

GRANTS/CONTINGENT AWARD REQUEST



To: Grants and Loans Office

Date: 2/19/2013

Project Manager: Johann Karkheck

Phone Number: 916-327-2457

Office: Energy Systems Research Office

Division: Energy Research and Development

MS- 43

Project Title: Real-time Active Pipeline Integrity Detection (RAPID)

Type of Request: (check one)

[X] New Agreement: (include items A-F from below) Agreement Number: PIR-12-013
Program: PIER NG / Energy Technology Systems Integration
Solicitation Name and/or Number: PON-12-505-03 (Pipeline Integrity Technology Demonstration Grant)
Legal Name of Recipient: Acellent Technologies, Inc.
Recipient's Full Mailing Address: 835 STEWART DR
SUNNYVALE, CA 94085-4514
Recipient's Project Officer: Ritubarna Banerjee Phone Number: 408-745-1188
Agreement Start Date: 6/30/2013 Agreement End Date: 9/30/2015

[] Amendment: (Check all that apply) Agreement Number: _____
[] Term Extension - New End Date: _____
[] Work Statement Revision (include Item A from below)
[] Budget Revision (include Item B from below)
[] Change of Scope (include Items A - F as applicable from below)
[] Other: _____

ITEMS TO ATTACH WITH REQUEST:

- A. Work Statement
B. Budget
C. Recipient Resolution, if applicable. (Resolution may be requested in Special Conditions if not currently available.)
D. Special Conditions, if applicable.
E. CEQA Compliance Form
F. Other Documents as applicable
• Copy of Score Sheets
• Copy of Pre-Award Correspondence
• Copy of All Other Relevant Documents

California Environmental Quality Act (CEQA)

[X] CEC finds, based on recipient's documentation in compliance with CEQA:
[X] Project exempt: 14 CCR Section 15301 NOE filed: _____
[] Environmental Document prepared: _____ NOD filed: _____
[] Other: _____
[X] CEC has made CEQA finding described in CEC-280, attached

Funding Information:

*Source #1: NG Amount: \$ 622,622.00 Statute: 11- FY: 12-13 Budget List #: 501.001F
*Source #2: _____ Amount: \$ _____ Statute: _____ FY: _____ Budget List #: _____
*Source #3: _____ Amount: \$ _____ Statute: _____ FY: _____ Budget List #: _____

If federally funded, specify federal agreement number: _____

* Source Examples include ERPA, PIER-E, PIER-NG, FED, GRDA, ARFVT, OTHER.

Business Meeting Approval: (refer to Business Meeting Schedule)

Proposed Business Meeting Date: 5/8/2013 [] Consent [X] Discussion
Business Meeting Participant: Johann Karkheck Time Needed: 5 minutes

Agenda Notice Statement: (state purpose in layperson terms)

Possible approval of a [X] Grant / [] Contingent Award to...
ACELENT TECHNOLOGIES, INC. Possible approval of Agreement PIR-12-013 with Acellent Technologies, Inc. for a \$622,622 grant to develop and demonstrate a Real-time Active Pipeline Integrity Detection (RAPID) System to continuously monitor and evaluate the integrity of natural gas pipelines. The agreement will not include any match funding. (PIER natural gas funding) Contact: Johann Karkheck. (5 minutes)

GRANTS/CONTINGENT AWARD REQUEST



Project Manager	Date	Office Manager	Date	Deputy Director	Date
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Exhibit A Scope of Work

TECHNICAL TASK LIST

Task #	CPR	Task Name
1		Administration
2		Establishment of Requirements for RAPID System Design
3		Sensor Design, Optimization, and Packaging
4		Hardware Development for Maximum Data Acquisition
5		System Level Design and Integration
6		System Reliability Issues
7	X	Software Development
8		System Testing, Data Collection and Analysis
9		Technology Transfer Activities
10		Production Readiness Plan

KEY NAME LIST

Task #	Key Personnel	Key Partner(s)
1-10	None	None

GLOSSARY

Specific terms and acronyms used throughout this scope of work are defined as follows:

