problem and if there are any other possible solutions that meet DoI needs.
- Develop a straightforward, spreadsheet level time and cost estimation tool to allow trade-off calculations at the project level and at various stages of UXO mitigation. The tool will not be a rigorous accounting package, but will allow estimation of relative costs and gains. The tool will be validated based on actual site data and from known cost-estimating models.

- Subtask 1: Program Management

  Subtask 1, Program Management, provides dedicated personnel with commensurate experience in conjunction with accepted financial and management control activities required to properly manage the NDCEE UXO Task No. 318. Subtask 1 is further divided into five work units to accomplish the requirements of the SOW (dated February 27, 2003).
- Subtask 2: Assess Extent of Shallow Water on Ranges, Identify and Assess Technological Impediments to Remediation, and Associated Regulatory Issues

  The results of Subtask 2 will provide an enhanced understanding of relevant and available information on UXO contaminated shallow water on ranges and will serve to quantify the magnitude of this unique problem. It will provide knowledge on the area encompassed by those active and former DoD shallow water ranges located in tidal, non-tidal and emergent wetlands. It will identify technical remediation and associated regulatory factors that impede cleanup of shallow water ranges and will result in the establishment of a searchable database that facilitates follow-on efforts to plan, program, budget, and execute programs to deal with this complex issue. And, it will provide the basis for identifying research and development needs that can help solve the technical challenges posed by UXO in shallow water ranges. A special emphasis will be placed on two shallow water ranges in the Chesapeake Bay Watershed and include a remediation Feasibility Assessment for each that provides remediation options, their costs, and their potential environmental impact. For the ranges surveyed, an evaluation of the effectiveness and failures or shortcomings of existing engineering and

institutional controls will be presented. This subtask is organized into five work units to accomplish the required objectives.

- Subtask 3: Survey and Compilation of Geology, Water, Vegetation and Other Relevant Factors at UXO Contaminated Sites to Identify General Trends to Support Research & Development Efforts

  At many UXO-contaminated sites, the site-specific requirements for remedial design and action follow the Comprehensive Environmental Response, Compensation, and Reliability Act (CERCLA) process; that is, removal alternatives will be guided by the scoping and characterization of UXO contamination survey results during the site inspection, remedial investigation, and feasibility study phases. These surveys rely predominately on the ability of technologies to detect, localize, and characterize UXO.

  Difficulties in positively identifying the presence and type of UXO exist and are related to site-specific factors / characteristics. The site-specific factors include soil, land use, geology, hydrogeology, vegetation, wetlands types, wetland / watershed ratio, topography and terrain. These factors can interfere and limit UXO detection technologies. Therefore, as a first approximation, this task will perform a survey of current and former UXO-contaminated sites in the U.S. and identify within each site the geographic and site-specific factors. This subtask is divided into four work units to accomplish the required objectives.

- Subtask 4: Dual-mode Navigation Tool (Improved Navigation)

  The execution of Subtask 4 will result in the development of a prototype tool for accurately determining the location of UXO objects. This tool will be handheld or man-portable and will allow two levels of accuracy. In the absolute mode, accuracies on the order of 0.1 m root mean square (rms) could be achievable. In the relative mode, accuracies could reach 0.01 m rms. This subtask is organized into six work units to accomplish the required objectives.

- Subtask 5: Field Deployment of Electronic Data Collection for UXO Recovery Database

  The results of Subtask 5 will result in the development of a field-deployable system that will allow recording of UXO recovery data in the field using a Personal Digital Assistant (PDA). From the field deployable system, the data will be directly uploaded into, and synchronized with, the UXO Recovery Database. In comparison to the development of written reports, this will improve the accuracy of data collection and transcription, reduce data entry costs, and provide a framework for real-time, electronic UXO data management.

  The objectives of this subtask include: 1) using a commercial-off-the-shelf (COTS), or custom-developed software application, to develop a system for onsite entry of UXO recovery data into a PDA / laptop; 2)

demonstrating operation of the application through beta and field testing; and 3) transferring this newly developed technology to the government with the results of a cost-benefit analysis. Ultimate benefits of this subtask include timely and cost-effective access to UXO recovery data, improved access to information for making decisions regarding OE projects, and minimization of the cost and risk of manually transcribing UXO recovery data to the UXO recovery database. This will improve predicting UXO recovery depths, making OE risk predictions, conducting OE sampling, as well as improving OE sweep efficiencies. By expanding the UXO recovery database and allowing easier manipulation and accessibility to the data, the Government can gain an understanding regarding munitions historical penetration nature and use this enhanced understanding to identify the best UXO detection technology for restoration related projects. This subtask is organized into four work units to accomplish the required objectives.

- Subtask 6: Environmental Chamber Migration Testing
  The purpose of this subtask is to assess and evaluate the potential for surface migration of buried UXO in environmentally controlled chambers. The results from this study will be compared to the results from actual field-testing conducted as part of NDCEE Task 307.

  In cold climates, the yearly freeze-thaw cycles can cause buried UXO to migrate towards the surface of the soil. It is hypothesized that the heat-chill temperature cycles experienced in warm climates in conjunction with other geophysical environmental conditions such as soil salinity can also cause buried UXO to migrate towards the ground surface. Surface migration of UXO (in both the cold- and warm-climate regions) is problematic when range areas that have been reported cleared to a certain depth may, in fact, no longer be considered cleared the previously specified depth. This phenomenon is suspected to occur when undetected UXO, or UXO buried to a certain depth, move to the surface due to freeze-thaw cycles or heat-chill cycles. Ultimately, frost-thaw and the heat-chill temperature cycles could cause a “heave” phenomenon, i.e., the lifting of buried UXO towards the soil surface. This phenomenon represents an important risk management factor that must be considered by the regulatory agencies during UXO clearance operations.

  It is further hypothesized that this phenomenon is directly related to the nature of the UXO (i.e., shape, type, and composition) and to soil types and soil factors, such as soil temperature, soil salinity, soil volumetric moisture, and soil-water potential. Accordingly, the migration of buried ordnance as a function of shape, ordnance type and composition, and soil types will be further assessed under controlled environmental conditions using chambers, and validated models. The results from both the chamber and the field studies will allow for a better understanding of the

UXO migration phenomenon and the mechanisms and factors that cause migration.

The Chamber testing will duplicate Task 307 migration test site parameters in an environmental test chamber and assess the potential for migration of buried ordnance both as a result of consecutive freeze / thaw and heat heave cycles. Prior to testing, a test plan will be developed to describe the design of test plots (three plots) and equipment to measure soil parameters that contribute to frost heave in controlled environment chambers to simulate two cold-climate DoD sites and heat heave to simulate warm-climate DoD sites. The goal will be to quantify the movement of buried ordnance during both phenomena. The design will include methods to measure the movement of buried ordnance to coincide with simulated freeze-thaw temperature cycles in cold-climate sites and simulated heat-chill temperature cycles in warm-climate sites. The setup and the experiments will be in test cells or test boxes containing three soil types that have been characterized by a soil scientist. Two soil types will represent cold-climate sites and the third soil type will represent a warm-climate site. The soils will be properly packed under the supervision of a soil scientist to replicate as closely as possible the actual soil bulk density in the field. The test soils will represent three soil types with different soil textures (i.e., various proportions of silt, clay, and sand), moisture content, and soil-moisture potential; three important properties that may influence the occurrence of a heave phenomenon and thus cause the uplifting of buried UXO. The test cells will be designed to be large enough to accommodate placing ordnance of different shapes and sizes in various depths ranging from surface to three feet deep. A reasonable number of freeze-thaw cycles and heat-chill cycles will be applied to the soil to simulate the actual field conditions. It is anticipated that 10 cycles will be applied during a fourteen-month period. Factors such as snow cover, rainfall, and vegetation (simulating the actual conditions in the cold and warm climate sites) will be considered in the test plan. A simulated "worst case scenario" will be conducted and the results documented. Results from this study will quantify the heave displacements of buried UXO and will be used to validate the most prominent available predictive model. This subtask is organized into five work units to accomplish the required functions.

- Subtask 7: Assessment of Munitions Design / Type and Rate of Corrosion and Factors Which Influence Corrosion Susceptibility
  The results of Subtask 7 will provide a thorough understanding of corrosion susceptibility of munition items by determining the environmental factors and design and manufacturing process changes over time that affect rates of corrosion of UXO. By understanding the rates of corrosion, the Government can make better-informed decisions on the prioritization of remediation efforts and can optimize the process, thus

reducing costs while maximizing personnel safety and minimizing environmental risk. This assessment can contribute to developing a better methodology for predicting the corrosion behavior of certain munitions. This subtask is organized into three work units to accomplish the required objectives.

- Subtask 8: Assessment of Ordnance "Dud Rates" Versus Environmental Factors
  The results of Subtask 8 will assess how environmental variables (e.g., soil type and plasticity, soil depth, rock hardness or other factors) may cause the inert120 mm HE mortar round and the 120 mm M931 practice round to split open upon impact. Engineering / physics evaluations using simple linear equations will be used to estimate the affect of soil and rock properties on the integrity of these rounds. These analyses may be supplemented with computer models and corroborated by comparison to collected field data. This subtask is organized into four work units to accomplish the required objectives.
- Subtask 9: Enhanced Munitions Detectability
  DoD ordnance items are designed stringently to function. However, ordnance items do fail to function properly either as a dud or a low order detonation, creating various hazards such as delayed or induced detonation of the explosive charge. These hazards do exist on military ranges and will continue to contaminate ranges as long as ordnance items fail.

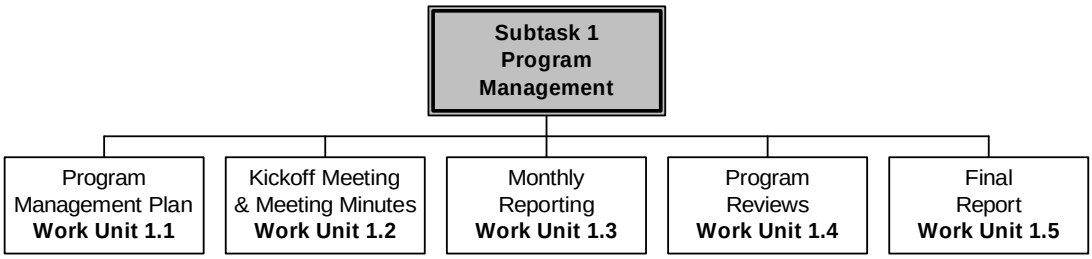
  Eliminating all failed ordnance is obviously a goal of the DoD, but since eliminating all failures is difficult and possibly not a realistic expectation, efforts to reduce the risks posed by failed ordnance can help to reduce the cost, time, and regulatory issues surrounding remediation of military ranges.

  The goal of the Enhanced Munitions Detectability Project is to reduce the threat posed by UXO through the identification of potential solutions to instrument ordnance so that items that fail to function as designed can transmit telemetry about their condition to a portable hand-held receiver. This subtask will investigate the potential of using sensor technologies inserted into ordnance which can instrument basic status of the ordnance and report that status if the ordnance fails to fully function. The solutions developed should be able to report the status of the ordnance in areas such as no function, low order detonation, live fuzes, etc. This subtask is organized into four work units to accomplish the required objectives.
- Subtask 10: Dud Rate and Low Order Detonation Rate Study
  The results of this subtask will provide a more accurate and reliable study of dud rates and low order detonation rates for a broad spectrum of ammunition types by leveraging the results of previous studies and incorporating additional data sets from multiple information sources,

specifically including the ordnance/fuze combinations that are being evaluated under the NDCEE FY02 Task 307, Subtask 7. Subtask activities will include: assessment of dud and low order detonation rates for a variety of ammunition types or subsets for which data were collected; a data gap analysis to identify data limitations (i.e., Navy and/or Air Force specific munitions); preparation of an electronic database (e.g., Microsoft ACCESS) that will allow the user to determine dud rates and low order detonation rates as an item, in combination or as a subset, in accordance with CDRL A024; and, preparation of a technical report to document subtask activities and findings, in accordance with CDRL A023. This subtask is organized into four work units to accomplish the required objectives.

- Subtask 11: Assess Extent of UXO "Dud" Problems Associated with the Use of Old Inventory Ordnance by the U.S. Department-of-Interior for Avalanche Control in Mountainous Regions - Is There a Better Solution?
  The results of Subtask 11 will provide comprehensive, in-depth and consolidated information on the extent and potential causes of UXO associated with the use of old DoD inventory ordnance for avalanche control and will identify possible new solutions to meet avalanche control needs. This information will enable the Government to modify existing, or develop new, technical and/or administrative requirements that will help mitigate the causative factors for this UXO, which will ultimately lower the dud rates and correspondingly reduce the UXO safety hazards and UXO clearance costs associated with this avalanche control practice. This subtask is organized into four work units to accomplish the required objectives.
- Subtask 12: Development of Time and Cost Trade-off Tool
  This subtask will result in the development of a Cost Trade-off Tool in the form of a spreadsheet. In short, the tool will provide a user straightforward time and cost estimates to allow project trade-off calculations at various stages of UXO mitigation (e.g., detection and characterization, technology selection, excavation, removal, etc). The tool will allow estimation (i.e., engineering estimates) of relative costs and proficiency gains. The tool will allow the Government to straightforwardly and consistently evaluate the potential cost and time of various approaches for UXO mitigation at a project site. Upon completion of this subtask, the Government will be able to quantify the cost effectiveness of various remediation/ assessment approaches in selection of the best UXO mitigation approach for the resources allocated and situation encountered. This subtask will be divided into four work units to accomplish the required objectives.

Subtask 1: Program Management



Subtask 1 is further divided into five work units to accomplish the requirements of the SOW:

- Develop a Program Management Plan (PMP) to act as the Technical and Management work plan, in accordance with CDRL A001,
- Complete a kickoff meeting with an experienced Project Team, including Government stakeholders, and submit meeting minutes for review and approval, in accordance with CDRL A003
- Prepare monthly reports, in accordance with CDRL A002, to document project progress and manage the technical, cost, and schedule approach to accomplish the UXO Task 318 SOW
  - Systematic interfacing with the Government
  - Management and coordination of all Subtasks
- Coordinate and host three In Progress Reviews (IPRs) and a "wrap-up" review meeting in accordance with CDRL A004
- Submit a summary final report, in accordance with CDRL A028.

Work Unit 1.1: Program Management Plan (PMP)

The NDCEE has prepared and developed this Program Management Plan (PMP), in accordance with CDRL A001 (DI-MGMT-81117), which addresses the activities and associated milestones required by the SOW and describes the management approach to executing and controlling this task. It includes and describes specific management plans and controls, technical approaches to be taken, the corresponding levels of effort required for each subtask, a project schedule with milestones, risk management, and a projected expenditure curve. This PMP contains a project organization chart depicting the names, types and the expertise of personnel assigned to each task, including contractor personnel and their involvement in the task.

This PMP includes a Contract Work Breakdown Structure (CWBS) that indicates resources and project tasks, which serve as a basis for program and technical planning, scheduling, cost estimating, resource allocation, performance management, configuration management, and status reporting. A Gantt chart that defines each project phase, schedules, and deliverables will also be included. The PMP will be revised and updated, as required, to correspond with necessary changes in task

execution. Any leasing of equipment, or changes in cost, schedule or scope of the SOW that were not included in the approved proposal will require written approval from the Government prior to initiation. This PMP is considered a working document, subject to change as necessary.

