2008 State Damage Prevention Program Grants Progress Report
Funding Opportunity Number: DTPH56-08-SN-0001
CFDA Number: 20.720

Award Number: DTPH56-08-G-PHPS09
Project Title: Virginia State Damage Prevention Program
Date Submitted: 12/23/2008
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Specific Objective(s) of the Agreement

Virginia State Corporation Commission's primary objective under this grant will be to research and implement the incorporation of Global Positioning System (GPS) with underground utility locating equipment in conjunction with the Virginia Pilot Project for One Call Technology Phase II ("Project") or ("Phase II"). This would allow the collection of data relative to markings of underground facilities. This data will be used for:

- Accurately document marking of facilities (electronic manifest);
- Provide an accurate depiction of marks on notification center maps to excavators as a check against marks in the field;
- Document compliance by pipeline operators with state and federal laws regarding marking of facilities before excavation; and
- Provide location data to operators for verification of existing facility as-builts, maps and plans.

Workscope

Under the terms of this agreement, the Grantee will address the following elements listed in 49 USC §60134 through the actions it has specified in its Application.

- *Element (1):* Participation by operators, excavators, and other stakeholders in the development and implementation of methods for establishing and maintaining effective communications between stakeholders from receipt of an excavation notification until successful completion of the excavation, as appropriate.
- *Element (8):* A process for fostering and promoting the use, by all appropriate stakeholders, of improving technologies that may enhance communications, underground pipeline locating capability, and gathering and analyzing information about the accuracy and effectiveness of locating programs.

Accomplishments for this period (Item 1 under Agreement Section 9.01 Progress Report: "A comparison of actual accomplishments to the objectives established for the period.")

The Project began with a kick-off meeting of stakeholders in January 2008. Identification of available and suitable GPS-locating equipment, development of software, identification of participating stakeholders and project planning progressed through 2008. Progress was facilitated and monitored through a series of meetings and discussions among the Project participants.

The purchasing of necessary equipment began in early 2009. Other hardware necessary for field testing and project implementation has been purchased and installation of a Storage Array Network Server ("SANS") is currently underway. It is expected that field testing will begin the second quarter of 2009. Field testing of the equipment, software and processes will extend over a period of six to eight months.

In the first quarter of 2010, data resulting from the field testing will be analyzed and the Project report will be developed.

With regards to Element (1), the assembled Project team consists of representatives from gas, phone, and electric utility operators, as well as contract locators, regulatory entities, the notification center, CGA, GTI, excavators and other various stakeholders. All parties have participated in the development of the Project and provided their unique perspectives to the notification process enhancement in order to facilitate enhanced communication between the various industries.

The electronic manifests produced by data collected during actual facility locates will be provided to the excavator as part of the positive response process. Locations of underground facilities will be included as an image file along with the marking status provided by the utility operators/ contract locators. Armed with this additional information, excavators can perform a more comprehensive site inspection and verify locate marks in a more efficient manner. It is believed that this may assist the excavator to identify situations where markings may have been destroyed and further encourage them to have those facilities remarked prior to commencing excavation activies. This added information may reduce damage to underground facilities, and in doing so, help reduce the likelihood of accidental death, injuries, and economic and environmental losses.

With regards to Element (8), the project is specifically designed to introduce technologies into the locate industry that will collect GPS of actual locates performed. This data will be stored at the notification center and made available to utility operators. Operators will use the data for two primary purposes.

First, they will be able to enhance quality assurance for their locators. The data will show the locations where underground facilities are found in the field and identify any abnormal operating conditions, such as inconsistencies between facility records and field locates. Operators will be able to address any inaccurate field locates during this process and thereby enhance public safety.

Second, the operators will have the opportunity to address inaccuracies of their own facility records and make necessary corrections. The integrity of their facility records will be enhanced through this process.

Quantifiable Metrics/Measures of Effectiveness (Item 2 under Agreement Section 9.01 Project Report: "Where the output of the project can be quantified, a computation of the cost per unit of output.")

A project team consisting of regulatory and industry representatives was formed to develop metrics for this research endeavor. Metrics have been designed to be both data driven and anecdotal as follows:

- Data Metrics:
    - Number of locates performed with complete GPS data for each locate.
    - Number of Phase II locates when locator tried but was not able to capture complete GPS data for the locate. Factors could include:
        - No GPS signal due to:
        - Time of day