Term/ Acronym	Definition
CBM	Condition Based Monitoring
CPM	Commission Project Manager
CPR	Critical Project Review
ERDD	Energy Research and Development Division
NDI	Non-destructive Inspection
PG&E	Pacific Gas and Electric Company
PZT	Piezoelectric Transducer
RAPID	Real-time Active Pipeline Integrity Detection
SHM	Structural Health Monitoring

Problem Statement:

The natural gas pipeline industry consists of both metallic and non-metallic pipelines that are susceptible to aging and degradation. In metallic pipelines, one of the leading causes of pipeline failures is corrosion. Non-metallic pipelines are susceptible to aging and degradation processes such as cracking, which results in a very tight slit-like opening and leaks.

Exhibit A Scope of Work

There are a variety of nondestructive methods for locating areas of a pipeline that have suffered mechanical damage either by a third party or from natural events (e.g., landslide) and degradation. However, when such damage is located, the pipe must be exposed and inspected to determine if the damaged areas require replacement. There is no reliable, built-in, nondestructive method for determining if the damage is sufficient to materially affect operational safety. Current inspection techniques for corrosion may require the pipeline to be shut down during inspection, resulting in loss of revenue.

The Recipient's Structural Health Monitoring (SHM) originated in the aerospace industrial environment and is increasingly being evaluated by the pipeline industry as an alternative way of improving the safety and reliability of pipeline structures and reduce their operational cost. Significant benefits are expected in all fields of application (particularly in laboratory and in-service), to reduce maintenance and to improve the efficiency of the design. The core of the technology is a self-sufficient system for the continuous monitoring, inspection, and damage detection of structures with minimal labor involvement. The aim of the technology is not simply to detect structural failure, but to provide an early indication of physical damage. The early warning provided by an SHM system can then be used to define remedial strategies before the structural damage leads to catastrophic failure.

Goals of the Agreement:

The goals of this Agreement are to:

- Maintain the safety of the pipeline system.
- Accurately measure a crack in a pipeline while it is in the ditch, and transmit pipeline data to the back office.
- Reduce structural inspection costs, avoid unplanned pipeline failure and move from schedule-driven to condition-based maintenance (CBM).

The Recipient will deliver a Real-time Active Pipeline Integrity Detection (RAPID) system for new and existing pipelines that has an optimized, sensor network-based Structural Health Monitoring technology to query, monitor, and evaluate the condition of pipeline structures.

Objectives of the Agreement:

The objectives of this Agreement are to:

- Obtain real-time information on the integrity of a structure during service
- Identify visible and invisible damage in metal and non-metallic structures
- Assess damage information from structural anomalies including:
 - fatigue cracks in highly loaded metallic fittings
 - impact damage
- Provide an easy to use inspection tool for maintenance personnel

Exhibit A

Scope of Work

TASK 1 ADMINISTRATION

Instructions for Submitting Electronic Files and Developing Software

Electronic File Format

The Recipient will deliver an electronic copy (CD ROM or memory stick or as otherwise specified by the Commission Project Manager (CPM) of the full text of any Agreement products in a compatible version of Microsoft Word (.doc).

The following describes the accepted formats of electronic data and documents provided to the Energy Commission as products and establishes the computer platforms, operating systems, and software versions that will be required to review and approve all software deliverables.

- Data sets will be in Microsoft (MS) Access or MS Excel file format.
- PC-based text documents will be in MS Word file format.
- Documents intended for public distribution will be in PDF file format, with the native file format provided as well.
- Project management documents will be in MS Project file format.

Software Application Development

If this Scope of Work includes any software application development, including but not limited to databases, websites, models, or modeling tools, the Recipient will use the following standard Application Architecture components in compatible versions:

- Microsoft ASP.NET framework (version 3.5 and up) Recommend 4.0.
- Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
- Visual Studio.NET (version 2008 and up) Recommend 2010.
- C# Programming Language with Presentation (UI), Business Object and Data Layers.
- SQL (Structured Query Language).
- Microsoft SQL Server 2008, Stored Procedures Recommend 2008 R2.
- Microsoft SQL Reporting Services Recommend 2008 R2
- XML (external interfaces).