This Draft PMP has been prepared and submitted to the Government within 30 days after contract award (DACA) and the Government will have up to 30 days to review and comment. The Final PMP will be submitted 30 days after receipt of Government comments on the Draft PMP.

Work Unit 1.2: Kickoff Meeting & Meeting Minutes

To ensure timely execution of task activities and to accomplish the requirements of the SOW, NDCEE will conduct a task kickoff meeting with Project Team members, including but not limited to, Government representatives from the following organizations:

- U.S. Army Environmental Center (USAEC), Aberdeen Proving Ground, Maryland
- U.S. Navy Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV), Indian Head, Maryland
- U.S. Air Force Research Laboratory, Tyndall AFB, Florida
- U.S. Army Corps of Engineers (USACE), Huntsville, Alabama
- U.S. Army Corps of Engineers (USACE) Waterways Experimental Station (WES), Vicksburg, Mississippi
- Technical Support Working Group (TSWG) for NDCEE
- U.S. Army Aberdeen Test Center, Aberdeen Proving Ground, Maryland
- Environmental Security and Technology Certification Program (ESTCP)
- Strategic Environmental Research and Development Program (SERDP)
- U.S. Naval Facilities Engineering Service Center (NFESC)
- Joint UXO Coordination Office (JUXOCO).

The USAEC Technical Monitor will suggest Points-of-Contact (POCs) to NDCEE from the aforementioned organizations and others, as appropriate, who will be contacted and invited to participate as a member of the UXO Project Team.

The Kickoff Meeting is to be held via video-conferencing at the *CTC* facility in Johnstown, Pennsylvania within 30 DACA. Within 15 days following the meeting (and all subsequent major meetings), the NDCEE will prepare and distribute minutes of this meeting for review and approval, in accordance with CDRL A003 (DI-ADMIN-81505). Also, the NDCEE will actively participate in UXO related information exchanges, including the 2004 UXO Countermine Forum, the 2003 and 2004 ESCTP / SERDP Technical Symposiums and Workshops, and two ITRC UXO Meetings (2003 and 2004).

In addition to maximize team communication, the NDCEE will prepare and distribute minutes of all related UXO Task 318 face-to-face meetings and teleconferences conducted during the period of performance (POP).

Work Unit 1.3: Monthly Reporting

The NDCEE will prepare and submit to the Government, by the 15th day of each month, a report that describes task activities for the previous month and anticipated activities for the upcoming month, and compares the current status of the actual task costs and progress to the proposed task schedule and resources. This report will specifically contain the following information:

- Schedule, technical, travel and cost status
- Highlights of work planned by NDCEE during this period
- Discussions of any problems or obstacles encountered and the actions taken to remedy the situation
- Highlights of work planned by the contractor for the next reporting period.

The NDCEE will submit this report to the Government, in accordance with CDRL A002 (DI-MGMT-80227), in both hard copy and electronic format using Microsoft Word. Also, biweekly teleconferences will be held with the UXO Project Team to ensure timely dissemination of task information among the team members.

Work Unit 1.4: Program Reviews

The NDCEE will coordinate three UXO In Progress Reviews (IPRs) and a "wrap-up" review during the POP of this Task. *CTC* recommends that the UXO Task 318 IPRs be held in conjunction with the UXO Task 307 IPRs and other Program Reviews that are tentatively scheduled for August 2003, February 2004, and September 2004. Holding the IPRs for both UXO Tasks, 307 and 318, along with other Program Reviews (i.e., NDCEE Program Reviews) will maximize the potential for Governmental and stakeholder participation during the reviews.

Following the proposed schedule above, the first IPR will take place approximately five months after contract award (MACA), the second IPR will take place approximately six months after the first IPR, and the third IPR shall take place approximately seven months after the second IPR. The IPRs are to be held in Johnstown, Pennsylvania, Washington D.C., and Johnstown, Pennsylvania, respectively, and in accordance with the other tentatively scheduled IPRs / Program Reviews. Travel, attendance, and participation in the IPRs have been provided for primary technical personnel.

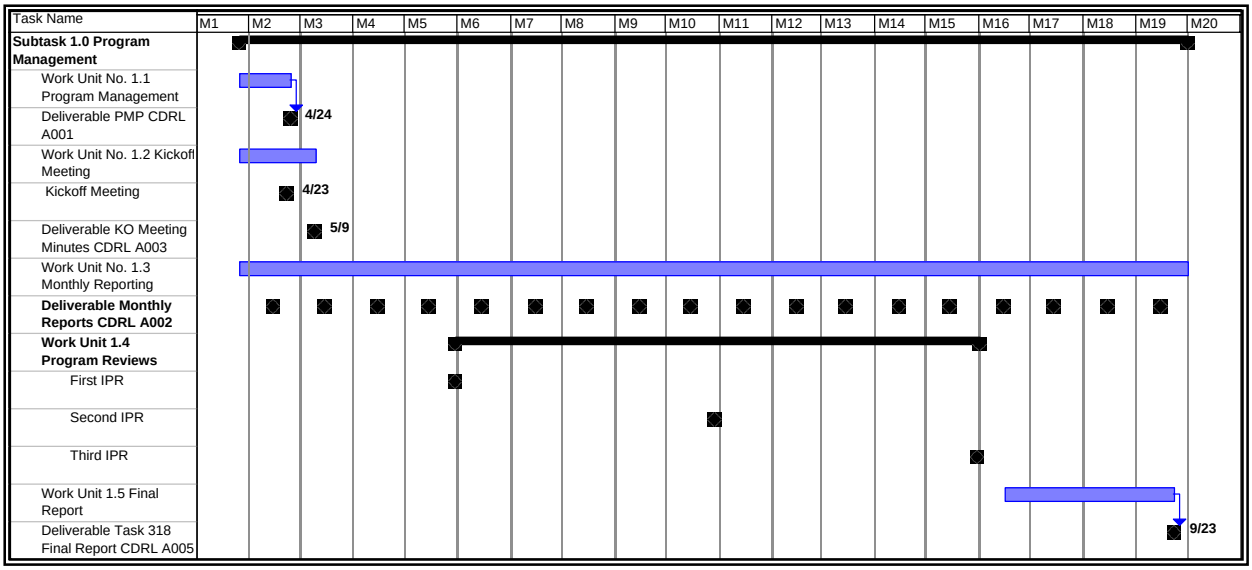
The NDCEE will prepare a comprehensive status report for presentation at each IPR, in accordance with CDRL A004 (DI-ADMIN-81373). Specifically, quad charts will be prepared for the overall UXO Task 318 and each Subtask, which will be accompanied by additional slides, if necessary, to provide additional information (e.g., resource curves, detailed Gantt charts with subtask work percentage complete, products / milestones, accomplishments, etc.).

Work Unit 1.5: Final Report

The NDCEE will prepare a Final Summary Report for all activities conducted under this effort within 548 DACA, in accordance with CDRL A028 (DI-MISC-80508). The report will include a summary of all subtasks and accomplishments, data summary, lessons

learned, costs, and conclusions and recommendations. In addition, the final reports for each subtask will be included in the Final Summary Report as appendices. A final report will be submitted 30 days after receipt of Government Comments on the Draft.

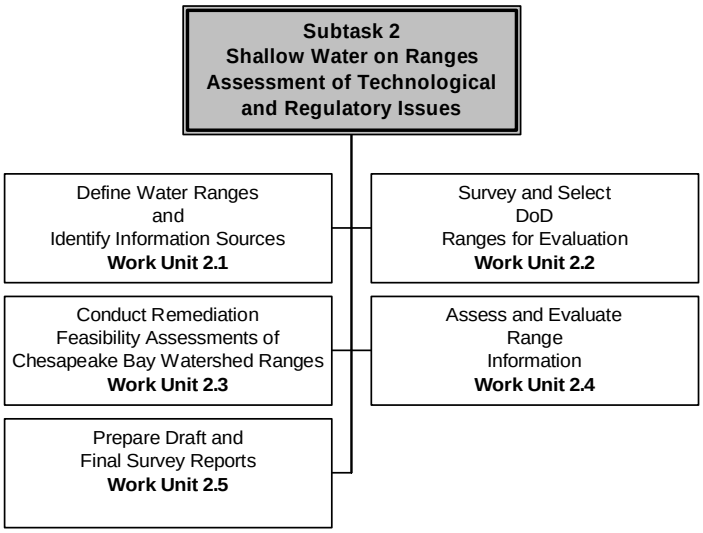
Schedule



Point of Contact

Concurrent Technologies Corporation
(814) 269-6255

Subtask 2: Assess Extent of Shallow Water on Ranges, Identify and Assess Technological Impediments to Remediation, and Associated Regulatory Issues



Subtask 2 is organized into five work units to accomplish the required objectives. The following provides an overview of the five work units:

- Using the established definition of shallow water ranges identify information sources that are pertinent to Subtask objectives and that can serve to meet the goals of determining the extent of the shallow water range UXO contamination problem and provide insight into remediation alternatives and contribute to formulation of cleanup strategies.
- Survey, assess, and evaluate information sources identified in Work Unit 2.1 that provides a logical representation of the broad shallow water range problem. During this process two ranges in the Chesapeake Bay Watershed will be selected to serve as case studies for detailed analysis and inclusion in the survey report.
- Conduct a Remediation Feasibility Assessment of two Chesapeake Bay Watershed shallow water ranges, one of which will be a tidal wetland. From this effort remediation options will be derived that will include cost analysis and environmental impact. The effectiveness and failure or shortcomings of existing engineering and institutional controls will be assessed.
- The remainder of the ranges identified under Work Unit 2.2 will be assessed and their status (e.g., active, closed, transferred, or transferring, etc.) determined, where they are located, their real extent, and physical descriptions of each to include surface water, depth, and presence of wetlands.
- Prepare draft and final survey reports that present the results of assessments and evaluations conducted under Subtask 2. The final survey report will provide valid documentation that can be used by Government decision

makers to plan, program, and budget for future remediation and cleanup of shallow water ranges. The survey report will be submitted in accordance with CDRL A005 (DI-MISC-8050). Information generated by this effort will be incorporated into an easily searchable electronic database that will form the knowledge base for any required follow-on efforts.

Work Unit 2.1: Define Water Ranges and Identify Information Sources

For purposes of this subtask shallow water ranges are defined as ranges that are covered with 10 feet of water or less and may be wholly or partially covered with water as a function of seasonal or meteorological fluctuations.

NDCEE personnel will conduct a comprehensive search of the retrievable literature sufficient to identify all significant published reports with focus on UXO in or on shallow water ranges and select documentation resulting from this search that contributes to achieving subtask objectives. Sources of information to be examined will include, but not be limited to, legacy data, government reports, UXO databases, and information obtained from participating stakeholders and subcontractors. Additionally, efforts will be made to identify and retrieve unpublished reports, informal studies and interview persons knowledgeable on the subject and document these interviews.

To assist in this process and to ensure a broad range of technical expertise is available, NDCEE will establish a stakeholder group with membership consisting of persons with experience in and responsibility for shallow water ranges. Active participation and an effective dialog among participants will be strongly encouraged. Efforts will be made to effectively integrate stakeholders into all aspects of the subtask. Major elements of this Work Unit include identification and retrieval of:

- Published literature / government technical reports / general accounting office reports, etc. that document the real extent of non-tidal and tidal water on ranges, and those with emergent wetlands.
- Draft reports, unpublished literature, research communications and documentation including SERDP / ESTCP and service-sponsored work, pertinent websites, etc.
- Personal interviews with Government, contractor, and other personnel knowledgeable in the area, or who have some degree of oversight responsibility for shallow water ranges.
- Periodic interactions among members of NDCEE and stakeholders to review status, identify information and sources, and to determine its quality and applicability to the goals of the Subtask.

The product of this Work Unit will be a bibliographic listing and hard copies of information will be used to survey, select, conduct feasibility assessments, and assess and evaluate the shallow water range issue in later Work Units.

NDCEE will utilize subcontractors to assist in compiling existing data from their archives to eliminate duplication of effort wherever possible.

Work Unit 2.2: Survey and Select DoD Ranges for Evaluation

NDCEE Personnel will survey, assess, and evaluate information sources and documentation identified and acquired during Work Unit 2.1 and to use this information to identify and select ranges for more detailed evaluation. Literature and other documentation identified and gathered will be:

- Reviewed and analyzed with an emphasis on determining the national magnitude and related challenges of shallow water on ranges.
- Evaluated to identify steps, if any, which are being taken to alleviate UXO problems on shallow water ranges.
- Used to determine the technologies being employed to identify and remediate UXO contamination on shallow water ranges.

During this effort information on the magnitude of the shallow water range issue will emerge and will include the identification of two shallow water ranges within the Chesapeake Bay Watershed to serve as case studies, one which will be a tidal wetland.

The product of this Work Unit will be a general listing of DoD shallow water ranges and two ranges in the Chesapeake Bay Watershed that meet the requirements indicated above.

Work Unit 2.3: Conduct a Remediation Feasibility Assessment of Two Chesapeake Bay Watershed Ranges

NDCEE personnel will analyze the two identified Chesapeake Bay Watershed ranges from Work Unit 2.2 and conduct a remediation feasibility assessment of each. The remediation assessment will:

- Identify remediation options, if any, and identify technological limitations to remediation.
- Include cost analyses and potential environmental impacts of these options, if any are identified.
- Include indications of the effectiveness, failure or shortcomings of existing engineering and institutional controls.
- Identify technical shortcomings of detecting, characterizing, and remediating UXO in or on shallow water ranges.
- Identify and discuss key regulatory implications for these ranges.

NDCEE will prepare a draft remediation feasibility assessment of the two Chesapeake Bay ranges that compiles the information and results of the assessment discussed above. The feasibility assessment will be incorporated into the draft summary report.

Work Unit 2.4: Assess and Evaluate Range Information

NDCEE personnel will assess and evaluate some specific ranges identified in Work Unit 2.2, excluding the two ranges selected from the Chesapeake Bay Watershed, and their status determined. Information derived during the analysis will include:

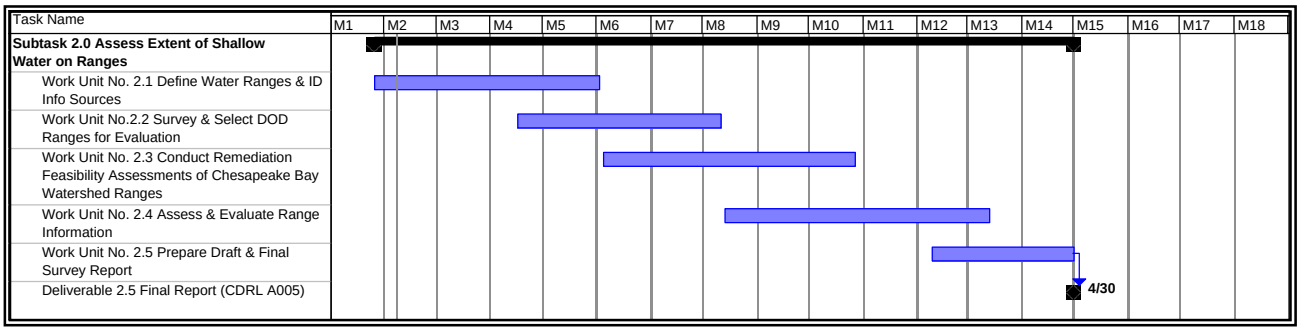
- The status of the range (i.e., active, closed, transferred, or transferring, etc).
- The location, real extent, and physical descriptions to include surface / near surface water and its variability, depth, and presence of wetlands.
- State and Federal regulators, regulatory mechanisms, and interested stakeholders for ranges included in the report.
- Any remediation requirements that serve as drivers and any technical and / or regulatory impediments to successful implementation and execution of remediation activities.
- The effectiveness, successes and / or failure or shortcomings, of existing engineering and institutional controls.
- Key regulatory implications for these ranges.