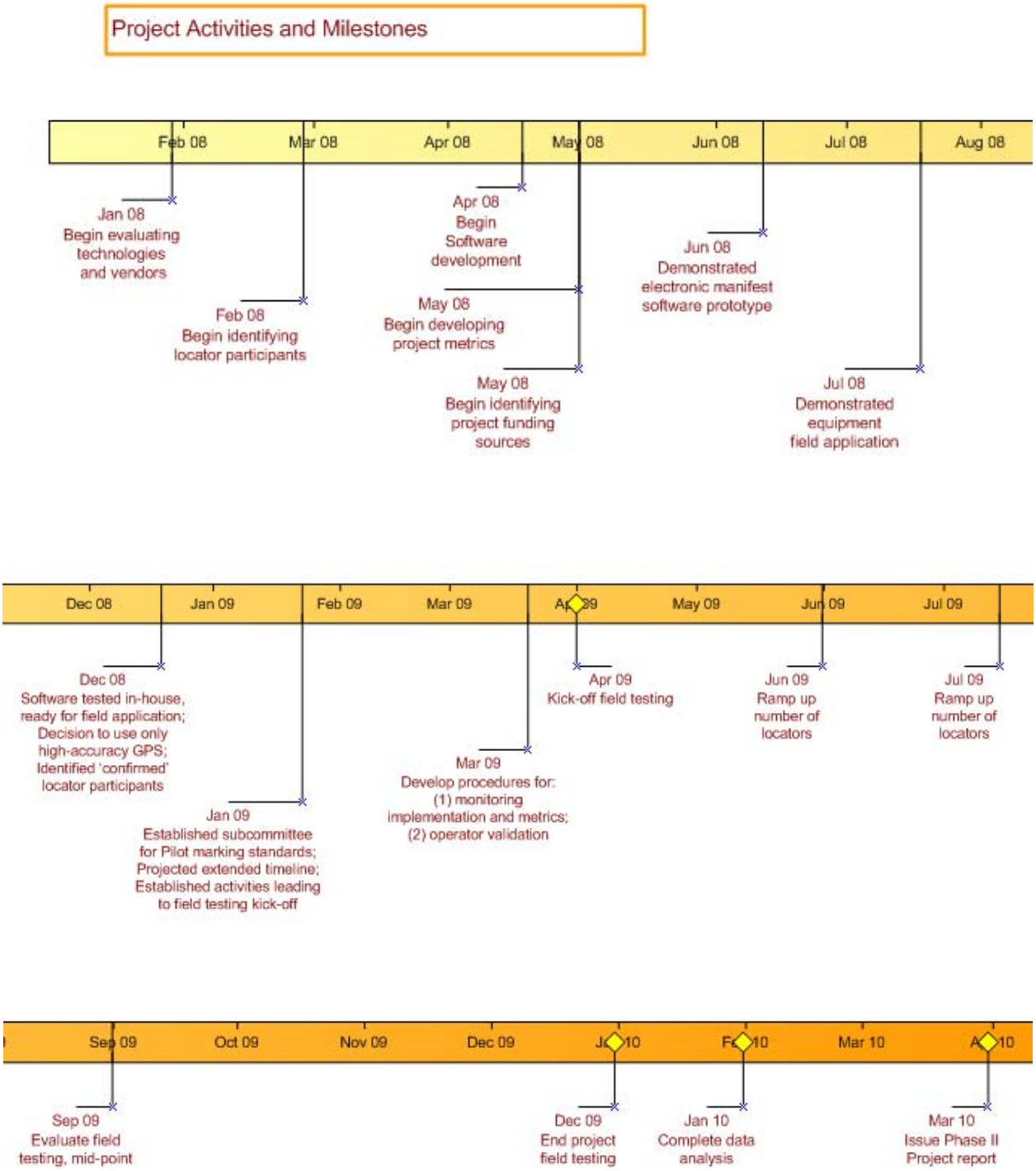
        - Next to buildings
        - Under canopy
    - Number of electronic manifests requested by excavators
    - Number of member utility queries into the electronic manifests
    - Number of needed changes to maps and records
        - identified by locators
        - confirmed by member utilities resulting from this process (i.e., number of occurrences where field representatives were dispatched for quality assurance purposes)
        - where corrective action was taken
    - Financial impacts to the locator
        - Average time to locate
        - Delta t = (additional time to perform locate over current average time)
        - Additional cost of equipment for industry adoption of the technology
        - Software costs for post processing of GPS Data
    - Data gathering process issues and solutions (statistics and anecdotal)
        - Excavators
        - Utilities & Locators
    - Gathering application software and hardware issues and solutions for
        - Locate Equipment
        - Locate Application
        - One-call software

- Anecdotal Metrics:
    - Evaluation of locator's ability to utilize this technology as an asset management / labor management tool
    - Analysis of electronic manifest to ensure accurate portrayal of all facilities located
    - Analysis of the locators ability to efficiently use the GPS equipment in conjunction with the locating and marking equipment to accurately locate and 'mark' the facilities with GPS coordinates
    - Analysis of locator industry support for the concept of adding GPS coordinates to create an electronic manifest
    - Analysis of utility operators and locators ability to use GPS based electronic manifests to improve current documentation processes and the mapping of subsurface infrastructures

Issues, Problems or Challenges (Item 3 under Agreement Section 9.01 Project Report: "The reasons for slippage if established objectives were not met. ")

Due to software development, the project has developed slower than originally anticipated. A working timeline and map of significant milestones has been developed. The SANS installation and configuration has taken longer than expected, and equipment manufacturers also had to

develop necessary interfaces to allow for data transfer between the locator device and the GPS unit. See the timeline below:



Other pertinent information including, when appropriate, actions taken to address the recommendations PHMSA provided in correspondence dated [Different for each] (Item 4 under Agreement Section 9.01).