Any exceptions to the Electronic File Format requirements above must be approved in writing by the Energy Commission's Information Technology Services Branch.

Task 1.1 Attend Kick-off Meeting

The goal of this task is to establish the lines of communication and procedures for implementing this Agreement.

Exhibit A Scope of Work

The Recipient shall:

- Attend a “Kick-Off” meeting with the CPM, the Grants Officer, and a representative of the Accounting Office. The Recipient shall bring its Project Manager, Agreement Administrator, Accounting Officer, and others designated by the CPM to this meeting. The administrative and technical aspects of this Agreement will be discussed at the meeting. Prior to the kick-off meeting, the CPM will provide an agenda to all potential meeting participants.

The administrative portion of the meeting shall include, but not be limited to, the following:

- Discussion of the terms and conditions of the Agreement
- Discussion of Critical Project Review (Task 1.2)
- Match fund documentation (Task 1.6) *No work may be performed until this documentation is in place.*
- Permit documentation (Task 1.7)
- Discussion of subcontracts needed to carry out project (Task 1.8)

The technical portion of the meeting shall include, but not be limited to, the following:

- The CPM’s expectations for accomplishing tasks described in the Scope of Work
- An updated Schedule of Products
- Discussion of Progress Reports (Task 1.4)
- Discussion of Technical Products (Product Guidelines located in Section 5 of the Terms and Conditions)
- Discussion of the Final Report (Task 1.5)

The CPM shall designate the date and location of this meeting.

- Submit an updated Schedule of Products, List of Match Funds, and List of Permits to the CPM.

Recipient Products:

- Updated Schedule of Products
- Updated List of Match Funds
- Updated List of Permits

Commission Project Manager Product:

- Kick-Off Meeting Agenda

Exhibit A

Scope of Work

Task 1.2 Critical Project Review (CPR) Meetings

The goal of this task is to determine if the project should continue to receive Energy Commission funding to complete this Agreement and to identify any needed modifications to the tasks, products, schedule, or budget.

CPRs provide the opportunity for frank discussions between the CPM and the Recipient. The CPM may schedule CPRs as necessary, and CPR costs will be borne by the Recipient.

Participants include the CPM and the Recipient, and may include the Commission Grants Officer, the Energy Research and Development Division technical lead, other Energy Commission staff and Management, and any other individuals selected by the CPM to provide support to the Energy Commission.

The Commission Project Manager shall:

- Determine the location, date, and time of each CPR meeting with the Recipient. These meetings generally take place at the Energy Commission, but they may take place at another location or may be conducted via electronic conferencing (e.g., WebEx), as determined by the CPM.
- Send the Recipient the agenda and a list of expected participants in advance of each CPR. If applicable, the agenda shall include a discussion of both match funding and permits.
- Conduct and make a record of each CPR meeting. One of the outcomes of this meeting will be a schedule for providing the written determination described below.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, and/or budget for the remainder of the Agreement. If the CPM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a written determination in accordance with the schedule. The written response may include a requirement for the Recipient to revise one or more products that were included in the CPR.

The Recipient shall:

- Prepare a CPR Report for each CPR that discusses the progress of the Agreement toward achieving its goals and objectives. This report shall include recommendations and conclusions regarding continued work on the project. This report shall be submitted along with any other products identified in this Scope of Work. The Recipient shall submit these documents to the CPM and any other designated reviewers at least 15 working days in advance of each CPR meeting.

Exhibit A Scope of Work

- Present the required information at each CPR meeting and participate in a discussion about the Agreement.

Commission Project Manager Products:

- Agenda and a list of expected participants
- Schedule for written determination
- Written determination

Recipient Product:

- CPR Report(s)

Task 1.3 Final Meeting

The goal of this task is to close out this Agreement.

The Recipient shall:

- Meet with Energy Commission staff to present the project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement.