Work Unit 2.5: Prepare Draft and Final Survey Reports

NDCEE will prepare a draft survey report that compiles the information obtained during execution of each previous Work Unit. The report will reflect the assessment, evaluation, and analysis of the shallow water range issue. The draft survey report will be provided to the Government for review and approval.

NDCEE will prepare a final survey report on shallow water ranges that reflects the comments and guidance of the Government. The final report will provide valid documentation as to the magnitude of the shallow water range issue, technical and regulatory factors that impede or limit cleanup, and can be used by Government decision makers to plan, program, and budget for future UXO remediation and cleanup of such ranges.

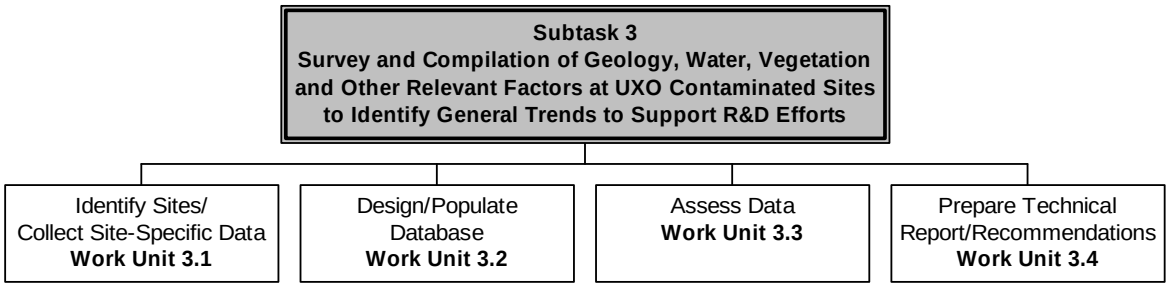
Schedule



Point of Contact

Concurrent Technologies Corporation
(850) 833-9350

Subtask 3: Survey and Compilation of Geology, Water, Vegetation and Other Relevant Factors at UXO Contaminated Sites to Identify General Trends to Support Research & Development Efforts



Subtask 3 is divided into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- Conduct technical literature and Internet searches for the names, locations, and existing information of active and inactive UXO sites and ranges throughout the United States. Collect information for site-specific factors (i.e., soil types, land use, geology and hydrology, vegetation, size, and topography).
- Design, build and populate a standard database with existing or previously collected information on UXO sites and ranges throughout the U.S.
- Perform an assessment of the data that compares and contrasts the differences of the UXO sites in the U.S. Perform a comprehensive assessment of both active and former UXO sites and ranges and compile a database of locations and real extents of ranges. This information will then be used to determine the locations for possible additional standardized UXO detection test sites. This information will also improve the selection of detection equipment based on the site-specific differences.
- Prepare a summary report of the findings of this Subtask by compiling pertinent information and establish a knowledge base essential for the research and development.

Work Unit 3.1: Identify Sites and Collect Site-Specific Data

This task focuses on researching historical and current data to determine the locations and names of active and inactive UXO sites within the United States. NDCEE will use data from the following sources as well as other sources that may yet be identified. These examples are not intended to be all-inclusive:

- Soil Survey Reports and Soil Sampling Reports
- Forest Service Reports
- USGS Maps
- State and Local public domain maps

- Range Information Management System (RIMS), Environmental Assessment Division (EAD), Argonne National Laboratory, Illinois, if available
- Individual Services' Real Property Inventories, (i.e., Army – HQ Army Integrated Facilities System (IFS), Navy – Navy Facilities Assets Database (NFADB), and the Air Force's Real Property Asset (RPA) database, if available)
- Geological / Topography Reports
- Removal Action Reports.

NDCEE will determine site-specific factors including: soil, land use, geology, hydrogeology, vegetation, wetland types, wetland / watershed ratio, topography and terrain. For example, the following data will be collected:

- Soil Data
- Land Use Data
- Geology of Site
- Topography of Site
- Vegetation of Site
- Hydrology of Site
- Size of Site

NDCEE will utilize subcontractors to assist in compiling existing data from their archives to eliminate duplication of effort wherever possible.

Work Unit 3.2: Design and Populate Database

NDCEE will design and structure a database and subsequently enter this information into it. NDCEE will make every effort to utilize existing relevant data from previous work performed for the DoD, analyze that data and incorporate it into the final database. A database will be populated with information found primarily in thorough searches of information and technical reports from projects where UXO has been recovered.

Work Unit 3. 3 Assess Data

NDCEE will assess the data by evaluating database elements, and interpreting the collected information. A comparison of the information will be conducted and differences between the UXO sites will be extracted. Examples of such comparisons and differences between UXO sites will be based on the collected information. NDCEE will make the following comparisons based on the collected information:

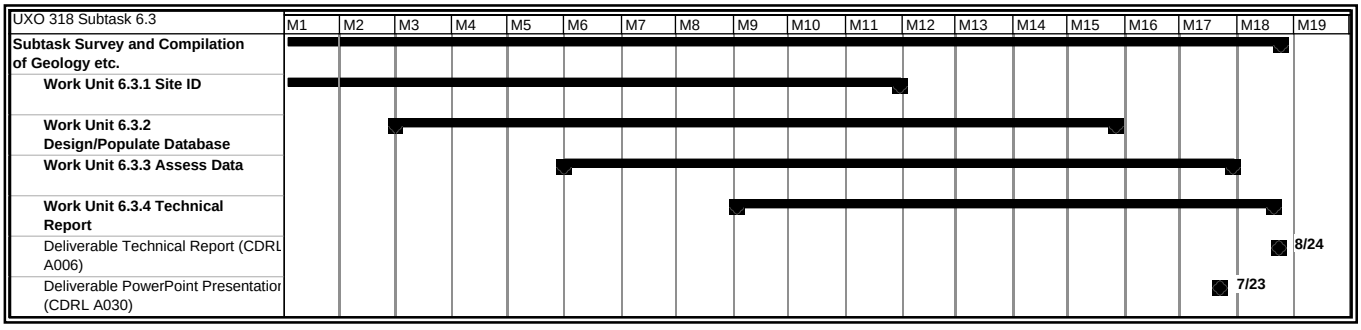
- Soil Data
  - Deep
  - Shallow
  - Organic
- Land Use Data
  - Urban
  - Rural

- Geology of Site
  - Alluvial
  - Weathered in place
  - Wind Carried
- Topography of Site
  - Mountainous
  - Hilly
  - Flat
- Vegetation of Site
  - Wooded
  - Grassland
  - Barren
- Hydrology of Site
  - Wetlands ratio
  - Submerged
  - Dry
- Size
  - Under 500 acres
  - 500-5,000 acres
  - Over 5,000 acres

Work Unit 3.4: Prepare Technical Report and Recommendation

NDCEE will use the technical database and analyzed information to provide a comprehensive report on all UXO sites within the continental U.S. This information and database will be for R&D purposes only.

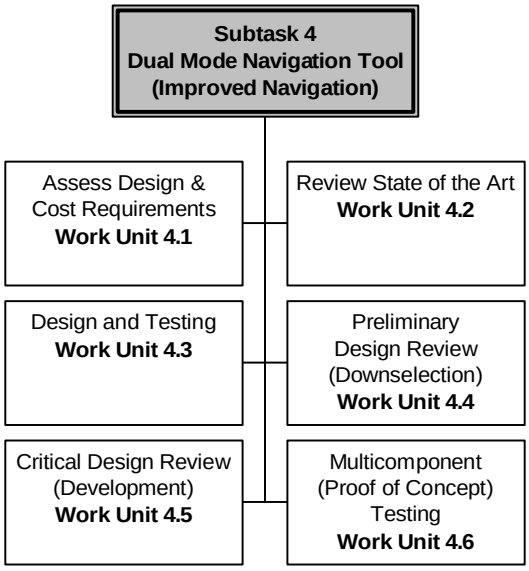
Schedule



Point of Contact

Concurrent Technologies Corporation
(619) 725-5014

Subtask 4: Dual-mode Navigation Tool (Improved Navigation)



Subtask 4 is organized into six work units to accomplish the required objectives. The following provides an overview of the six work units:

- Assess Design / Design Cost Requirements: the goal of this activity is to determine the technical and performance specifications of the Dual-mode Navigation Tool.
- Review Current State-of-the-Art: the goal of this work unit is to assess the current state-of-the art in positioning systems and positioning system manufacturers.
- Design and Testing: the goal of this work unit is to develop preliminary designs delineating the components of systems that would meet the technical performance and operational requirements for the Dual-mode Navigation Tool. The design(s) will be evaluated through a series of laboratory testing with an emphasis on signal degradation measurement.
- Preliminary Design Review (PDR): the preliminary design(s) of the sub-systems that produced the best test results will be reviewed by the stakeholder team and the task monitor to ensure that all the requirements and specifications have been addressed in the design and are potentially achievable.
- Critical Design Review: the goal of this work unit is to further refine / define the preliminary design with additional detail and specifications, resulting in a critical design from which components / modules can be selected for future development to physical (packaging) and functional specifications. The critical design will be reviewed by the stakeholder team and task monitor prior to multi-component testing.
- Multi-component (System) Testing and Evaluation: the goal of this work unit is to integrate the aforementioned breadboard systems and to perform field testing under operational conditions.

Work Unit 4.1: Assess Design/Design Cost Requirements

The NDCEE team will determine the technical and performance specifications of the Dual-mode Navigation Tool based on input from the stakeholder team and UXO personnel/EOD technicians.

Performance factors, which may affect requirements, include signal propagation effects, communication (both voice and data), interface specifications for commonly used survey instruments, processor requirements for determining positions at the proper update rate for man-portable applications, potential geographical scenarios, and input from the user community regarding operator interfaces, displays and other user features.

The NDCEE team will establish the stakeholder team composed of leaders in the field of positioning systems/GIS and users of these systems. As previously stated, this team will be leveraged to provide input to help ensure the proposed requirements will best serve the end-user. Notably the subtask team will leverage the ESTCP project entitled "Innovative Navigation Systems to Support Digital Geophysical Mapping," being conducted by Mr. Scott Millhouse, PE, of the U.S. Army Corps of Engineers (USACE) - Huntsville, which is investigating and evaluating current positioning systems.

In addition to technical design requirements, cost drivers will be determined to identify cost trade-off opportunities. The NDCEE team will document the results of this work unit in the System Decision Paper.

A trip to the NDCEE IPR for briefing Subtask 4 is scheduled under this work unit.

Work Unit 4.2: Review Current State-of-the-Art

The NDCEE team will compare the specification for current state-of-the-art positioning systems against the design requirements identified in Work Unit 1 to determine which of these systems, if any, can be modified to meet the design specifications, or if a "bottoms-up" design will be required. In particular, the cost vs. performance for these systems will be evaluated. The results of the aforementioned ESTCP project will be considered and incorporated as appropriate into this work unit. The NDCEE team will document the results of this work unit in the System Decision Paper.

A trip to the NDCEE IPR in Washington, D.C. is scheduled under this work unit.

Work Unit 4.3: Design and Testing

Design requirements will be met by modifying existing hardware and/or by bread boarding using either electronic hardware modules/subassemblies or discrete components, depending on the availability of electronic modules for the technologies selected. Bread boarding with discrete components will be a more labor-intensive process; therefore, modification will be the preferred approach, if possible.

The design will incorporate the applicable specifications for each of the components, including identification of currently available components (manufacturer, part number, etc.), either modular or discrete. Preliminary circuit designs will be generated to the degree required for functional testing. The components will be configured to provide both modes of operation and may utilize more than one type of technology, such as laser and RF. The NDCEE team will generate a draft Test Plan for the component and multi-component testing, which delineates the test procedures and evaluation criteria in accordance with CDRL A008, and will submit these test plans for Government review within 120 days after contract award (DACA).

The NDCEE team will document the results of the component testing in a draft Test Report in accordance with CDRL A009, which will be submitted within 60 days of testing completion. The Test Report will be used to make a go/no-go decision regarding the feasibility of these technologies to meet the requirements and the initiation of subsequent work units.

Work Unit 4.4: Preliminary Design Review (PDR)

The stakeholder team and task monitor will be requested to review the preliminary design(s). The optimum preliminary design will serve as the basis for the critical design. The NDCEE team will submit design documents to the Government and the stakeholder team prior to the preliminary design review. The NDCEE team will make every effort to establish a face-to-face meeting of the stakeholder team to conduct the PDR. If schedules or travel restrictions make this meeting infeasible, a teleconference and/or videoconference will be conducted.

The preliminary design will be subjected to a functional/physical audit against the specifications and requirements. A trip to the NDCEE IPR in Johnstown, Pennsylvania will be taken under this work unit for briefing this subtask. In addition, the NDCEE IPR will be suggested as a potential opportunity to conduct the face-to-face PDR meeting. The NDCEE will record and report the results of the PDR in the draft System Decision Paper.

Work Unit 4.5 Critical Design Review

The NDCEE team will ensure that the critical design is reviewed by the stakeholder participants and the task monitor prior to multi-component testing, ensuring the design will meet the stated specifications and requirements. All proposed modifications received during the critical design review would be documented in the meeting minutes and the draft System Decision Paper, and incorporated into the design, where feasible.