Project management will be utilized to ensure the project timeline, personnel and costs associated with the project are adhered to. For additional information with regards to the project management, scope, metrics, and deliverables a draft of the project business case is attached.

Mid-term Financial Status Report

Phase II requires locate technicians to have equipment that is able to collect GPS coordinates of underground facilities and transmit that data back to VUPS. The units that met this requirement were developed by McLaughlin Boring Systems.
McLaughlin combined their Verifier G2 locate unit with a Magellan CX GPS device providing the locator with a simple, all in one system. Software was developed to provide the interface between the two (2) devices and allow for the data to be available for uploading to the notification center.
The locate equipment that was purchased for the Phase II of the Virginia Pilot program come with the standard frequency generator of 38 kHz. This frequency is acceptable for most locates however, some locates may require additional frequencies when locating certain types of underground facilities. VUPS purchased external coils to handle the locator's requirements for additional frequencies.

VUPS purchased the following equipment from McLaughlin for the initial procurement of locate instruments for the Pahse II:

Invoice Number	Description	Cost
9200201	6 Verifier G@ with GPS Unit	$44,659.98
9200204	6 External Coils	$ 2,270.60
Total:		**$46,930.58**

Additionally, the locator has the ability to enter Positive Response codes for each facility located. The data will then be uploaded to a PC running manufacturer specific differential correction software for the lat/long coordinates. The differential correction software corrects any errors received from the GPS unit resulting data points with sub-meter accuracy. Finally, the data will be transmitted to the one-call software application for the creation of the electronic manifest and the posting of the positive response.

The application interface to accept the data to build the electronic manifest and positive response was created by a third party vendor, Norfield Data Products, Inc. The application accepts the GPS coordinates, the utility/operator member code, and the positive response code for the Miss Utility ticket. The application also creates the electronic manifest by depicting each utility located and provides a method for the operator to review and approve the manifest as well as the positive response code associated with each member code.

VUPS incurred the following costs in development of the application to accept the data, build the electronic manifest and post the positive response:

Invoice Number	Description	Amount
080124	Initial Programming (1st payment of 3)	$20,000
080265	Initial Programming (2nd payment of 3)	$10,000
090061	Initial Programming (3rd payment of 3)	$ 5,000
080262	Transmit & Receive Software	$12,000
090062	Software to handle shape files	$ 8,000
Total:		$55,000

Plans for next period (remainder of grant)
There are no additional plans for the remainder of this grant.

Requests of the AOTR and/or PHMSA
No actions are requested at this time.

Virginia Pilot Project

Incorporating GPS Technology To Enhance One-Call Damage Prevention

Phase 2: Electronic Manifests

Project Plan

(Business Case)

Draft

February 2009

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Project Summary

Background and Introduction

Underground facilities are vulnerable to damage that can result during nearby excavation activities. Damage to underground facilities such as pipelines, electrical, and telecommunication systems can result in serious consequences to public safety and the environment, and cost millions of dollars each year to both the public and private sectors. Effective damage prevention programs are necessary to ensure public safety and continuity of vital services; damage prevention is a shared responsibility among all stakeholders.

Critical to any effective damage prevention program is the exchange of accurate and timely information about planned excavations and the underground facilities that may be affected by those excavations. An effective and efficient process to communicate accurate and timely information is critical to ensuring that facilities aren't damaged during the excavation process.

Excavation information must be communicated by the excavator to underground facility operators that have facilities in the area of the planned excavation. Facility operators or their contract facility locators must then determine the exact locations of their underground facilities and communicate that information back to the excavator so that care can be taken to not damage the facilities when excavating.

One-call centers facilitate communication between excavators and facility operators. The one-call center maintains maps of notification areas, receives locate request information from excavators about planned excavations, and issues locate tickets to facility operators so that underground facilities in the areas of planned excavations can be located and marked. In some states, the one-call center also provides a positive response to the excavator when affected underground facilities have been located and marked.

Underground facilities that are located and marked through the one-call process, prior to excavation, include but are not limited to:

- Gas and hazardous liquid transmission pipelines,
- Natural gas distribution mains and service lines,
- Municipal water and sewer systems,
- Electric transmission and distribution systems, and
- Telecommunications infrastructure.

The Virginia Pilot Project was undertaken to evaluate the feasibility and benefits of incorporating global positioning system (GPS) technology to enhance one-call damage prevention.

Virginia as the Pilot State

Virginia was chosen as the place to conduct the pilot project for several reasons, including its pipeline safety leadership, stakeholder participation (excavators, operators and regulators), existing damage prevention laws, and active enforcement processes. In Virginia, intrastate natural gas utilities are required to report all damages and probable violations to the State Corporation Commission (SCC). These reports are thoroughly investigated. The facts regarding reported damages are evaluated, the root causes are determined and the information is captured in a single database. The results are reviewed by an appointed panel and penalties may be assessed on the parties responsible for damage incidents. Over a recent 10 year period, reported damages to gas pipelines in Virginia were reduced by more than 60 percent.