This meeting will be attended by, at a minimum, the Recipient, the Commission Grants Office Officer, and the CPM. The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the discretion of the CPM.

The technical portion of the meeting shall involve the presentation of an assessment of the degree to which project and task goals and objectives were achieved, in addition to findings, conclusions, recommended next steps (if any) for the Agreement, and recommendations for improvements. The CPM will determine the appropriate meeting participants.

The administrative portion of the meeting shall involve a discussion with the CPM and the Grants Officer about the following Agreement closeout items:

- Disposition of any equipment purchased with Energy Commission funds
- Energy Commission's request for specific "generated" data (not already provided in Agreement products)
- Need to document Recipient's disclosure of "subject inventions" developed under the Agreement
- "Surviving" Agreement provisions
- Final invoicing and release of retention

Exhibit A Scope of Work

- Prepare written documentation of any agreements made between the Recipient and Commission staff during the meeting.
- Prepare a schedule for completing the closeout activities for this Agreement.

Products:

- Written documentation of meeting agreements
- Schedule for completing closeout activities

Task 1.4 Monthly Progress Reports

The goal of this task is to periodically verify that satisfactory and continued progress is made towards achieving the research objectives of this Agreement on time and within budget.

The objectives of this task are to summarize activities performed during the reporting period, to identify activities planned for the next reporting period, to identify issues that may affect performance and expenditures, and to form the basis for determining whether invoices are consistent with work performed.

The Recipient shall:

- Prepare a Monthly Progress Report that summarizes all Agreement activities conducted by the Recipient for the reporting period, including an assessment of the ability to complete the Agreement within the current budget and any anticipated cost overruns. Each progress report is due to the CPM within 10 days of the end of the reporting period. The recommended specifications for each progress report are contained in the Terms and Conditions of this Agreement.
- In each Monthly Progress Report and invoice, provide a synopsis of project progress. Also document and verify the following:
 - Energy Commission funds received by California-Based Entities (CBEs);
 - Energy Commission funds spent in California; and
 - Match fund expenditures

Product:

- Monthly Progress Reports

Task 1.5 Final Report

The goal of the Final Report is to assess the project's success in achieving its goals and objectives, advancing science and technology, and providing energy-related and other benefits to California.

Exhibit A Scope of Work

The objectives of the Final Report are to clearly and completely describe the project's purpose, approach, activities performed, results, and advancements in science and technology; to present a public assessment of the success of the project as measured by the degree to which goals and objectives were achieved; to make insightful observations based on results obtained; to draw conclusions; and to make recommendations for further projects and improvements.

The Final Report shall be a public document. If the Recipient has obtained confidential status from the Energy Commission and will also prepare a confidential version of the Final Report, the Recipient shall perform the following activities for both the public and confidential versions of the Final Report.

The Recipient shall:

- Prepare an Outline of the Final Report.
- Prepare a Final Report following the approved outline and the latest version of the Final Report guidelines which will be provided by the CPM. The CPM shall provide written comments on the Draft Final Report within 15 working days of receipt. The Final Report must be completed at least 90 days before the end of the Agreement Term.
- Submit one bound copy of the Final Report with the final invoice.

Products:

- Draft Outline of the Final Report
- Final Outline of the Final Report
- Draft Final Report
- Final Report

Task 1.6 Identify and Obtain Match Funds

The goal of this task is to ensure that the match funds planned for this Agreement are obtained and applied to this Agreement during the term of this Agreement.