Work Unit 4.6: Multi-component (System) Testing and Evaluation

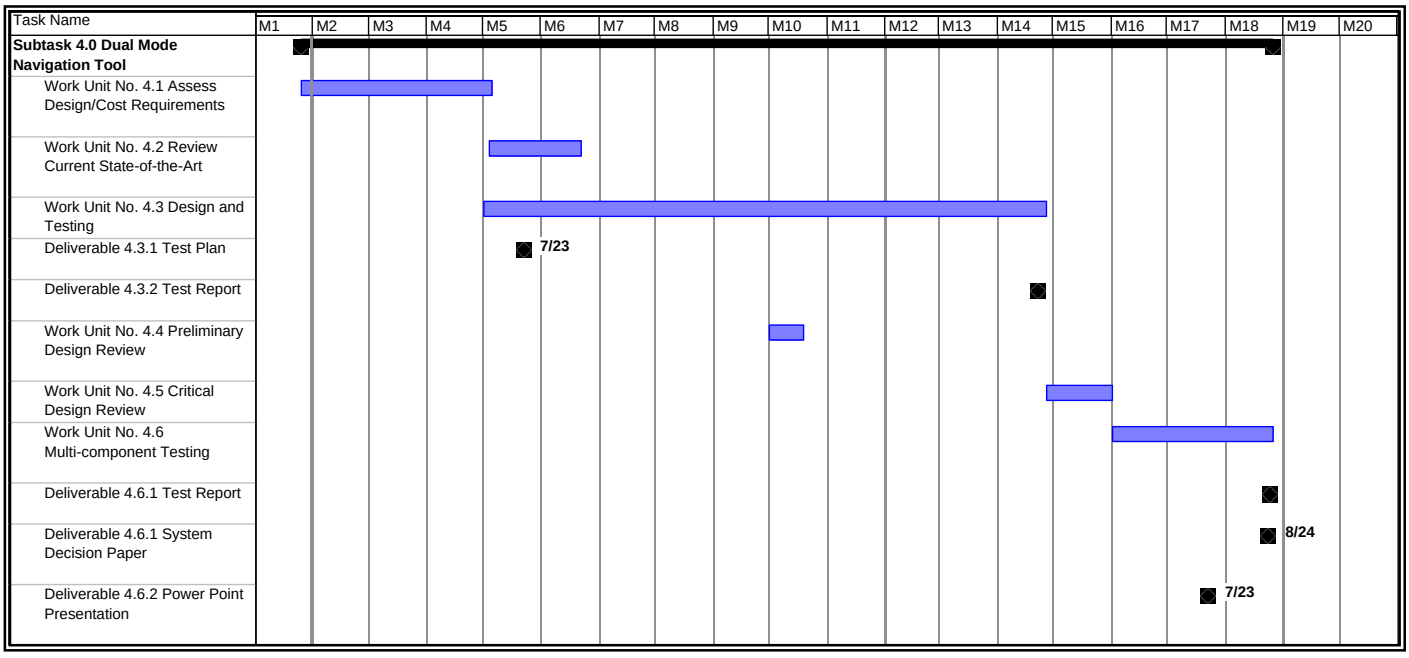
The primary purpose of this testing is to determine if the functional prototypes can operate in proximity to each other without cross-coupling/mutual interference that could degrade their functionality and to evaluate if the integrated system meets the established requirements to the greatest extent possible.

Since this subtask is a hardware design effort, and software development is not part of this subtask, only physical effects (attenuation, phase shift, etc.) of the position data signals will be evaluated. Positional accuracy will be extrapolated from the measured physical affects.

A trip to Aberdeen Proving Ground will be made to perform field evaluations under a variety of operational scenarios. The NDCEE team will note any system deficiencies and will recommend potential solutions. Also, a determination as to the feasibility, including both technical and cost, of implementing a Dual-mode Navigation Tool utilizing the critical design components will be provided.

The NDCEE team will generate a Test Report (CDRL A009) that documents the results of the multi-component testing that will be submitted within 60 days after completion of the multi-component testing. A 20-minute Microsoft PowerPoint presentation documenting the background, approach and results of this subtask will be prepared in accordance with CDRL A030. The System Decision Paper, which will be prepared in accordance with CDRL A007 (DI-MISC-80508) and will be submitted within 518 DACA, will be developed under this work unit.

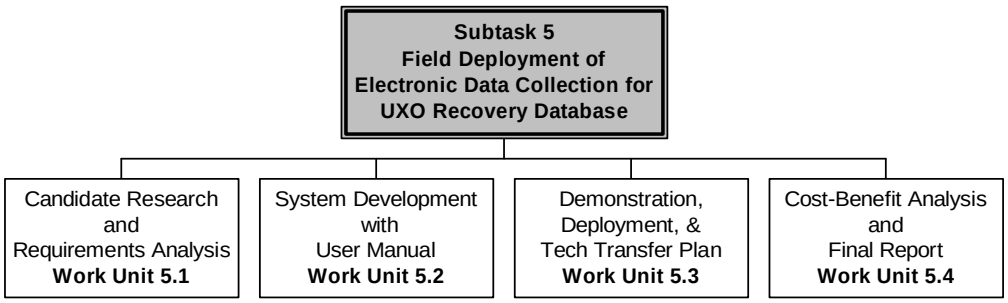
Schedule



Point of Contact

Concurrent Technologies Corporation
1-888-226-5962

Subtask 5: Field Deployment of Electronic Data Collection for UXO Recovery Database



Subtask 5 is organized into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- Work Unit 1: Candidate Research and Requirements Analysis will consist of gating input from key stakeholders and broad research to determine application requirements and the best approach to achieve subtask objectives.
- Work Unit 2: System Development with User Manual will support the development of a wireless field application for on-site entry of UXO recovery data along with all system documentation and a User Manual.
- Work Unit 3: Demonstration, Deployment, and Technical Transfer Plan will be comprised of conducting beta and field testing; demonstrating and deploying the system; preparing a plan for transfer of the application to the Government; and, delivery of the system with documentation.
- Work Unit 4: Cost-Benefit Analysis and Final Report will constitute leveraging the U.S. Army Cost and Economic Analysis Center (CEAC)-compliant CBA methodology and reporting indicators such as payback and return on investment of the system along with a summary of all task activities.

Work Unit 5.1: Candidate Research and Requirements Analysis

Work Unit 5.1, Candidate Research and Requirements Analysis, will consist of conducting research to identify candidate hardware and software systems, providing support for the selection of the best candidates, and garnering stakeholder input for the development of system requirements. The possibility of incorporating a Geographical Information System (GIS) interface will also be researched in this work unit. Research and requirement definition is the first and most critical step in the development of the Field Deployable UXO Recovery Database application.

The objectives of this work unit are to identify the best hardware/software system candidates for development and to determine requirements for the system that will best meet the needs of end users. The end product of this work unit will be a System Requirements Document that will be used internally in the development of a Design Document and Test Plan as well as in the development of the field-deployable system.

A stakeholder meeting will be conducted during the early stage of the project (e.g., month 2 or 3) to solicit input from key stakeholders. Stakeholders such as the USACE – Huntsville, Navy, other USACE organizations, and National Association of Ordnance and Explosive Waste (OEW) Contractors (NAOC), will be encouraged to participate to assure quality input toward the development of the field-deployable system. This meeting will be held via teleconference and will facilitate communication of multi-service expectations. NDCEE personnel will provide research results and recommendations for candidate systems. Stakeholders will provide input toward the requirements and end-user scenarios for the development of the System Requirements Document. Effective communication will provide valuable insight for management of this subtask.

The Requirements Document will include specific sections for definition of general system requirements (hardware and software along with development tools and languages) and user interface requirements for data entry, quality control, and system administration. An additional end-user scenarios section will be included to provide insight for the development team as to who may be using the system and for what purpose.

The System Requirements Document will be completed in draft form and provided to the stakeholders for review. Comments will be addressed in the development of an interim final document. However, revision of the document will continue through the beginning of Work Unit 5.2 in order to resolve programming issues that may arise during the initial phases of development. Discrete packages associated with this work unit are described below.

- Collection and organization of information for candidate systems and GIS interface.
- Development of recommendations and presentation at Kickoff meeting with key stakeholders to determine best candidate system and requirements for development.
- Development of the Draft Systems Requirements Document based on non-biased research and stakeholder input.
- Development of the Interim Final System Requirements Document based on review and comment from stakeholders.
- Continued refinement of the System Requirements Document as development of the system begins.
- Completion of the Final System Requirements Document with programming issues resolved.

Work Unit 5.2: System Development with User Manual

Work Unit 5.2 will lead to the development of the Field Deployable System for the UXO Recovery Database and developing a User Manual to assist in training end users. The objective is to provide the Government with a portable system that can be used for

onsite entry of UXO recovery data during UXO excavation. The product of this work unit will be a Beta Field Deployable System that can be reviewed and tested.

Initiation of this work unit will include development of a Design Document based on the Requirements Document from Work Unit 5.1. This work unit will also allow for the procurement of hardware and software tools required. Specifically, a PDA field unit and a Windows CE Toolkit will be procured. At the end of the task, the PDA field unit will be transitioned to the government.

Actual programming of the system will begin with a Prototype System for stakeholder review. Based on comments received on the prototype, programming of the Beta System will commence. Programming the Beta System will constitute the majority of Subtask 5 and specifically of Work Unit 5.2.

Development of the User Manual will occur during the final stages of Work Unit 5.2. The User Manual will provide general use instructions for the Field Deployable System. It will be written in a manner consistent with the technical level of understanding for projected end users. Screen shots will be provided, where possible, to assist in ease of use and understanding.

Work Unit 5.2 is expected to last approximately nine months, beginning in Month 6 and ending in Month 14. As stated above, the beginning of this work unit will overlap Work Unit 5.1 for two months. This is necessary to refine the System Requirements Document based on the resolution of potential programming issues. In addition, Work Unit 5.3 will commence during the final two months of this work unit to allow for testing, demonstration, deployment, and transition activities that are associated with development. Discrete packages associated with this work unit are described below.

- Development of the Design Document and procurement of required hardware and software.
- Development of the Prototype System.
- Collaboration with key stakeholders to review prototype and respond to comments.
- Commencement of Beta System programming.
- Continuing beta programming coordinated with development of the User Manual.
- Collaboration with key stakeholders to review beta and respond to comments.
- Revision of Beta Version and production of Final Version.

Work Unit 5.3 Demonstration, Deployment and Technical Transfer Plan

Work Unit 5.3 will consist of planning and executing demonstration, deployment and technical transfer of the Field-Deployable System. The objective is to ensure that the system meets the needs of the government and that users are appropriately trained in system use. The product of this work unit will include the system, all system

documentation including source code, and a user manual, as well as a Technical Transfer Plan for deployment of the system.

Demonstration and deployment will commence with development of a Test Plan based on the System Requirements Document in Work Unit 5.1. Revision of the Test Plan will follow a stakeholder review and comment period, after which execution of the Test Plan will begin.

The Beta Test will overlap system development in Work Unit 5.2 to allow resolution of development issues that may arise during testing. When all issues are resolved, the system passes from Beta Version to Final Version.

The Field-Deployable System Final Version will be used for the demonstration. Three NDCEE experts will travel to Huntsville to demonstrate the Final Version. Field deployment of the Final Version will also require three NDCEE experts to travel onsite to an undetermined location (assumed Huntsville) to perform data entry in a live UXO excavation scenario.

Development of the Technical Transfer Plan will be based on results of the previous demonstration and deployment. The stakeholders will review the plan and issues will be resolved prior to final delivery of the Technical Transfer Plan.

The Deliverables for Work Unit 5.3 include:

1. Field-Deployable System Final Version with PDA Field Unit and documentation including source code, and User Manual
2. Technical Transfer Plan.

Work Unit 5.3 is expected to last approximately six months beginning in Month 13 and overlapping Work Unit 5.2 for the first two months. This overlap will provide the opportunity for resolution of development issues that may arise during testing, demonstration, and deployment of the system. This work unit will also overlap Work Unit 5.4 for the final four months of the Subtask. Discrete work packages associated with this work unit are described below.

- Development of the Test Plan based on the System Requirements Document.
- Revision of the Test Plan based on Stakeholder review.
- Execution of the Test Plan.
- Demonstration and Deployment of the Final Version, Development of the Technical Transfer Plan.
- Delivery of Final Version System with documentation including source code, user manual, and delivery of the Technical Transfer Plan.
- Stakeholder review and resolution of comments.

Work Unit 5.4: Cost-Benefit Analysis and Final Report

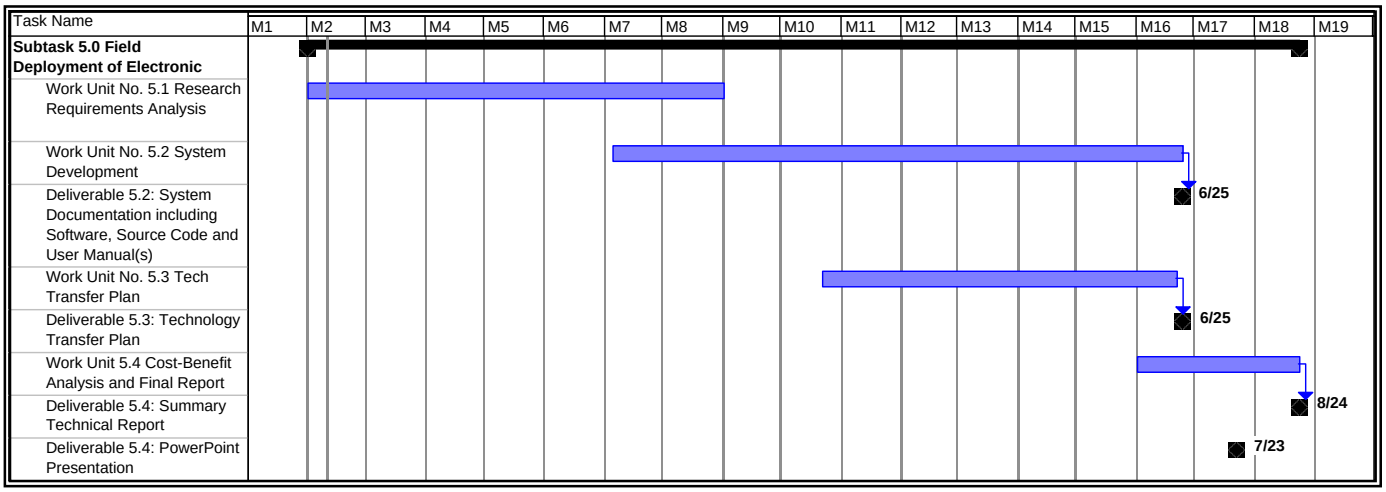
Work Unit 5.4 will consist of conducting a Cost Benefit Analysis (CBA) and summarizing task activities. The objective is to provide the government with a basis for production and use of the field-deployable system. The product of this work unit will include a Summary Technical Report with the CBA results.

All task activities will be summarized in the Final Report. The CBA will be CEAC-compliant and will include recommendations and justification for the newly developed technology. It will be conducted using multiple approaches and will provide traditional indicators such as payback and return on investment.

Work Unit 5.4 is expected to last approximately four months and will be conducted during the final months of this Subtask. It will overlap with Work Unit 5.3. Discrete work packages associated with this work unit are described below.

- Initiation of the CBA.
- Completion of the CBA.
- Development of the Draft Summary Technical Report.
- Response to review and comment from key stakeholders.