As Virginia's one-call system operator, Virginia Utility Protection Service (VUPS) is required to capture and maintain a large number of data elements relative to its operation, including data regarding locate requests, types of excavation activities, utility marking status, and other aspects of the one-call process. The data is continuously reviewed and analyzed to evaluate the one-call program and to take appropriate actions to further reduce damage to underground facilities.

Based on the maturity of Virginia's program, the availability of historical performance data, and a formal process to investigate damages and determine root causes, Virginia was considered an appropriate place to conduct a pilot project to identify current technologies to be refined or new ones to be developed to further improve the communication between excavators and operators.

Additionally, in conjunction with Phase I of the Pilot Project, VUPS upgraded its one-call system software, converting from the use of grids to define excavation locations on base maps to the use of user-defined polygons. VUPS also migrated from the use of base maps based on Enhanced Tiger Files to base maps that incorporate the use of ortho-photographic enhanced digital overlays. These enhancements serve to illustrate that Virginia is on the leading edge in the use of technology to enhance the one-call damage prevention process.

Phase I Project

Phase I of the Virginia Pilot Project, conducted during 2006 – 2007, examined the application of GPS technology to improve the locational accuracy of locate requests submitted by excavators to the VUPS one-call center. The emphasis of Phase I was on

the development and use of enhanced electronic white-lining[1] through the use of GPS technology and enhanced one-call processes. The primary goal of Phase I was to reduce the rate of over-notification[2] by improving the quality and accuracy of locate notification tickets.

Phase I demonstrated that application of GPS technology in electronic white-lining can provide significant benefit to the damage prevention process. Significant reductions were achieved in the rates of over-notification, resulting from a reduction in the average locate ticket polygon size. Additionally, significant improvements were demonstrated in process efficiencies whereby locate requests were processed in a more timely and accurate manner as a result of improvements in the quality of information on locate tickets. These improvements will have tangible benefits to all stakeholders through significant cost reductions and improvements in safety. Further application of the technology throughout Virginia would result in significant cost and safety benefits to all stakeholders; if applied across the nation the cost benefits could result in savings of hundreds of millions of dollars.

Phase II Project

Upon receiving a locate ticket, facility operators must determine if they have facilities in the excavation area. If they do, they or their contract facility locators must then determine the approximate horizontal locations of their underground facilities and communicate that information back to the excavator so that care can be taken to not damage the facilities when excavating.

Communicating information back to the excavator about the location of underground facilities is normally and primarily done by the placement of visible markings or flags on the ground, indicating the approximate horizontal location of the underground facilities. However, it is believed that the excavation process and safety can be improved by providing additional information back to the excavator as to when facilities have been located (positive response). This can be achieved by accurately depicting the locate activity on electronic maps for reference by both the excavator and the facility operator.

Extending into the next aspect of the one-call process, the focus and purpose of Phase II of the Virginia Pilot Project is to evaluate and research the feasibility and benefits of applying GPS technology to improve the facility locating process. The Phase II project will enhance the communication of accurate information among excavators, one-call centers, underground facility operators and facility locators, through the development and use of “electronic manifests”.

1 “White-lining” is the term used for the excavator’s delineation of an excavation area through the painting of white lines on the ground. Electronic white-lining involves the delineation of the excavation area through the use of GPS and electronic mapping technology.

2 “Over-notification” is the term used to describe the excess locate notification tickets issued to facility operators for excavation locations where the operators don’t actually have installed facilities or would not have been notified had the dig site on the ticket been more specifically defined.

Phase II Project Implementation

Phase II Project Scope

The Phase II project will identify and allow the evaluation of options for improving the locational process, effectiveness and efficiency of locates and enable the creation and use of electronic records (manifests) for individual locates. Electronic manifests for excavators and facility operators are expected to provide enhanced site overviews for the excavator and facility operator, provide correction data for operator facility mapping, and enable rapid posting and availability of positive response data for the excavator.

The Phase II project will involve the evaluation of technology for determining GPS coordinates during facility locates, and the development, use and evaluation of electronic manifests to communicate the facility location information. Software will be developed and existing one-call system processes will be modified to ensure the enhanced facility locate data is effectively and efficiently captured and communicated.

The Phase II project will involve facility locators covering various geographical areas throughout much of the Commonwealth of Virginia. It is estimated that approximately 40 facility locators will be involved in field testing the technology. The level of involvement should be sufficient to produce more than enough electronic manifests in the 6 to 8 months of field testing to produce valid results, potentially involving in excess of 40,000 locate tickets.

At least three facility operators will participate in the Phase II project. In addition to providing participation by their in-house and contract locators, the facility operators will validate the electronic manifests produced during the field testing by comparing the manifests with their own mapping to determine if mapping correction is necessary or to identify potentially inaccurate facility locates.