The costs to obtain and document match fund commitments are not reimbursable through this Agreement. Although the Energy Commission budget for this task will be zero dollars, the Recipient may utilize match funds for this task. Match funds shall be spent concurrently or in advance of Energy Commission funds for each task during the term of this Agreement. Match funds must be identified in writing and the associated commitments obtained before the Recipient can incur any costs for which the Recipient for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a letter documenting the match funding committed to this Agreement and submit it to the CPM at least 2 working days prior to the kick-off meeting. If no match funds were part of the proposal that led to

Exhibit A Scope of Work

the Energy Commission awarding this Agreement and none have been identified at the time this Agreement starts, then state such in the letter. If match funds were a part of the proposal that led to the Energy Commission awarding this Agreement, then provide in the letter a list of the match funds that identifies the:

- Amount of each cash match fund, its source (including a contact name, address and telephone number), and the task(s) to which the match funds will be applied.
- Amount of each in-kind contribution, a description, documented market or book value, its source (including a contact name, address and telephone number), and the task(s) to which the match funds will be applied. If the in-kind contribution is equipment or other tangible or real property, the Recipient shall identify its owner and provide a contact name, address, telephone number, and the address where the property is located.
- Provide a copy of the letter of commitment from an authorized representative of each source of cash match funding or in-kind contributions that these funds or contributions have been secured. For match funds provided by a grant a copy of the executed grant shall be submitted in place of a letter of commitment.
- Discuss match funds and the implications to the Agreement if they are reduced or not obtained as committed, at the kick-off meeting. If applicable, match funds will be included as a line item in the progress reports and will be a topic at CPR meetings.
- Provide a letter including the appropriate information to the CPM if during the course of the Agreement additional match funds are received.
- Provide a letter to the CPM within 10 days if during the course of the Agreement existing match funds are reduced. Reduction in match funds must be approved through a formal amendment to the Agreement and may trigger an additional CPR.

Products:

- A letter regarding match funds or stating that no match funds are provided
- Copy(ies) of each match fund commitment letter(s) (if applicable)
- Letter(s) for new match funds (if applicable)
- Letter that match funds were reduced (if applicable)

Task 1.7 Identify and Obtain Required Permits

The goal of this task is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track.

Exhibit A

Scope of Work

Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement. Although the Energy Commission budget for this task will be zero dollars, the Recipient shall budget match funds for any expected expenditures associated with obtaining permits. Permits must be identified in writing and obtained before the Recipient can make any expenditure for which a permit is required.

The Recipient shall:

- Prepare a letter documenting the permits required to conduct this Agreement and submit it to the CPM at least 2 working days prior to the kick-off meeting. If there are no permits required at the start of this Agreement, then state such in the letter. If it is known at the beginning of the Agreement that permits will be required during the course of the Agreement, provide in the letter:
 - A list of the permits that identifies the:
 - Type of permit
 - Name, address and telephone number of the permitting jurisdictions or lead agencies
 - The schedule the Recipient will follow in applying for and obtaining these permits.
- Discuss the list of permits and the schedule for obtaining them at the kick-off meeting and develop a timetable for submitting the updated list, schedule, and copies of the permits. The implications to the Agreement if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in the Progress Reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, provide an updated list of permits (including the appropriate information on each permit) and an updated schedule to the CPM.
- As permits are obtained, send a copy of each approved permit to the CPM.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CPM within 5 working days. Either of these events may trigger an additional CPR.

Products:

- Letter documenting the permits or stating that no permits are required
- Updated list of permits as they change during the term of the Agreement (if applicable)
- Updated schedule for acquiring permits as changes occur during the term of the Agreement (if applicable)
- A copy of each approved permit (if applicable)

Exhibit A Scope of Work

Task 1.8 Obtain and Execute Subcontracts

The goal of this task is to ensure quality products and to procure subcontracts required to carry out the tasks under this Agreement consistent with the terms and conditions of this Agreement and the Recipient's own procurement policies and procedures. This task will also provide the Energy Commission an opportunity to review the subcontracts to ensure that the tasks are consistent with this Agreement, and that the budgeted expenditures are reasonable and consistent with applicable cost principles.

The Recipient shall:

- Manage and coordinate subcontractor activities.
- Submit a draft of each subcontract required to conduct the work under this Agreement to the Commission Agreement Manager for review.
- Submit a final copy of the executed subcontract.
- If the Recipient decides to add new subcontractors, it shall notify the Commission Agreement Manager.