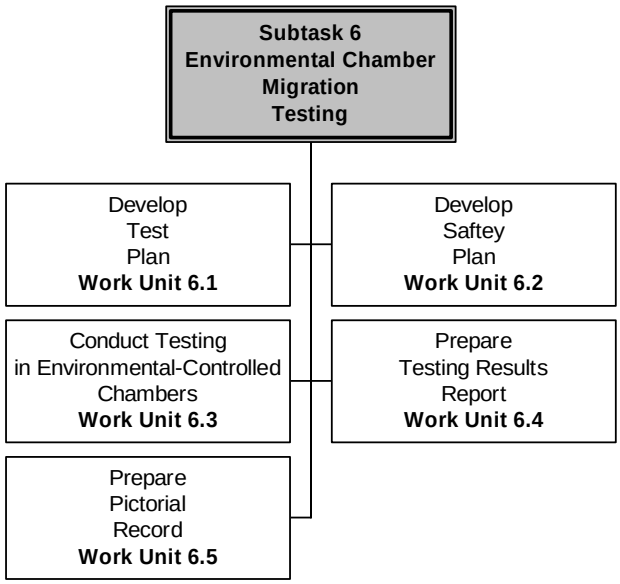
Schedule



Point of Contact

Concurrent Technologies Corporation
(814) 269-6834

Subtask 6: Environmental Chamber Migration Testing



Subtask 6 is organized into five work units to accomplish the required functions. The following provides an overview of the five work units:

- The Test Plan will be developed to ensure thorough preparation, quality assurance, and data validity. The Test Plan will be tailored to test under chamber conditions by delineating the test execution process in order to ensure that appropriate, meaningful data is collected, retained and archived with an emphasis toward validation of existing models.
- The Safety Plan will be developed and tailored to the specific conditions of chamber testing. Accordingly, it will ensure the safety of both personnel and equipment while meeting all local and DoD safety policies and procedures.
- Testing will be conducted in order to provide scientific, repeatable, and quantifiable data on inert ordnance training shapes of differing sizes, shapes and composition in test chambers. The migration chamber testing will be performed in a manner very similar to field migration testing (FY02 Subtask 08) that an accurate correlation of data from both sources can be made. Each ordnance training shape will be fitted with Hall effect sensors, linear transducers and back up visual monitoring system of PVC pipe to monitor movement. The PVC pipe will allow for visual determination of movement. Some ordnance shapes will not be fitted with PVC piping in case the PVC piping would restrict potential sideways displacement. In addition, soil moisture content, temperature and soil-matric potential will be monitored at several depths within the test cell with all data collected hourly on data-loggers.
- A detailed technical report will be prepared on the findings from the chamber study. The data obtained from the chamber testing will supplement and

complement the data obtained from Subtask 8 (NDCEE Task307) and will be used in validating the most promising applicable model.
- A pictorial record will be maintained throughout the task to ensure each phase is thoroughly documented.

Work Unit 6.1: Develop Test Plan

It is essential to prepare a thoughtful and comprehensive Test Plan before conducting any testing in environmental chambers, have a thorough understanding of the UXO and soil parameters that cause heave effects and subsequent migration of UXO, and identify the relevant parameters vis-à-vis UXO migration and prepare a parameter test matrix. This work unit addresses all these critical and important factors prior to conducting the tests in chambers.

A Test Plan is required prior to conducting testing in environmental chambers. The following summary of tasks and requirements from the Government-provided SOW correlate to and are addressed (in whole or in part) by Subtask 6, Work Unit 6.1.

The objectives of Work Unit 6.1 are:

- Identify potential UXO migration parameters, including soil parameters and parameters related to UXO shape, type, and composition. These parameters are the same parameters identified in Subtask 8 (NDCEE Task 307), UXO migration, field-testing at three DoD sites.
- Develop a test matrix to be included in a Test Plan.
- Prepare and deliver a Test Plan in accordance with CDRL A029 (DI-MISC-80508).

The Test Plan will be designed to assess the effect of the parameters identified and selected in the test matrix with an emphasis on the controlled environmental conditions that exist in test chambers. The Test Plan will contain applicable sections for each test plot, two plots simulating the cold-climate region and one test plot simulating the hot-climate region.

NDCEE will coordinate with the US Army Cold Regions Research and Engineering Laboratory (CRREL) to use their environmental chambers for the execution of this Subtask to simulate the environmental conditions for two sites in the cold-climate region and one site in the hot-climate region.

Additionally, NDCEE will conduct a site visit to ensure the test plan contains all site-specific requirements. Travel will be in conjunction with a site visit for UXO Task 307 Subtask 8.

NDCEE, working with CRREL, will describe all aspects of testing to include, as a minimum, data to be assessed/collected, methods used, data reduction and analysis, usage of any testing devices and probes to include description. Additionally, a listing of all devices and probes to be purchased, leased, on hand, or received on loan from a

vendor, description of all calibration procedures and calibration equipment used, quality assurance / quality control (QA / QC) procedures and methods will be compiled in the test plan.

The activities involved in this work unit include the following:

- Developing the Test Plan
- Assessing test parameters
- Identifying data requirements
- Writing the Test Plan
- Discussing the Safety Issues and standard laboratory protocols
- Discussing the PPE
- Discussing the SOPs
- Approving the Test Plan
- Modifying the Plan by incorporating Government comments
- Designing the Freeze-Thaw and Hot-Chill Migration Tests
- Perform a site visit, addressing considerations for soils and parameters for testing and conditions in chambers
- Obtaining access to the test location at CRREL
- Determining how the tests are to be controlled under the chambers conditions
- Describing the use of inert ordnance target shapes differing in shape, type and composition
- Discussing the degaussing of test munitions
- Discussing caliber nomenclature
- Presenting the needed laboratory and chamber work sheets
- Describing the work space issues
- Coordinating with CRREL personnel and other appropriate parties
- Describing storage
- Describing the contract support provided
- Addressing the safety certifications for handling residues, if any
- Discussing any required permits
- Discussing data to be collected / assessed
- Discussing equipment and methods
- Discussing data reduction and analysis
- Addressing mobilization of equipment and equipment description
- Describing the calibration procedures
- Describing the calibration equipment used
- Defining DQOs and QA / QC procedures
- Describing the Cold and Heat Heave Testing

The goal of the Test Plan is to ensure thorough preparation before chamber testing is conducted. A detailed plan will ensure that valuable test data will be obtained at the desired quality level allowing for the validation of existing models. In addition, having a viable Test Plan, with DQOs and detailed procedures, will minimize costly errors while maximizing the quality and timeliness of the results collected, ensuring

appropriate, meaningful data is collected, retained, and archived. The Test Plan will also delineate the test execution process, requiring consideration be given to cover uncertainties and the incorporation of contingency plans.

Work Unit 6.2: Develop Safety Plan

It is prudent and necessary to have a Safety Plan in place to delineate a thorough description of the safety measures required when working in laboratories and chambers in order to ensure safe working habits. The Safety Plan will contain all safety aspects, to include all safety devices and personal protective equipment requirements when working in laboratories/chambers. Recognizing that CRREL maintains a current Health and Safety Plan, this NDCEE Safety Plan, as required under this Subtask, will be tailored specifically to UXO migration chamber testing. All safety issues will be addressed in accordance with this specific safety plan for chamber testing.

The activities involved in this work unit include the following:

- NDCEE will coordinate with CRREL regarding safety measures in chambers
- NDCEE will review the CRREL-developed Safety Plan
- NDCEE will submit, incorporate comments accordingly, and obtain the approval of the Safety Plan by DoD
- NDCEE will submit draft copy of the Safety Plan to the Government
- NDCEE will incorporate appropriate Government comments
- NDCEE will submit the final Safety Plan to the Government

The benefit of developing a Safety Plan is to prevent unnecessary injuries and exposure to potential hazards associated with working in laboratories/chambers and to ensure compliance with DoD as well as CRREL's local policies and procedures.

Work Unit 6.3: Conduct Testing in Environmental Chambers

Chamber testing is required to determine the environmental conditions causing potential UXO migration, and to compare the results from the chamber study to the results from the ongoing field study contracted under NDCEE Task 307. The chamber study will produce data under controlled environmental conditions simulating many cycles of freeze-thaw and heat-chill in a short time compared to testing in the field. The data from the chamber study is expected to calibrate existing migration models. Additionally, the chamber data will complement the data to be generated from the ongoing field-testing.

The objective of Work Unit 6.3 is to conduct testing in environmentally controlled chambers to assess and evaluate the potential for migration of buried UXO. The objectives are to: 1) Conduct freeze-thaw UXO migration testing in chambers by simulating two test plots in two separate environmental conditions representing cold-climate region, and 2) Conduct hot climate (salt heave) testing in chambers by simulating one test plot simulating environmental conditions at hot-climate region.

The Technical approach for conducting the chamber work can be summarized as follows:

- NDCEE and CRREL will conduct tests using inert, stamped training ordnance in accordance with the approved Test Plan as provided by DoD.
- Tests will be performed considering three soil parameters (soil temperature, soil moisture, soil-water potential) determined from the identification of potential UXO migration that are related to soil and will be included in the test matrix in the Test Plan.
- NDCEE and CRREL will measure the displacement of the buried ordnance by at least two methods. Displacement will be recorded in real time using dataloggers. It is important to measure ordnance displacement by more than one method to provide duplicate methods in the event the primary method fails or encounters interference and noise and to compare reproducible results.
- The soil at each test cell will be probed at 8 depths in addition to air measurement: 0 (surface), 2", 6", 12", 18", 24", 36", and 48". The cost estimate will be based on using temperature and volumetric water-content probes and heat dissipation matrix water potential sensors attached to data loggers.
- DoD will provide all the inert, stamped ordnance items at no cost to NDCEE. This includes (a) the degaussing of inert ordnance test targets to remove any remnant magnetic signature, (b) caliber nomenclature, (c) munitions target stock or lot number, and (d) size / weight of ordnance targets.

NDCEE and CRREL will conduct ordnance testing in test cells housed in a controlled environment chamber where a minimum of 10 cycles will be simulated by freezing the soil each time to 3-ft. depth. Heat heave testing will be conducted in test cells housed in a controlled environment chamber in which a minimum of 10 cycles will be simulated heating and chilling the soil each time to 3-ft. depth. NDCEE and CRREL will monitor data collected in real time using data loggers.

NDCEE and CRREL will use the data and results from this testing to quantify the environmental conditions affecting the heave phenomenon as it relates to UXO migration. The data generated from the chamber study under controlled environmental conditions will complement the data generated from the actual field testing (NDCEE Task 307) and will serve to validate existing models and determine what factors may affect UXO migration. Proper monitoring, both electronically and visually, will produce quality data to determine when and under what conditions the migration is the greatest. The chamber study will allow simulation of many cycles of both freeze-thaw and heat-chill in a relatively shorter time than the field-testing. However, both chamber data and field data will be required for calibrating and validating migration models.

From the test data, NDCEE and CRREL will draw preliminary conclusions regarding the major factors contributing to UXO migration due to thermal cycling effects. The collected data and resulting conclusions will then be available to site managers to aid in

their understanding of UXO migration and allow them to more efficiently and accurately assess UXO clearance depths over time, depending on temperature cycles and other data.

Work Unit 6.4: Prepare Test Report

The technical report is required to present data, findings and results to facilitate transfer of knowledge. The ultimate users of the technical report will be DoD site managers and decision-makers.

The technical report will include as a minimum the following requirements:

- Aim and objectives
- DQOs and methods used
- Test data
- Test results supported by data
- Problems encountered
- Solutions to problems and lessons learned
- Tables and charts of equipment calibrations
- All necessary calculations
- Tables and charts of results
- Significant data and data analysis
- Raw data
- Chamber temperature data
- Soil temperature data
- Soil moisture data
- Soil-water potential data
- UXO movement monitoring data
- Metadata data
- Soil characterization data
- Any other applicable data
- Any other applicable data and analysis
- Model validation
- Photographs and drawings required for adequate description

NDCEE and CRREL will use the data results and findings to validate the most promising model. Subsequently, the data results and findings can then be used by the Government and DoD decision makers and regulatory agencies to aid in making efficient and accurate determinations of the depth of UXO clearance and incorporate the knowledge gained into the UXO exposure and UXO risk maps. The report will be used to help DoD site managers account for UXO migration in their UXO remediation plan and overall aid in better management of ranges with respect to UXO. A thorough Test Report will ensure the validity of the data collected, allow for the test to be replicated and allow for the possibility of new UXO migration theories to emerge without duplication of effort.

Work Unit 6.5: Prepare Pictorial Record

A requirement exists to show pictorially all the steps followed in the installation of equipment and testing in chambers. The pictures will help the decision-makers in their assessment of the UXO migration every step of the way during testing.

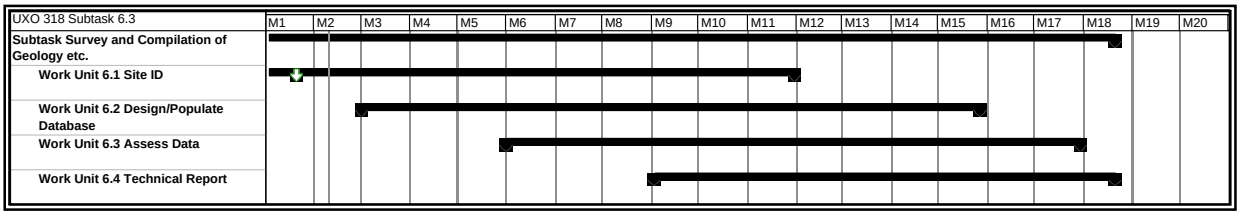
The objective of Work Unit 6.5 is to document activities of Subtask 6 and develop a pictorial record as well as prepare and present the finding to DoD.

This work unit specifies that NDCEE will:

- Provide a pictorial record of all the steps during the testing that will be created and maintained, electronically over the duration of testing. This pictorial record will include documentation on the test plots and test cells, the ordnance to be utilized (prior to burial), the electronic monitoring devices, and the relevant environmental control conditions during testing in chambers. The pictorial record will also show ordnance and electronic monitoring devices being installed, or buried, and the ordnance retrieval process.
- Provide CD ROM disks that contain all color still pictures taken during the tasks.
- Prepare a 20-minute Microsoft PowerPoint presentation that will summarize the testing activities and conclusions at the completion of the chamber study.

An accurate, concise, and purposeful pictorial record will offer a visual account for the steps followed during testing. The pictures will be easily accessible and useable by NDCEE and DoD to present the testing procedures and important findings in conferences and decision-making meetings.

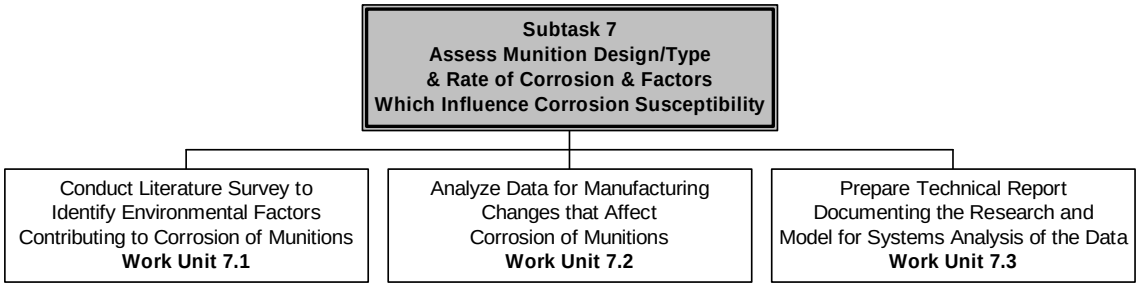
Schedule



Point of Contact

Concurrent Technologies Corporation
(619) 725-5014

Subtask 7: Assessment of Munitions Design/Type and Rate of Corrosion and Factors which Influence Corrosion Susceptibility



Subtask 7 is organized into three work units to accomplish the required objectives. The focus of the subtask will be on conventional ordnance items. Chemical ordnance and mines are not a part of the subtask. No corrosion testing of any ordnance items will be conducted. The following provides an overview of the three work units:

- Perform a literature study including SERDP and non-classified public data to identify environmental factors contributing to corrosion of UXO in wet soils.
- Conduct a detailed systems analysis including ARDEC data to determine how munition design and manufacturing process changes over time affect corrosion of UXO.
- Prepare a Technical Report that documents the research and provides details on how the combined effects of environmental factors and design and manufacturing process changes over time affect corrosion of UXO.