Project Team

Phase II of the Virginia Pilot Project is being carried out by a team of stakeholders from various industries and agencies. This includes representatives of underground facility operators, the one-call center operator, excavators and locators, as well as both federal and state regulatory agencies. Specific participating and supporting organizations include:

- Virginia Utility Protection Service, Inc. (VUPS)
- U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration (PHMSA)

- Virginia State Corporation Commission, Division of Utility and Railroad Safety (VA SCC)
- Gas Technology Institute, Operations Technology Development (OTD)
- NYSEARCH, Northeast Gas Association (NGA)
- Common Ground Alliance (CGA)
- Several Virginia-based utility owners/operators
- Several Virginia-based contract utility locating companies

It is expected that information developed and lessons learned from Phase II of the Virginia Pilot Project will have an ultimate positive impact on underground facility damage prevention and the safety of operations of underground facilities.

Project Report: Summary of Benefits and Drawbacks of the Technologies

The final report for Phase II of the Virginia Pilot Project will include commentary about lessons learned and best practices determined from the Project and an analysis of the advantages and improvements expected to be gained from further implementation of the technology used in the Project.

Benefits Assessment

Of course, the ultimate benefit of this Pilot Project is to improve the damage prevention process overall. Effective damage prevention programs are necessary to ensure public safety and continuity of vital services.

The development and use of one-call systems has made an enormous contribution to the prevention of excavation damage to underground facilities; however, there are clearly some areas of potential improvement.

- Further enhancements to more accurately define planned excavation locations to ensure affected utilities can be efficiently identified and located will increase our ability to prevent damage to those facilities and avoid the serious consequences to public safety and the environment that can result.
- Accurate base maps are critical to the success of the one-call process. One-call center maps are necessary to determining potential conflicts between planned excavations and existing installed infrastructure. Improved methods for ensuring one-call center maps are accurate will:
    - Enable improvements to further reduce over-notification,
    - Improve safety for excavators and locators,
    - Reduce the potential for facility damages, and
    - Reduce risks to public health and safety by improving the safety of operations of facilities.
- Locate requests that accurately identify and describe the excavation area so that the affected utilities can be more accurately and efficiently located and marked are also key to improving the one-call process. (VA Pilot Project, Phase I)
- Reducing excavation damages, as well as reducing the cost of damage prevention programs, will benefit all damage prevention stakeholders through improvements in public safety, environmental protection and service reliability.

Direct benefits to damage prevention stakeholders are expected to be demonstrated from the Pilot Project. Common to the excavator, locator, and facility operator are:

- Reduction in liability resulting from process transparency and ability to have 3rd-party source verify and time-stamp better documentation/records.
- Improved relationships among stakeholders, resulting from improved communications and better documentation for supporting discussions.

- *Public* – This pilot project will demonstrate possible benefits to the public through:

  - A reduction in threats to public safety and the environment.
  - A reduction in outages from damaged facilities.
  - A reduction in utility service costs.

- *Excavation Contractors* – This pilot project will enable the excavator realize improvements in safety by ensuring potentially dangerous incidents are avoided. It will also enable the excavator to work more effectively and efficiently by providing access to an accurate and easy to understand electronic manifest. This pilot project will demonstrate possible benefits through:
  - A reduction in the likelihood of damaging existing infrastructure.
  - A reduction in the likelihood of injuring employees.
  - A reduction in the likelihood of equipment damage.
  - A reduction in the likelihood of downtime from damage incidents.
  - Reduction in liability resulting from process transparency and ability to have 3rd-party source verify and time-stamp better documentation/records.
  - Improved relationships among stakeholders from improved communications and better documentation for supporting discussions.
- *One-call Centers* – This pilot project will allow the one-call center to improve its services to member operators and excavators by:
  - Providing efficient means to communicate the electronic manifest created by the locators to the excavators and the member operators.
- *Locators* – This pilot project will allow the locator to:
  - Improve the method by which manifests of locates are created and maintained.
  - Increase productivity through the elimination of redundant documentation of marks (sketches, photos, etc.).
  - Increase the speed and accuracy of remarking tickets.
  - Additionally, when the notification ticket includes GPS data to define the excavation area, the locator's use of GPS-enabled locating equipment will allow locators to verify they are at the right location. This can reduce the occurrence of marking incorrect locations.
  - Reduction in liability resulting from process transparency and ability to have 3rd-party source verify and time-stamp better documentation/records.
  - Improved relationships among stakeholders from improved communications and better documentation for supporting discussions.
- *Underground Utility Owners/Operators* – This pilot project will enable the facility owner/operator to realize a reduction in over-notifications and will allow the

owner/operator to focus resources to have a greater impact on preventing damage to underground facilities. It will:

- Increase locate accuracy through more efficient use of resources.
- Improve the method by which locating of facilities are documented.
- Improve the accuracy of existing facility maps and data by comparing them to the locate data.
- Reduction in liability resulting from process transparency and ability to have 3rd-party source verify and time-stamp better documentation/records.
- Improved relationships among stakeholders from improved communications and better documentation for supporting discussions.

The concept of electronic white-lining (Phase I) and electronic manifests (Phase II) is expected to provide a valuable resource to all stakeholders in cases of utility damage/accidents where disputes, investigations and legal proceedings result.