Products:

- Draft subcontracts
- Final subcontracts

TECHNICAL TASKS

TASK 2 ESTABLISHMENT OF REQUIREMENTS FOR RAPID SYSTEM DESIGN

The goal of this task is to ensure that the developed system can be directly implemented and used by existing and new pipeline systems. The team will generate a list of requirements that need to be addressed for this purpose. The list will be developed early in the project.

The Recipient shall:

- Identify the appropriate sensor types, sizes, and specifications for maximum area coverage.
- Determine the optimum sensor size and spacing. This will depend on several factors including the sensitivity required, the corrosion size to be determined, and the wave propagation distance.
- Identify network design and integration issues for the sensors and layers.
- Identify sensor operation and survivability issues.
- Identify hardware connection, data collection, and data transfer issues.
- Perform data interpretation/intelligent signal analysis.

Exhibit A Scope of Work

- Prepare a Notification Letter that: (1) includes requirements for sensors, hardware, and software; (2) documents the status of the system and any issues that may arise; and (3) includes any relevant photographs network hardware and issues such as proposed sensor spacing and defect types.

Products:

- Notification Letter

TASK 3 SENSOR DESIGN, OPTIMIZATION AND PACKAGING

The goal of this task is to design an optimized sensor network based on the pipelines chosen for the demonstration. The proper selection of diagnostic waveform and an understanding of the interaction between the actuator/sensor and structure will ease the interpretation strategy for damage detection. For all practical purposes, the sensors must be placed at an optimum distance so that the sensor and actuator signals do not overlap. This optimum distance will depend on the size of the pipeline structure. Based on the application, appropriate sizes and locations for the piezoelectric sensors must be selected. Based on the damage size and the structure (geometry and material), the signal propagation distance and damage must relate to the size of the sensor utilized.

The Recipient shall:

- Select appropriate materials and sizes for the SMART Layer[®], including those for the carrier film and the piezoelectric materials for the sensors and actuators.
- Optimize the number of sensors for the pipeline so that a minimum number of sensors that can monitor a large area are used.
- Select sensor sizes appropriate for the pipeline. Typical Piezoelectric Transducer (PZT) sizes vary from 1/8" diameter to 1/4" diameter, and from 10 mil-30 mil thickness. In order to achieve the highest transport energy or signal-to-noise ratio (SNR), the shape and dimension of the piezoelectric actuator/sensor should be chosen so that there is a maximum energy transmission between the actuator/sensor and structure.
- Prepare a Report on Sensor Size and Layout Optimization.

Products:

- Report on Sensor Size and Layout Optimization (no draft)

TASK 4 HARDWARE DEVELOPMENT FOR MAXIMUM DATA ACQUISITION

The goals of this task are to develop hardware for maximum data acquisition and to ensure that data can be reliably transferred from the SMART Layer[®] to the hardware.

Exhibit A Scope of Work

The Recipient shall:

- Utilize a prototype system available in-house as a basis for the customization of hardware for use with the SMART Layer[®].
- Prepare a Report on Hardware Development that includes hardware design and component layout.

Products:

- Report on Hardware Development (no draft)

TASK 5 SYSTEM LEVEL DESIGN AND INTEGRATION

The goal of this task is to design and implement the SMART Layer[®] and diagnostic hardware on the pipeline on a system level.

The Recipient shall:

- Address issues concerned with SMART Layer[®] installation including surface preparation, installation procedures, proper adhesives, and application of protective coatings.
- Address wiring and connectors/connections between the sensors and the hardware. The system must be designed for optimal placement of the connectors on the pipeline structure. The connectors must be placed at discrete locations to avoid affecting the integrity of the pipeline structure. This will require close collaboration with the Pacific Gas and Electric Company (PG&E).
- Determine hardware placement for data acquisition on selected pipelines.
- Modify existing pipeline maintenance procedures for system implementation.
- Prepare an Interim Report on an Optimal Solution for System-Level Design and Integration that includes system design, installation methods, and placement.
- Prepare a Final Report on an Optimal Solution for System-Level Design and Integration that includes system design, installation methods, and placement.