Work Unit 7.1: Conduct Literature Survey to Identify Environmental Factors Contributing to Corrosion of Munitions

In evaluating UXO environmental risk at U.S. military installations, it is important to understand the environmental factors that influence the rate of UXO corrosion. There have been past studies regarding UXO corrosion under various environmental conditions, and current studies are ongoing. NDCEE personnel, with the help of stakeholders, will identify and request final reports of past studies of UXO corrosion in order to ascertain the factors that influence the rate of UXO corrosion. Specifically, NDCEE personnel will request interim information and the final report concerning the ongoing SERDP Compliance Project 1226 (UXO Corrosion – Potential Contamination Source) to facilitate a better understanding of UXO casing perforation resulting from corrosion.

NDCEE personnel will establish a stakeholder group consisting of Government subject matter experts in the areas of munition design changes and UXO corrosion. Major stakeholder organizations will include SERDP, Picatinny Arsenal, ARDEC, the U.S. Army Corps of Engineers, academia, and representatives from the munitions manufacturing industry. NDCEE personnel will initiate and hold teleconferences with these stakeholders to establish familiarity with past and ongoing UXO environmental

corrosion studies to determine the important environmental factors and munition design changes that affect UXO corrosion.

Visits are planned to information repositories located at AEC (Baltimore), Picatinny Arsenal (Newark) and the U.S. Army Corps of Engineers (Huntsville) to talk to subject matter experts and locate and review required information.

Work Unit 7.2: Analyze Data for Manufacturing Changes that Affect Corrosion of Munitions

NDCEE personnel will conduct a comprehensive systems analysis, based on known corrosion principles, using data provided by ARDEC and others, to establish a thorough familiarity of how design and manufacturing process changes over time have affected corrosion susceptibility. Available reference information and existing models, if available, for predicting corrosion behavior will be evaluated and utilized in the systems analysis. Specifically, NDCEE personnel will request from ARDEC information and the final report outlining their research on the effects of design and manufacturing changes on the type and rate of corrosion on munitions. NDCEE personnel will communicate with personnel recommended by the Government to gain a fuller understanding of the basis for the ARDEC data provided, and will analyze the various types of munitions for their potential for corrosion susceptibility to identify those that are most prone to corrosion.

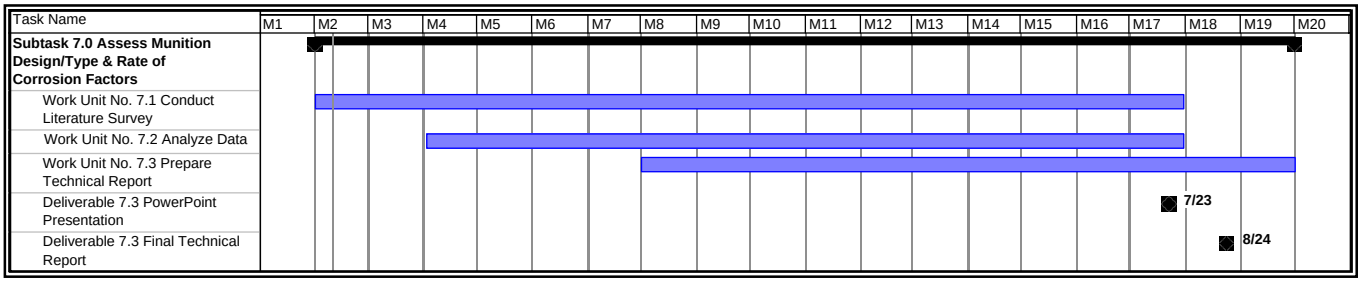
Work Unit 7.3: Prepare Technical Report Documenting the Research and Model for Systems Analysis of the Data

NDCEE personnel will prepare a Technical Report that will document the reviews of studies on the effects of environmental factors on the rate of UXO corrosion as well as research on how design and manufacturing changes affect corrosion of UXO. The Technical Report will identify how design and manufacturing changes affect the degree, rate, type and probable location of corrosion on ordnance; why certain ordnance is prone to corrosion and what mechanisms may be responsible; which munitions would be suitable for corrosion testing study; and the basis for suitability. The combined effects of environmental factors and design and manufacturing process changes on corrosion will be evaluated. The process model for accomplishing the systems analysis will be described.

NDCEE personnel will prepare an outline for the Technical Report, documenting the class of munitions and the types of munition changes that will be addressed, for the Government to review. NDCEE personnel will revise the outline based on Government comments. NDCEE personnel will prepare and submit to the Government a draft report in both hard copy and electronic format (Microsoft Word) 518 days after contract award in accordance with CDRL A015 (DI-MISC-80508). Thirty days after receipt and appropriate incorporation of Government review comments, NDCEE personnel will deliver a final report to the Government in both hard copy and electronic format (Microsoft Word).

A draft 20-minute PowerPoint presentation summarizing the activities and conclusions of this assessment will be developed by NDCEE personnel and submitted to the Government 488 days after contract award in accordance with CDRL A030 (DI-MISC-80508). The final version of the presentation will be delivered 15 days after receiving Government review comments.

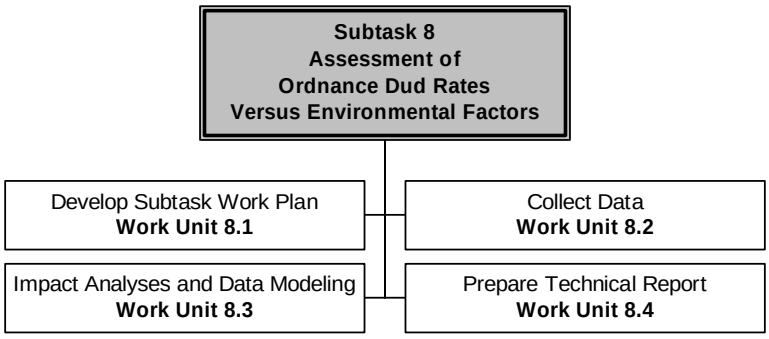
Schedule



Point of Contact

Concurrent Technologies Corporation
(727) 549-7006

Subtask 8: Assessment of Ordnance "Dud Rates" Versus Environmental Factors



Subtask 8 is organized into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- Develop Subtask Work Plan – The goal of this work unit is to prepare a work plan that outlines the technical approach for the following subtask activities: assemble a stakeholder group; identify information types and sources; collect site- and ordnance-specific data and information; conduct a thorough technical review and evaluation of the collected data; conduct ordnance impact analyses using engineering / physics methods and computer model simulations and compare results to the collected environmental data; and, develop a final technical report to document subtask activities and findings.
- Collect Data – The goal of this work unit is to collect as much information as possible about the 120 mm HE mortar round and the 120 mm M931 practice round, including engineering design and specifications, impact analysis methods and computer models, UXO attributes, site characteristics and environmental variables to identify potential correlations between ordnance dud rates and environmental factors. The collected data will be maintained in electronic format to facilitate data input, access, management, review and analysis for assessment of potential factors that could affect dud and low order detonation rates for these mortar rounds.
- Impact Analyses and Data Modeling – The goals of this work unit are to conduct impact analyses of the 120 mm HE and the 120 mm M931 mortar rounds to assess potential environmental conditions that could cause the ordnance to split open upon impact and to compare these results to collected data to help identify and assess potential correlations between ordnance dud rates and environmental factors. Technical evaluations will include a data gap analysis to identify data limitations as well as engineering / physics analyses and computer modeling to assess relationships between dud rates and environmental variables (e.g., soil types, rock hardness and soil plasticity).
- Prepare Technical Report – The goal of this work unit is to prepare a technical report and a Microsoft PowerPoint presentation that documents subtask

activities and findings, including identification of the various environmental conditions that could cause dud rounds to split open upon impact.

Work Unit 8.1: Develop Subtask Work Plan

The Subtask Work Plan will delineate the rationale and approach to assemble an informed stakeholder group, develop data quality objectives, identify and locate different information types and sources, conduct impact analyses using pertinent engineering / physics analytical approaches and existing computer models, compare impact analysis results to the collected data, and develop a final technical report. An initial stakeholder group will be identified and selected members of this group will review the Subtask Work Plan to provide input and ensure that subtask activities are consistent with the stated subtask goals and objectives. The NDCEE will coordinate with ARL, ARDEC and other DoD organizations in the planning and execution of this subtask.

Work Unit 8.2: Collect Data

Published and unpublished records, reports and other information on dud and low order detonation rates for the specified ordnance, site characteristics and environmental factors will be collected from identified sources. This data will be maintained in electronic format to facilitate technical review and evaluation activities. NDCEE personnel will teleconference with and travel to four face-to-face meetings with UXO, Explosive Ordnance Disposal (EOD) and ordnance / munitions experts from the U.S. Army Ordnance Mechanical Maintenance School, 61st Ordnance Brigade, the U.S. Army Ordnance Munitions and Electronics Maintenance School (OMEMS), 59th Ordnance Brigade, the Army Research Laboratory (ARL), the U.S. Army Tank-Automotive Armaments Command, Armaments Research and Development Engineering Center (TACOM-ARDEC), the U.S. Army Research Laboratory, the U.S. Army Corps of Engineers Ordnance and Explosives Mandatory Center of Excellence and Design Center (USACE-MCX), the U.S. Army Environmental Center (USAEC), the U.S. Navy Explosive Ordnance Disposal Technology Division (NAVEODTECH), or the U.S. Air Force Research Laboratory (USAFRL) as part of data collection and evaluation activities.

Work Unit 8.3: Impact Analyses and Model Data

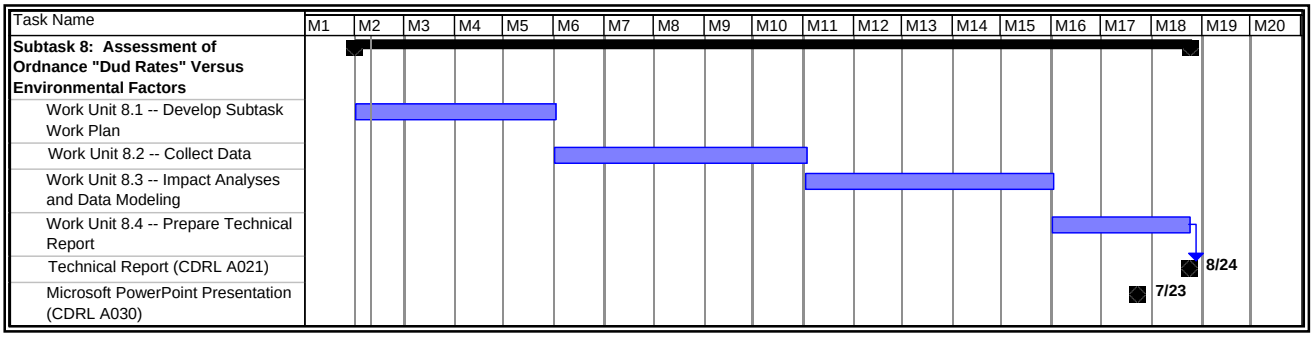
Technical review and evaluation activities will include engineering and physics analyses as well as existing computer model simulations of the 120 mm HE and 120 mm M931 mortar rounds to assess environmental conditions (e.g., soft soils, bedrock, peat, vegetation and water) that could cause these rounds to split open upon impact (assuming the round is a dud). Any finite difference modeling that may be conducted will not be applied in a Monte Carlo fashion; only so many runs as necessary to bound realistic scenarios will be conducted. The results of the engineering / physics analyses and computer model predictions will be compared to the collected data for these rounds that impacted either hard rock (specifications will be provided by the government) or 1-12 inches of silty / clay soils in an arid / northern climate. The NDCEE will coordinate with the Army Research Laboratory and ARDEC to obtain engineering

and physics analytical approaches and relevant computer models for conducting impact analyses as well as engineering specifications and impact angles for the ordnance under consideration.

Work Unit 8.4: Technical Report

In support of meeting the objectives of this subtask, the NDCEE will prepare a final summary technical report in accordance with CDRL A021 (DI-MISC-80508) that documents subtask activities and findings, including identification of the various site environmental conditions that could cause dud rounds to split open upon impact. The draft summary report will be delivered to the Government in electronic (Microsoft Word 2000) and hard copy formats for review and comment. The NDCEE will deliver the final technical report to the Government within 30 days after receipt and appropriate incorporation of Government review comments. The NDCEE will prepare and submit a draft 20-minute Microsoft PowerPoint presentation that summarizes subtask activities and conclusions in accordance with CDRL A030 (DI-MISC-80508) and will deliver the final version within 15 days after receipt of Government review comments. As part of work unit activities, NDCEE personnel will attend In-Process Reviews (IPRs) to provide timely subtask reviews and to facilitate stakeholder discussions with subtask team members as well as an UXO Task wrap-up meeting as part of subtask completion activities.

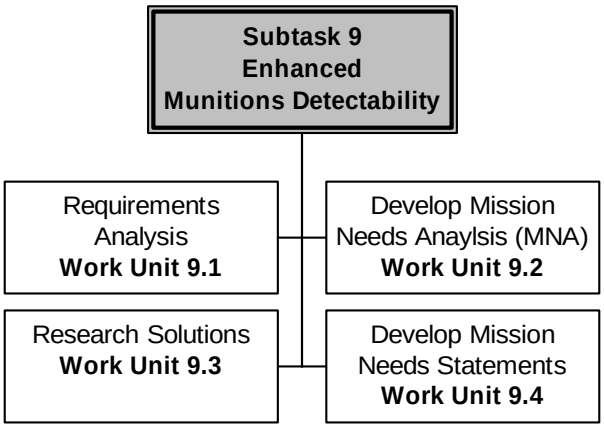
Schedule



Point of Contact

Concurrent Technologies Corporation
(814) 269-6439

Subtask 9: Enhanced Munitions Detectability



Subtask 9 is organized into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- A requirements analysis will be conducted to define the operating environment parameters under which any sensor would be required to function. NDCEE personnel will then conduct a literature review to determine what other efforts have been accomplished which are of a similar sensor technology goal.
- From the data collected during the requirements analysis, a Mission Needs Analysis will be developed for five categories of ordnance, specifically for 1) large caliber, 2) medium caliber, 3) rockets and missiles, 4) kinetic penetrators, 5) mortar ammunition. Based on the parameters defined for the object sensor technology, non-material and material solutions will be researched.
- Once all of the research priorities and guidance documents are developed, NDCEE will research potential solutions.
- Results of this research will be compiled into a Mission Needs Statement for each candidate sensor technology, per ordnance category. These supporting acquisition documents, MNAs and MNSs, will be incorporated into a Final Report (CDRL A022), that NDCEE will develop detailing the entire project, methodologies, and outcomes. In addition, a PowerPoint presentation will developed to accompany the final report.

Work Unit 9.1: Conduct Requirements Analysis

In order to properly assess determine if and how to integrate sensor technology into ordnance, it is critical to first identify the operating parameters required of any sensor technology.

NDCEE will investigate the limitations for a sensor such as space, power, interface, and other applicable limitations. NDCEE will also identify the operating conditions required for a sensor such as g-forces, shock, heat, vibration, and other related

conditions. NDCEE will also conduct a literature review of past-related efforts in order to leverage this data and reduce duplication of effort.

NDCEE anticipates the need for as many as two trips to the Aberdeen Test Center may be required to complete this task. These trips will be leveraged to include Naval EOD Technology Division, Naval Surface Warfare Center Dahlgren, and Picatinny Arsenal. Any information needed from White Sands will be gathered using electronic means.