Financial Summary

Direct funding for Phase II of the Pilot Project is required for the purchase of necessary vendor-supplied technology and services to specifically support the project. These direct project costs will include the purchase of GPS-enabled locating devices for use by locators in the field. It is estimated that 40 locators will participate in the Phase II project for a six-month period. This will require the purchase of equipment to support all 40 locators for the duration of the Project. The direct costs also include costs for third-party software development and testing, and user training support.

Direct funding will be used to:

- Develop software necessary to:
    - Incorporate GPS coordinates into VUPS ticket archives;
    - Allow excavators to view their locate requests as electronic manifests;
    - Automatically transmit electronic manifests to the respective facility operators.
- Develop dual storage array networks to provide the increased data storage needs from Phase II of the Virginia Pilot Project and data replication;
- Purchase GPS-enabled locating instruments.

The amount of direct funding will determine the overall scope of the project in that it will determine the number of GPS-enabled locating devices that can be purchased and, therefore, the number of participating locators that can be supported. Anticipated available direct funding is approximately $577,500.00.

Direct funding is being provided from a variety of sources. These include funding from damage prevention program grants, funding from facility operator organizations impacted by and benefiting from damage prevention activities, and funding from pipeline research organizations.

- Projected available funding for the Phase II project includes:
    - $150,000 (PHMSA/CGA Grant),
    - $100,000 (PHMSA State Damage Prevention Grant to VA SCC)
    - $45,000 (GTI OTD)
    - $20,000 (NGA);
    - $262,500 (PHMSA Consent Order to Williams Gas Pipeline).
    - **$577,500 Total projected available funding**
- GTI OTD may also be able to provide up to an additional $50,000 for funding of GPS/locator equipment units if needed and if (1) the GPS units were capable of

submeter readings and if (2) the equipment becomes the property of GTI OTD after completion of the Phase II project activities. GTI will use the equipment in support of Phase III.

The following table projects the direct expenditures for the Phase II project.

Expenditure	Projected Cost
Develop software necessary to incorporate GPS coordinates into Virginia one-call ticket archives	$25,000
Develop software to allow excavators to view electronic manifests associated with their unique locate requests	$25,000
Develop software necessary to automatically transmit electronic manifests to the respective facility operators	$25,000
Develop dual storage array networks to support the increased data storage and data replication needs for the Phase II Project	$190,000
Purchase GPS-enabled locating instruments at approximately $7,500 per unit. (At this cost the total projected funding available will provide approximately 41 units. The exact cost per unit is not yet determined.)	$307,500
Subtotal of projected direct expenditures:	$572,500
Total anticipated direct funding available:	$577,500

Project "In-kind" Investment Summary

In addition to the direct funding considerations noted above, and perhaps representing the largest portion of the investment in the Phase II Project, the Phase II Project participants are contributing their time and efforts through the support of their respective companies and sponsoring organizations. This "in-kind" investment of resources is necessary for the Project to move forward. Participant investment will vary based upon the duration and details of the Project effort.

<u>"In-kind" participant costs</u>:

- *Utility Operators*
    - Three underground utility operators, to include internal project management and process support
- *Excavators*

  - To evaluate electronic manifests and provide feedback regarding accuracy and usefulness

- *Locators*
  - At least forty locators to participate in the project
- *VUPS One-Call Center and Other Stakeholder Participants*
  - Project management and oversight support, including time and other direct costs
  - Project-specific database
  - Technology testing, benchmarking and training
  - Project report preparation and presentation documents
- *PHMSA*
  - Project management and oversight support
- *Virginia SCC*
  - Project management and administrative support
  - Technology research
  - Project report preparation and presentation documents
  - On-going support during the course of the project

Project Timeline & Milestones

As noted, the focus and purpose of Phase II of the Virginia Pilot Project is to evaluate and research the feasibility and benefits of applying GPS technology to improve the facility locating process. It will evaluate enhancements to providing timely information back to the excavator as to when facilities have been located (positive response), and the accurate depiction of the locate activity on drawings and maps for reference by both the excavator and the operator.

Project Timeline

The Phase II project began with a kick-off meeting of stakeholders in January 2008. Identification of available and suitable GPS-locating equipment, development of software, identification of participating stakeholders and project planning progressed through 2008. Progress was facilitated and monitored through a series of meetings and discussions among the Project Team participants.