Products:

- Interim Report on an Optimal Solution for System-Level Design and Integration (no draft)
- Final Report on an Optimal Solution for System-Level Design and Integration (no draft)

Exhibit A

Scope of Work

TASK 6 SYSTEM RELIABILITY ISSUES

The goal of this task is to address the RAPID system's reliability. The major focus will be on system self-diagnostics, which are vital for the program because a health monitoring system is expected to last through the life of the structure. The key to the successful development of the system is diagnostic procedures that can help determine if the sensors integrated with a structure are undamaged. Sensor self-diagnostics can eliminate the ambiguity that arises during structural monitoring regarding whether there is real damage in the structure or whether the damage is projected due to sensor debond or breakage.

Through a grant from the U.S. Army, the Recipient is currently developing an impedance-based sensor self-diagnostic method to determine if the sensors integrated with a structure are undamaged. This method will be modified for use with the RAPID system.

The Recipient shall:

- Integrate sensors into the pipeline using the SMART Layer®.
- Outline diagnostic procedures that can help determine if the sensors integrated with a structure are undamaged.
- Prepare a Report on System Reliability that describes system diagnostic procedures and the reliability of sensors.

Products:

- Report on System Reliability (no draft)

TASK 7 SOFTWARE DEVELOPMENT

The goal of this task is to develop the diagnostic software for damage detection and damage size estimation. The Recipient has developed numerous algorithms and software to detect damage in metallic structures with built-in sensors and actuators. They will be used as a basis for the development.

The Recipient shall:

- Develop diagnostic methods similar to the current signal analysis methodology based on comparing the current sensor responses to previously recorded "baseline" sensor responses from the undamaged structure.
- Develop software to quantify damage. Use an empirical-based quantification scheme that will gain accuracy as tests are conducted on pipeline structures. To facilitate the damage quantification scheme, several modules must be developed:

Exhibit A Scope of Work

- A user-friendly software module that will catalog and store various damages measured by conventional NDI
- A module to automatically generate the damage index curves using the selected frequencies, time windows, and analysis methodology from an unlimited number of data files
- An automated approach to calculate the slope of each damage index curve
- An automated method to calculate the uncertainty in the damage size estimates
- A module to automatically generate the results in tabular form.
- Prepare an Interim Report on Software Development that includes a description of software interface and output used in detection of pipeline damage.
- Prepare a CPR Report in accordance with Task 1.2 (Administration).
- Participate in a CPR Meeting.

Products:

- Interim Report on Software Development (no draft)
- Final Report on Software Development (no draft)
- CPR Report

TASK 8 SYSTEM TESTING, DATA COLLECTION AND ANALYSIS

The goals of this task are to ensure that the work conducted is directly applicable for condition-based maintenance of pipelines used in the field and to collect operational data, analyze the data for economic and environmental impacts, and include the data and analysis in the Final Report.

The system testing and validation will first be conducted at the coupon/laboratory level, and then on an actual pipeline facility. The objective of the testing will be to determine if the RAPID system developed above can detect and quantify corrosion/erosion occurring in pipeline structures during testing. The test results will be validated using existing NDI techniques. The Recipient will work closely with PG&E in this task.

The Recipient shall:

- Instrument the coupons with the SMART Layers[®] and conduct testing by introducing damage such as material loss (erosion), cracks and pitting on the exterior surface of the pipes. Internal damage will be simulated by stick-on patches. At various damage stages, the RAPID system output will be corroborated with visual measurements.
- Work closely with PG&E to obtain sample pipeline specimens including straight and curved sections of pipes.