The outcome of this work unit is a requirements document outlining the necessary operating parameters and properties required of the technology solution.

Work Unit 9.2: Develop Specific Mission Needs Analysis

Once the general scope of the problem is identified by the requirements analysis, specific research and identification of parameters associated with the specific ordnance categories must be accomplished in order to focus the research. It will be important to the scope of follow on test and demonstration efforts (later years) to identify commonalities and critical differences affecting sensor integration amount in the various ordnance categories to determine if there might be a single solution, multiple solutions, or a requirement to develop dedicated ordnance specific solutions.

NDCEE will study each category of ordnance to determine the sensor integration issues surrounding each category. This study will seek to determine the commonalities and differences between ordnance category fuzing and instrumentation. The purpose of this is to determine if there are any issues that would drive the research into solutions. If it can be determined that one solution can be developed to meet the needs across all categories of ordnance this will save significant development, deployment, and maintenance costs.

Using the data gathered under work unit 11.1 and this subtask, NDCEE will develop a specific sensor Mission Needs Analysis (MNA) for the following categories of ammunition: 1) large caliber, 2) medium caliber, 3) rockets and missiles, 4) kinetic penetrators, 5) mortar ammunition. The MNA documents will be developed based on an evaluation of the issues identified by the requirements analysis and the specific ordnance sensor requirements in accordance with CJCSI 3170.01B *REQUIREMENTS GENERATION SYSTEM*.

NDCEE anticipates the need for one (1) trip to the Aberdeen Proving Grounds (visit ATC and Ordnance School) to complete this task. This trip will be leveraged to include Naval EOD Technology Division, Naval Surface Warfare Center Dahlgren, and Picatinny Arsenal. Any information needed from White Sands will be gathered using electronic means.

The outcome of the MNA process will be clearly defined solution research priorities, which focus the work to be to identify solutions under Work Unit 9.2.

Work Unit 9.3: Identify Solutions

Once all of the research priorities and guidance documents are developed, the work of researching potential solutions can begin.

Using the output of the requirements analysis, the literature review, and the MNA NDCEE will investigate potential non-material and material solutions to instrumenting ordnance for enhanced detection. NDCEE will work with government agencies such as the Aberdeen Test Center, U.S. Army Ordnance School, Picatinny Arsenal, White Sands Missile Range, and Strategic Environmental Research and Development Program to gather data. NDCEE will use extensive contacts within the ordnance and EOD communities to gather information. NDCEE will also contact ordnance vendors and ammunition plants to discuss the problem and gather data.

Should any non-material solutions be identified, NDCEE will recommend a Doctrine, Training, Leader Development, Organization, and Soldier (DTLOSM) analysis be conducted as part of follow-on efforts. This kind of analysis would be helpful under future efforts in support of deployment of the final identified technology or methodology.

Material solutions developed by NDCEE will leverage as much as possible commercial off the shelf solutions in areas of sensor and receiver technologies. Any solutions proposed will be characterized by a set of parameters developed under the MNA process and will include, but will not be limited to system interface, survivability, scalability, interoperability, cost, implementation timeline, and ease of use.

NDCEE has the expectation and assumption that the Technical Monitor will ensure the appropriate agencies provide the NDCEE research team with access to applicable data. This access is the highest program risk associated with the successful completion of the Enhanced Munitions Detectability Project, which makes the commitment of the Technical Monitor to ensure access critical.

NDCEE anticipates the need for one (1) trip to the Aberdeen Proving Grounds (visit ATC and Ordnance School) to complete this task. This trip will be leveraged to include Naval EOD Technology Division, Naval Surface Warfare Center Dahlgren, and Picatinny Arsenal. Any information needed from White Sands will be gathered using electronic means.

The identification of potential solutions, both material and non-material, will provide the baseline information needed to develop Mission Needs Statements that will focus test and demonstration of prototype ordnance sensor systems.

Work Unit 9.4: Mission Needs Statements

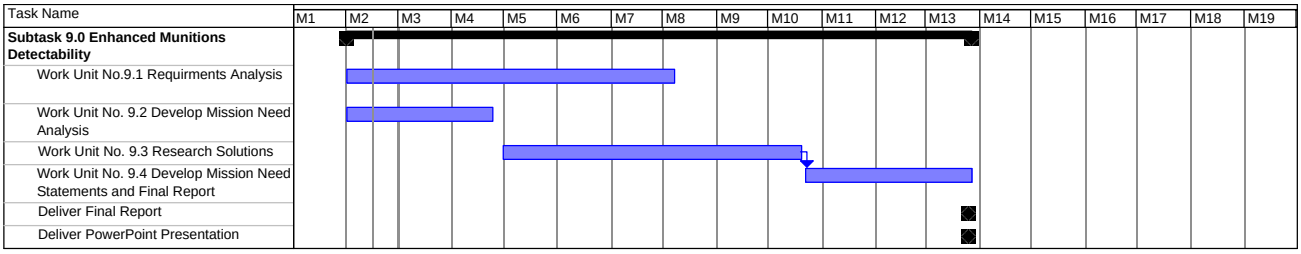
Once all of the parameters of the sensor environment, ordnance instrumentation needs, and available solutions are identified, correlating all of this effort into a focused path forward will become important.

NDCEE will correlate all of the data gathered through the previous work units by ordnance category, sensor solution, and anticipated prototype development issues to

create a Mission Needs Statement (MNS) for each of the candidate technologies. Each Mission Needs Statement will summarize the decision factors relevant to each ordnance sensor capability shortfall and will address the technology under consideration for satisfying the mission effectively. Each Mission Needs Statement developed will justify in analytical terms the actions required to resolve the detectability shortfall in each ordnance category and identify the tasks required to pursue a technology opportunity for addressing the detectability of each ordnance category. By using this approach the MNS can be used to formulate a FY04 test and demonstration program. The MNSs shall be attached to a Final Technical Report (CDRL A022).

The output of this process will be a Mission Needs Statement (MNS) for each of the candidate technologies, which can be used to formulate a FY04 test and demonstration program to work with ordnance users, ordnance and sensor vendors, and others to develop working prototype sensor systems. The MNSs shall be attached to a Final Technical Report, which will be developed and formatted in accordance with CDRL A022 (DI-MISC-80508).

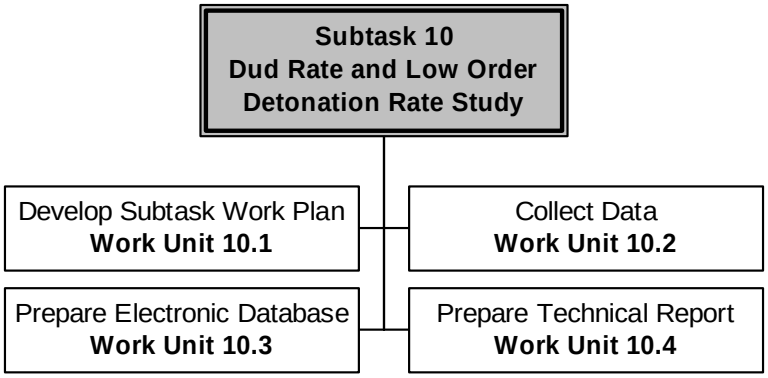
Schedule



Point of Contact

Concurrent Technologies Corporation
(843) 744-2829

Subtask 10: Dud Rate and Low Order Detonation Rate Study



Subtask 10 is organized into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- Develop Subtask Work Plan – The goal of this work unit is to prepare a work plan that outlines the technical approach for the subtask activities as well as assemble a Stakeholder Group, identify information types and sources, and delineate other approaches for researching dud rates and low order detonation rates.
- Collect Data – The goal of this work unit is to collect as much information as possible for as wide a variety of ammunition types. Data and information from published and unpublished reports, records and documents will be collected.
- Prepare Electronic Database – The goals of this work unit are to develop a database in Microsoft Access and enter the collected data into a user friendly Dud Rate and Low Order Detonation Rate Database, in accordance with CDRL A024. A data gap analysis will be performed. Statistical analyses will be included in the database.
- Prepare Technical Report – The goal of this work unit is to prepare a technical report that documents subtask activities and findings, in accordance with CDRL A023.

Work Unit 10.1: Develop Subtask Work Plan

The Subtask Work Plan will delineate the rationale and approach to: identify and assemble an informed stakeholder group; develop data quality objectives; identify and locate different information types and sources; conduct technical reviews and evaluations of the collected data to enable selection of UXO as an item, in combination or as a subset; and, develop a final technical report. An initial stakeholder group will be identified and selected members of this group will review the Subtask Work Plan to provide input and to ensure that subtask activities are consistent with the stated subtask goals and objectives. NDCEE will leverage previous experience with similar data collection and analysis tasks (including NDCEE Task 307) and interaction with informed stakeholders within the DoD and UXO communities.

Work Unit 10.2: Collect Data

Data and information from published and unpublished reports; records and documents will be collected for as many ammunition types as possible, excluding small arms ammunition (i.e., smaller than .50 caliber). Data will be sorted and compiled according to munitions size (e.g., 20 mm and 40 mm), family (e.g., grenades, mines and pyrotechnics), type (e.g., HE, Smoke and Illumination), Department of Defense Identification Code (DoDIC), and other pertinent information as identified. NDCEE personnel will teleconference with and conduct five face-to-face meetings with UXO, EOD and ordnance / munitions experts from the U.S. Army Ordnance Mechanical Maintenance School, 61st Ordnance Brigade, the U.S. Army Ordnance Munitions and Electronics Maintenance School (OMEMS), 59th Ordnance Brigade, the U.S. Army Tank-Automotive Armaments Command, Armaments Research and Development Engineering Center (TACOM-ARDEC), the U.S. Army Corps of Engineers Ordnance and Explosives Mandatory Center of Excellence and Design Center (USACE-MCX), the U.S. Army Environmental Center (USAEC), the Naval Explosive Ordnance Disposal Technology Division (NAVEODTECHDIV), or the U.S. Air Force Research Laboratory (USAFRL), as part of data collection and evaluation activities.

Work Unit 10.3: Prepare Electronic Database

The results of previous Phase I and Phase II studies will be leveraged and augmented by incorporating additional data sets and multiple information sources not previously included, and specifically including the ordnance / fuze combinations that are being evaluated under Subtask 7 of NDCEE UXO Task 307. A data gap analysis will be performed to identify data limitations (e.g., specific Navy and Air Force munitions) and statistical analyses will be conducted to assess data quantity and quality.

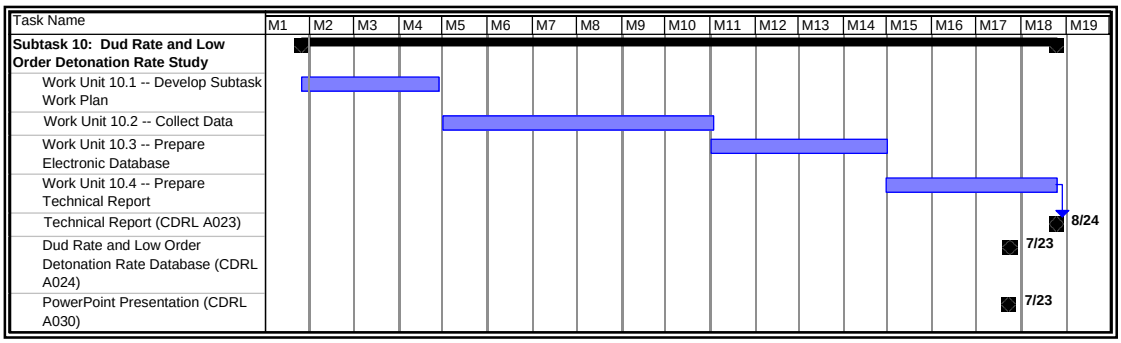
NDCEE will prepare a Dud Rate and Low Order Detonation Rate Database in accordance with CDRL A024 (DI-MISC_80508) that will combine the results of this and previous efforts to allow the user to determine dud rate and low order detonation rate as an item, in combination or as a subset. At a minimum, the database will consist of the following fields: DoDIC, Size (e.g., 20 mm and 40 mm), Model Number, Family (e.g., grenade and pyrotechnic), Type (HE, HEI, and HEI-T-SD), Dud Rate, Low Order Detonation Rate, Fuze(s) and Number of Rounds Fired.

Work Unit 10.4: Prepare Technical Summary Report

In support of meeting the objectives of this subtask, NDCEE will prepare a final summary technical report in accordance with CDRL A023 (DI-MISC-80508) that documents subtask activities and findings. The draft summary report will be delivered to the Government in electronic (Microsoft Word 2000) format for review and comment. NDCEE will deliver the final technical report to the Government within 30 days after receipt and appropriate incorporation of Government review comments. NDCEE will prepare and deliver a draft Microsoft ACCESS Database that combines the results of the Phase I and Phase II Studies of Ammunition Dud Rate and Low Order Detonation Rates in accordance with CDRL A024 (DI-MISC-80508). The final database will be delivered

60 days after receipt of Government review comments. NDCEE will prepare and submit a draft 20-minute Microsoft PowerPoint presentation that summarizes subtask activities and conclusions in accordance with CDRL A030 (DI-MISC-80508) and will deliver the final version within 15 days after receipt of Government review comments. As part of work unit activities, NDCEE personnel will attend In-Process Reviews (IPRs) to provide timely subtask reviews and facilitate stakeholder discussions with subtask team members as well as a UXO Task wrap-up meeting as part of subtask completion activities.

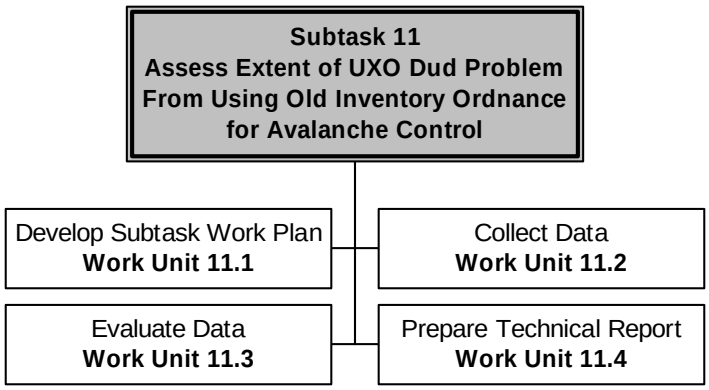
Schedule



Point of Contact

Concurrent Technologies Corporation
(814) 269-2789

Subtask 11: Assess Extent of UXO "Dud" Problems Associated with the Use of Old Inventory Ordnance by the U.S. Department-of-Interior for Avalanche Control in Mountainous Regions - Is There a Better Solution?



Subtask 11 is organized into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- Develop Subtask Work Plan – The goal of this work unit is to prepare a work plan that outlines the technical approach for the subtask activities as well as assemble a Stakeholder Group, identify information types and sources, and conduct technical review and evaluation of the collected data.
- Collect Data – The goal of this work unit is to collect published and unpublished information and field data to enable a thorough assessment of the extent of UXO-related problems associated with the use of old DoD inventory ordnance for avalanche control activities as well as possible replacement ordnance and delivery systems.
- Evaluate Data – The goals of this work unit are to conduct a detailed technical review and evaluation of all collected information and UXO field survey data to assess the extent of UXO-related problems associated with the use of old DoD inventory ordnance, to identify potential causative factors for this UXO, and to delineate possible new solutions to meet avalanche control program needs.
- Prepare Technical Report – The goal of this work unit is to develop a technical report and a PowerPoint presentation that documents subtask activities and findings.