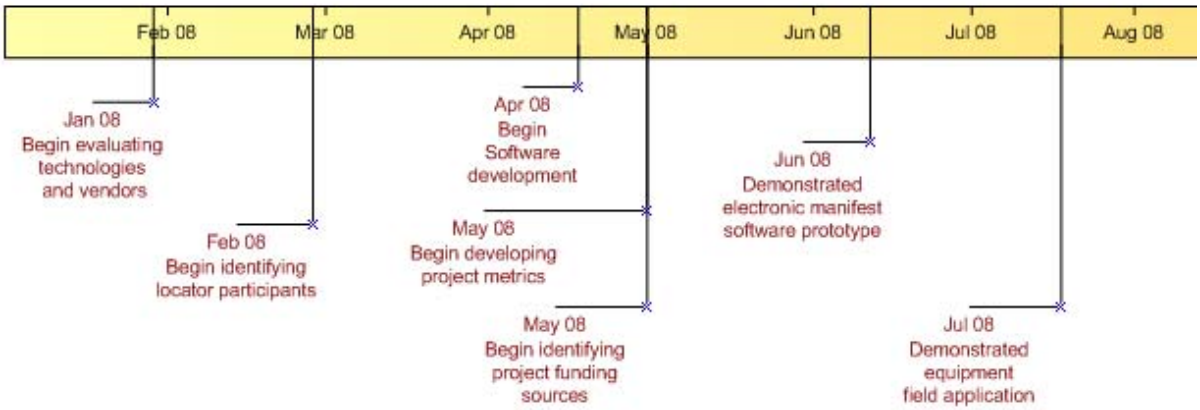
In 2009 it is expected that all necessary equipment will be purchased and installed (storage array networks) and that field testing will commence in the second quarter. Field testing of the equipment, software and processes will extend over a period of six to eight months.

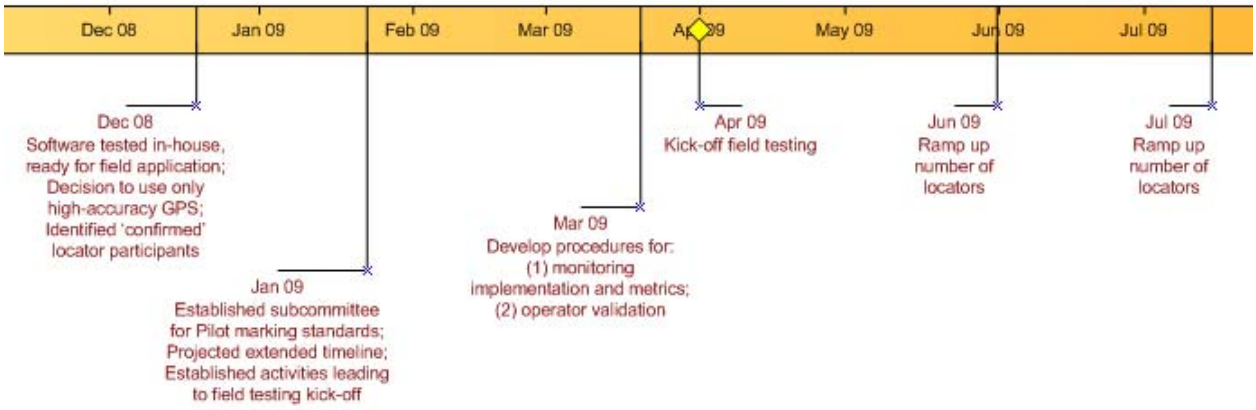
In the first quarter of 2010, data resulting from the field testing will be analyzed and the project report will be developed.

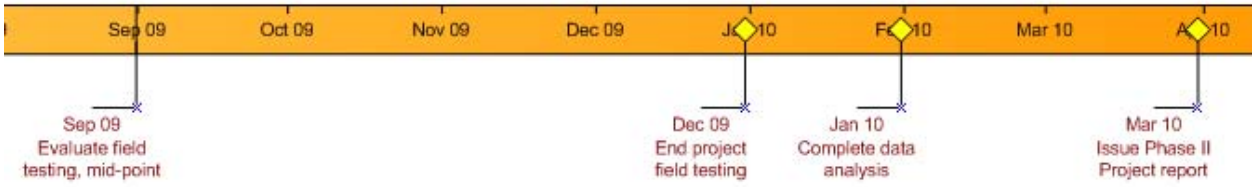
Project Milestones

The following graphics depict several milestones for the Phase II project. These may change during the course of the project. For example, the timeline may be extended as a result of seasonal weather influences during the data gathering phase. Obviously, some of the milestones have already been met.

Project Activities and Milestones







Key Process Considerations

The technology must facilitate and improve the accuracy of documenting locating and marking of facilities by developing accurate electronic locate manifests incorporating GPS reference points.

Field testing of the hardware, software and enhanced locate processes will:

- Establish an expected confidence level regarding the feasibility of gathering GPS coordinates during the facility locate process;
- Confirm the ability to develop, store and submit electronic manifests to the VUPS one-call center from the field using the selected hardware and software; and
- Verify that the electronic manifests can be made available and useful to the excavator and facility operator.

Key considerations relative to the use of technology include:

- The facility locator will gather the GPS coordinates of the facility locations by utilizing the GPS-enabled locating equipment while performing otherwise normal facility locates.
- The locators will post-process the GPS data for data correction.
    - The software has been designed so that it is transparent as to which GPS vendor is used. The software specifications identify what data must be sent (corrected shape file) to VUPS.
    - The data correction software is a part of and specific to the GPS/locating equipment package.
    - The data correction software must be installed on a single PC for each locator company.
    - There will be no additional cost to the locator.
- Facility locate and associated GPS data for development of the electronic manifests will be transmitted to the VUPS one-call center electronically via the internet.
- Electronic manifests will be validated by participating facility operators by comparison with their mapping to determine if mapping correction is necessary or if potentially inaccurate facility locates have occurred.
- Electronic manifests will be available to the excavator specifically for each locate request and only for the time the ticket is open.