Exhibit A Scope of Work

- Conduct an in-field demonstration at PG&E facilities chosen at the kick-off meeting. Corrosion/erosion developed during testing will be monitored by the Recipient using the RAPID system. The results will be verified using visual and/or external NDI techniques.
- Develop a data collection test plan based on input from the CPM. The plan will include but not limited to a discussion of the following:
 - Energy savings and estimated cost savings
 - Greenhouse gas reductions
 - Other non-energy benefits
- Provide data on potential job creation, market potential, economic development, and increased state revenues that may result from the expected future expansion.
- Provide an estimate of the project's energy savings and other benefits such as potential statewide energy savings once market potential has been realized.
- Compare project performance and expectations provided in the proposal to actual project performance and accomplishments.
- Prepare an Interim Report on System Validation at the Coupon Level in Laboratory. The report will include test methods and results from Coupon Level testing.
- In-Field Demonstration Report that includes test methods and results from in-field demonstration.
- Prepare a Data Analysis Report that includes results of data compiled from lab and field demonstrations, and a review of system performance.

Products:

- Interim Report on System Validation at the Coupon Level in Laboratory (no draft)
- Final In-Field Demonstration Report (no draft)
- Draft Data Analysis Report
- Final Data Analysis Report

TASK 9 TECHNOLOGY TRANSFER ACTIVITIES

The goal of this task is to develop a plan to make the knowledge gained, experimental results and lessons learned available to key decision-makers.

The Recipient shall:

- Prepare a Technology Transfer Plan. The plan shall explain how the knowledge gained in this project will be made available to the public. The level of detail expected is least for research-related projects and highest for demonstration projects. Key elements from this report shall be included

Exhibit A Scope of Work

- in the Final Report for this project.
- Conduct technology transfer activities in accordance with the Technology Transfer Plan. These activities shall be reported in the Monthly Progress Reports.

Products:

- Draft Technology Transfer Plan
- Final Technology Transfer Plan

TASK 10 PRODUCTION READINESS PLAN

The goal of the plan is to determine the steps that will lead to the manufacturing of the technologies developed in this project or to the commercialization of the project's results.

The Recipient shall:

- Prepare a Production Readiness Plan. The degree of detail in the Production Readiness Plan discussion should be proportional to the complexity of producing or commercializing the proposed product and its state of development. The plan shall include, as appropriate, but not be limited to:
 - Identification of critical production processes, equipment, facilities, personnel resources, and support systems that will be needed to produce a commercially viable product
 - Internal manufacturing facilities, as well as supplier technologies, capacity constraints imposed by the design under consideration, identification of design critical elements and the use of hazardous or non-recyclable materials. The product manufacturing effort may include "proof of production processes"
 - A projected "should cost" for the product when in production
 - The expected investment threshold to launch the commercial product
 - An implementation plan to ramp up to full production

Products:

- Draft Production Readiness Plan
- Final Production Readiness Plan



Award Number: PIR-12-013

Date: 04 / 12 / 2013

Note: The Energy Commission Project Managers Manual includes detailed instructions on how to complete this section, with examples of grants that are “Projects” and are not “Projects”. When the Project Manager is completing this section, if questions arise as to the appropriate answers to the questions below, please consult with the Energy Commission attorney assigned to review grants or loans for your division.

1. Is grant/loan considered a “Project” under CEQA? Yes (skip to question #2) No (continue with question #1)

Please complete the following: *[Public Resources Code (PRC) 21065 and 14 California Code of Regulations (CCR) 15378]:*

Explain why the grant/loan is **not** considered a “Project”? The grant/loan will not cause a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment because grant/loan involves:

2. If grant/loan is considered a “Project” under CEQA: (choose either **IS** or **IS NOT**)

Grant/loan **IS** exempt:

Statutory Exemption: (List PRC and/or CCR section numbers) _____

Categorical Exemption: (List CCR section number) 14 CCR Section 15301

Common Sense Exemption. (14 CCR 15061(b)(3))

Explain reason why the grant/loan is exempt under the above section:

The project involves design and testing of pipeline inspection technology. Testing and data collection will take place within existing pipeline infrastructure and will not result in a significant environmental impact.

Please attach draft Notice of Exemption (NOE). Consult with the Energy Commission attorney assigned to your division for instructions on how to complete the NOE.

Grant/loan **IS NOT** exempt. The Project Manager needs to consult with the Energy Commission attorney assigned to your division and the Siting Office regarding a possible initial study.