Work Unit 11.1: Develop Subtask Work Plan

The Subtask Work Plan will delineate the rationale and approach to assemble an informed stakeholder group, develop data quality objectives, identify and locate different information types and sources, conduct in-depth technical reviews and evaluations (including pertinent statistical analyses) of the collected data, and develop a final technical report. An initial stakeholder group will be identified and selected members of this group will review the Subtask Work Plan to provide input and ensure that subtask activities are consistent with the stated subtask goals and objectives. The

NDCEE will leverage experience with similar data collection and analysis tasks (including NDCEE Task 307) and interaction with informed stakeholders within the DoI, DoD and UXO communities to develop the subtask work plan and conduct subtask activities.

Work Unit 11.2: Collect Data

Private, state and federal avalanche control organizations that may use old inventory ordnance for avalanche control practices will be surveyed to collect the following information: ordnance used, delivery system(s) used, and deployment or use data as well as input for possible replacement ordnance and delivery systems, suggested new or modified technical actions and administrative requirements, and alternative technologies or approaches that could minimize or eliminate UXO-related problems, but still meet avalanche control program needs. NDCEE personnel will teleconference with and travel for four face-to-face meetings with DoI personnel to review avalanche control needs and current practices and problems, and with UXO, EOD and ordnance / munitions experts from the U.S. Army Ordnance Mechanical Maintenance School, 61st Ordnance Brigade, the U.S. Army Ordnance Munitions and Electronics Maintenance School (OMEMS), 59th Ordnance Brigade, the U.S. Army Tank-Automotive Armaments Command, Armaments Research and Development Engineering Center (TACOM-ARDEC), the U.S. Army Corps of Engineers Ordnance and Explosives Mandatory Center of Excellence and Design Center (USACE-MCX), the U.S. Army Environmental Center (USAEC), the Naval Explosive Ordnance Disposal Technology Division (NAVEODTECH), or the U.S. Air Force Research Laboratory (USAFRL) as part of information collection and evaluation activities. An initial review of the collected data will be conducted to select two primary and two secondary (i.e., alternate) locations for conducting UXO field surveys.

NDCEE personnel will travel to two locations, as identified from preliminary data review activities, within the western mountains (e.g., Colorado and Utah) to conduct UXO field surveys. The purpose of these surveys is to collect and catalog UXO field data to verify data trends collected from published and unpublished information sources. UXO remediation at these field sites will not be conducted. Qualified personnel will collect pertinent information on UXO encountered at the sites and this data will be used to help assess potential causes for the observed dud problems. Before going into the field, NDCEE personnel will prepare and deliver to the Government for approval a signed Health and Safety Plan and a Field Survey Plan. To facilitate data input, access, management, review and analysis, all collected information will be entered into a UXO Avalanche Control Database.

Work Unit 11.3: Evaluate Data

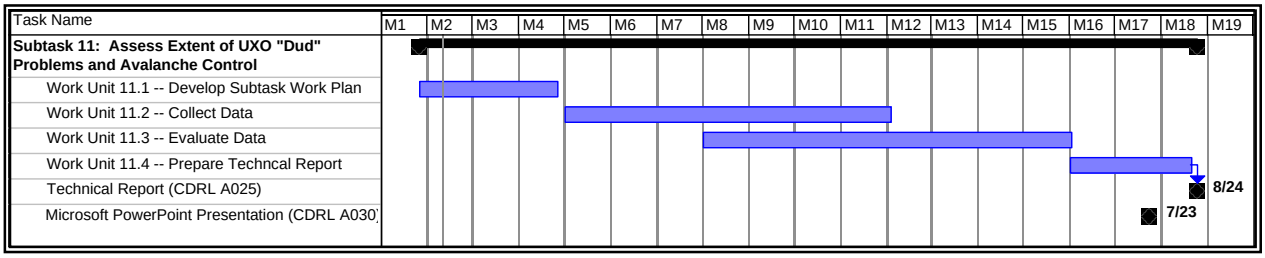
A data gap analysis will be performed to identify data limitations, while statistical analyses will be conducted to assess data quantity and quality, and to help identify potential correlations between dud rates and identified variables, such as ordnance and UXO attributes (e.g., fuze type), deployment data (e.g., number of live rounds, number of dud rounds, gun types and associated costs), UXO incidents and response actions,

and other program data. Statistical analyses will be conducted to assess data quantity and quality, and to help identify potential correlations between UXO-related problems from the use of old inventory ordnance and other identified variables. The results of the technical evaluations will be used to assess the extent of UXO-related problems from old inventory ordnance and to formulate recommendations for changes to, or development of new, technical and operational procedures or protocols.

Work Unit 11.4: Develop Technical Report

In support of meeting Subtask 11 objectives, the NDCEE will prepare a final summary report, in accordance with CDRL A025 (DI-MISC-80508), that documents sub task activities, including data collection and analysis activities, evaluation of the collected data and information to assess causative factors for the UXO, and recommendations for changes to the old DoD inventory ordnance usage program to mitigate UXO-related problems. The draft report will be delivered to the Government in electronic format (Microsoft Word 2000) for review and comment. The NDCEE will deliver the final technical report to the Government within 30 days after receipt and appropriate incorporation of Government review comments. The NDCEE will prepare and submit a draft 20-minute Microsoft PowerPoint presentation that summarizes subtask activities and conclusions in accordance with CDRL A030 (DI-MISC-80508) and will deliver the final version within 15 days after receipt of Government review comments. As part of work unit activities, NDCEE personnel will attend In-Process Reviews (IPRs) to provide timely subtask reviews and facilitate stakeholder discussions with subtask team members as well as an UXO Task wrap-up meeting as part of subtask completion activities.

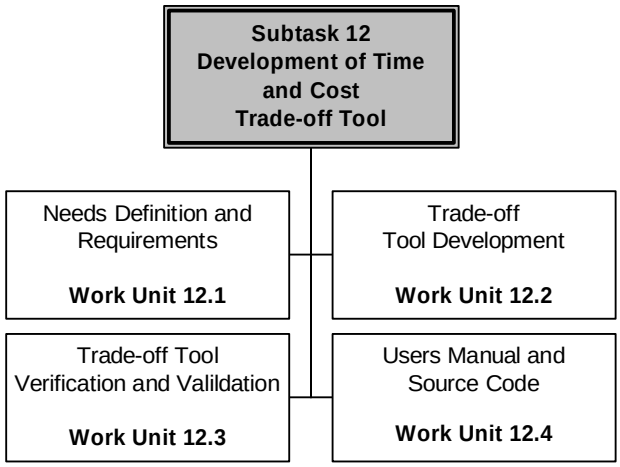
Schedule



Point of Contact

Concurrent Technologies Corporation
(303) 297-0180 ext. 116

Subtask 12: Development of Time and Cost Trade-off Tool



This subtask will be divided into four work units to accomplish the required objectives. The following provides an overview of the four work units:

- A design specification and requirement meeting will be conducted with stakeholders / end-users to identify the specific features and capabilities of the tool to meet the users requirements. These requirements will include, but are not limited to, software preference (e.g., Excel, Lotus), input and output formats, reporting requirements, calculation needs, data sources, etc.
- NDCEE will develop the actual spreadsheet Trade-off Tool in three phases, which include: Design Data Input; Report Output Design; and, Programming and Calculations.
- Following development, the trade-off tool will be verified against the original design requirements and validated for accuracy against a known standard or reference. This will be accomplished by first confirming the original design criteria against the users needs requirements, and secondly by comparing the calculation results of the spreadsheet with the software tool RACER.
- The Trade-off Tool spreadsheet will be supported with a Users Reference Manual providing step-by-step instructions in how to use the estimating tool. All cost algorithms and macros developed within the spreadsheet shall be provided in a Source Code document as an Appendix to the Users Reference Manual.

Work Unit 12.1: Needs Definition and Requirements

NDCEE will conduct a design specification and requirement meeting with stakeholders / end-users to identify the specific features and capabilities to meet the user's requirements. These requirements will include, but are not limited to, software preference (e.g., Excel, Lotus), input and output formats, reporting requirements, calculation needs, data sources, etc. One design review meeting will be conducted via teleconference within 60 days of NTP. The goal of this step is to identify as many desired features for the tool as possible. General Requirements and Key Features, as presented in the SOW will be reviewed as a starting point for this stakeholder meeting.

Moreover, POCs will be contacted to participate in the meeting to help fill information gaps, answer questions, and indicate the key features that they desire.

General Requirements and Key Features

In accordance with the SOW, the tool will be designed to meet, at a minimum, the following key requirements: 1) A baseline "as currently performed" estimate; 2) Changes (i.e., efficiency gains) incurred using more costly (i.e., more efficient) survey techniques; 3) Time trade-offs for confirmation sensors at various stages of mitigation; 4) Cost / time comparisons to mechanical removal, either as a stand-alone tool for impact areas or as a first step to be followed by geophysics; and, 5) Time trade-offs for post-processing applications versus the number of targets detected discriminated and excavated (i.e. technology proficiency). The tool will be designed to address a number of cost variables to include, but not limited to: site type, size, and technology used.

In accordance with these requirements, the Trade-off Tool will include, at a minimum, the following a Key Features:

- A baseline time and cost estimates
- Multiple technology alternatives / scenarios (Stand alone or in combination)
- Performance indicators (decreased false alarms, increased Pd)
- Impacts (Time, explosives used, cost of standoff requirements)
- Type of Removal
- Type of post-processing applications
- Process Efficiency calculation(s) (targets excavated / discriminated)

Work Unit 12.2: Trade-off Tool Development
Phase I — Design Data Input

NDCEE will develop the Trade-off Tool in three phases. The Needs and Requirements Information Summary developed under Work Unit 12.1 will provide the basis for the Phase I preliminary report design; incorporating the stakeholders required reporting outputs, formats, report layout, precision requirements, etc. NDCEE will conduct one design review meeting via teleconference and provide a draft design report to the stakeholders for review and approval.

Phase II — Report Output Design

Phase II will consist of the design of the data input portion of the spreadsheet. NDCEE specialists will develop the spreadsheet utilizing a single workbook with multiple supporting spreadsheets for data input, calculations, and reports. Data input would be simplified where possible with pull-down menu selections or check boxes to reduce data entry errors. Default values for common assumptions would be "built-in" for standard calculations and assumptions. Users will be able to customize the assumptions as needed. Once the required inputs and outputs are clearly defined, the required calculations can be constructed during Phase III.

Phase III — Programming and Calculations

Calculations developed by programmers for the tool will be password protected to prevent inadvertent changes by users. Programmed macros will be used to simplify repetitive and routine tasks. Users will be provided pull down menus and check boxes where appropriate.

Calculations would be developed in separate spreadsheets to be eventually locked and hidden to prevent users inadvertently changing the formulas. Calculations would be verified and validated in Work Unit 12.3.

Work Unit 12.3: Trade-off Verification and Validation

NDCEE will validate any calculations in the Trade-off Tool against any comparable calculations in the cost-estimating model RACER. Specifically, test data will be entered into the spreadsheet and one of the RACER's ordnance cost sub-models (i.e., Ordnance & Explosive removal action) to verify any comparable calculations. NDCEE will coordinate and support the appropriate Government agency, in order to gain access to and appropriate training for the RACER tool.

NDCEE will also validate the Trade-off tool against actual report calculations using actual site data from at least three recently completed mitigation sites and associated reports. NDCEE will contact, coordinate with, and request from the appropriate site personnel, relevant cost and performance data along with the appropriate report cost calculations for validating the Trade-off Tool. All calculations, at a minimum, would use test data as inputs to validate all calculations.

Next, in order to verify that the user's needs and specifications have been reflected in the final design, the specification list from Work Unit 12.1 will be compared with the final design. Also, consenting stakeholders would be provided a prototype working copy for 'Beta' evaluation. Feedback from the Beta testers would be used to verify the design.

NDCEE shall train (four) analysts in use of the Trade-off Tool. A two-hour classroom training session will be held at NDCEE's Johnstown facilities, or other mutually acceptable location, on the use of the Trade-off Tool.

Work Unit 12.4: Trade-off Users Manual and Source Code

NDCEE will prepare a user manual and source code. In accordance with CDRL A026, NDCEE shall submit a draft version (electronically) for Government review prior to final submittal. Government acceptance and approval will be in writing only. NDCEE will incorporate Government comments and submit the final document 15 days after receipt of the comments.

The Trade-off Tool spreadsheet will be supported with a Users Reference Manual providing step-by-step instructions in how to use the estimating tool. All cost

algorithms and macros developed within the spreadsheet shall be provided in a Source Code document as an Appendix to the Users Reference Manual.

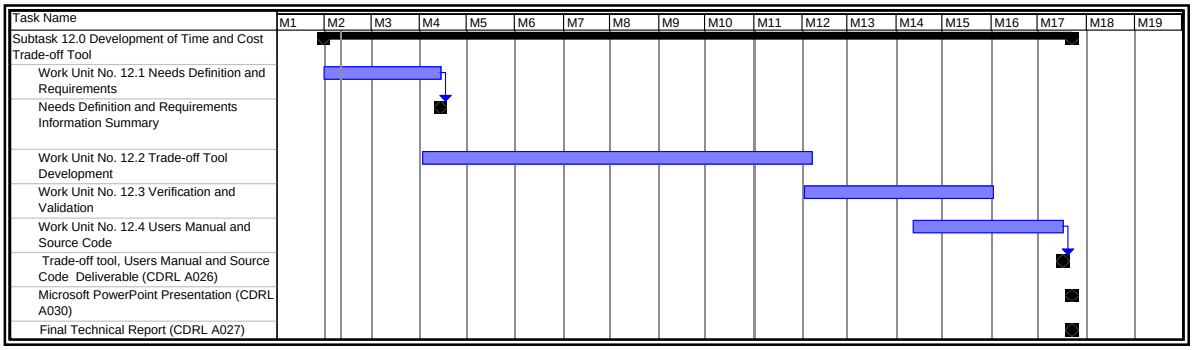
Deliverables

The NDCEE will develop a spreadsheet and any supporting executable code such as Macros along with the user/reference manual, and documented source code. The draft code and user manual will be delivered to the Government no later than 488 days after task award in hard copy and electronic format in accordance with CDRL A026. The NDCEE will deliver the final code and manual within 60 days after receipt of Government comments.

The findings of this subtask will be documented in a final technical report. The report will summarize the overall effectiveness and usefulness of the spreadsheet tool. The report will also include recommendations on the future deployment of the Trade-off Tool and potential improvements in future versions of the tool.

The NDCEE will deliver the draft final technical report in electronic format and hard copy 518 days after task award in accordance with CDRL A027 (DI-MISC-80508). The NDCEE will deliver the final report 30 days after receipt of the Government comments. A draft 20-minute PowerPoint presentation summarizing the activities and conclusions of this study will also be developed in accordance with CDRL A030 (DI-MISC-80508). The final version of the presentation will be delivered 15 days after receiving Government review comments.

Schedule



Point of Contact

Concurrent Technologies Corporation
(814) 269-6805