Project Metrics

The Phase II Project Team developed metrics for the Project. Metrics may be both data driven and anecdotal.

- Data Metrics:
  - (VUPS) Number of Phase II locates performed with complete GPS data for each locate.
  - (VUPS) Number of Phase II locates when locator tried but was not able to capture complete GPS data for the locate and had to create a hard copy manifest. Factors could include:
    - No GPS signal due to:
    - Time of day
    - Next to buildings
    - Under canopy
  - (VUPS) Number of electronic manifests requested by the excavators
  - (VUPS) Number of member utility queries into the electronic manifests
  - (Operators) Number of needed changes to maps and records
    - identified by locators
    - confirmed by member utilities resulting from this process (i.e., number of occurrences where field representatives were dispatched for quality assurance purposes)
    - where corrective action was taken
  - (Locators) Financial impacts to the locator
    - Average time to locate
    - Delta t = (additional time to perform locate over current average time)
    - Additional cost of equipment[3]
    - Software costs[3]
  - (VUPS Help Desk) Data gathering process issues (statistics and anecdotal)
    - Excavators
    - Utilities & Locators
  - (VUPS) Gathering application software and hardware issues and fixes

[3] For the Phase II Pilot Project, there will be no costs to the locators for equipment or software. All projected costs for equipment and software development are shown in the Financial Summary section of this plan. The Project Report will demonstrate costs for implementing similar capabilities beyond the Pilot Project.

- Utilize VUPS Help Desk as central source for tracking and documentation. Identify issues and fixes with the following:
  - Locate Equipment
  - Locate Application
  - One-call software

- Anecdotal Metrics:
  - (Locators) Evaluation of locator's ability to utilize this technology as an asset management / labor management tool
  - (Locators) Does the electronic manifest correctly indicate position of all facilities located?
  - (Locators) Can the locator efficiently use the GPS equipment in conjunction with the locating and marking equipment to accurately locate and 'mark' the facilities with GPS coordinates?
  - (Locators) Does the locator understand and support the concept of adding GPS coordinates to create an electronic manifest?
  - (Locators) Does the locator see value in the development and use of electronic manifests as compared to current methods of documentation?

Technology Considerations

Technology Considerations

Equipment and an enhanced locate process is required for the accurate collection of GPS data, as well as for data transmission, storage, and verification in the generation of electronic manifests. The process must be effective and usable by affected parties without the need for extensive training, prohibitively expensive equipment or negative impacts on job processes.

Following are some considerations for that equipment and process. Some of these considerations might apply for the wider acceptance and use of the technology following the Pilot Project. Some considerations, such as the one-call center data storage and transfer application server requirements are not noted here but are necessary.

- Data Collection - GPS Accuracy
    - Current capabilities of technologies used need to be identified and measured for reliability and reproducibility
- Data Collection - GPS Field Needs
    - GPS Field Data Collection Hardware
        - Portability
        - Ruggedness
        - Affordability
            - Cost per unit
            - Cost of operation
            - Cost of training
    - User interface (ease of use, visibility in daylight)
    - Timely GPS data collection process (time at points taken vs. accuracy of GPS)
    - Electronic communication and synchronization with paired locating equipment
    - On screen visual display of data (e.g., GPS coordinates, work order number, etc.) for ease of confirmation.
    - Application restrictions and range
    - Reliability and reproducibility

- GPS Field Data Collection Software
    - Data content management: single or multiple ticket (onboard suspense function)
    - Communication with separate enabling device (cell phone, smart phone, PC)
    - Communication with VUPS server to generate electronic manifest
    - Training; deployment and upgrading.
- Enabling Technologies for GPS Field Data Collection Process
    - Existing Technologies for Field Data Collection, e.g.: GPS technology; GPS handheld receivers; Bluetooth technology; Wireless notebook PC; Smart phones; cellular technology
    - Software Upgrades
        - VUPS to accept multiple GPS points and render electronic manifest
        - VUPS to handle suspense requests on partial data entry

Market Assessment

Market Assessment

- Underground facilities include but are not limited to:
  - Gas and hazardous liquid transmission pipelines,
  - Natural gas distribution mains and service lines,
  - Municipal water and sewer systems,
  - Electric transmission and distribution systems, and
  - Telecommunications infrastructure.
- Specific data related to facility damages is found more frequently on utilities that are currently regulated and required to track and report damages, or soon to be required to report damage data, either at the Federal or state level.
- The Common Ground Alliance (CGA) can provide additional insights to underground facility damages but more specifically to the amount of excavation activity being performed across the nation.
- There are more than ### locate tickets processed by one-call centers in the United States annually (source OCSI).


One Call Technology Pilot Project Phase II