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INTERAGENCY AGREEMENT NUMBER CPSC-I-02-1290

BETWEEN THE

NAVAL RESEARCH LABORATORY (NRL)

AND THE

CONSUMER PRODUCT SAFETY COMMISSION (CPSC)

A. DESCRIPTION OF SERVICES

The Contractor shall provide an evaluation of current smoke alarms and wireless technologies to determine the feasibility of producing a battery operated smoke alarm that is interconnected by wireless communication in accordance with the Statement of Work.

B. CONTRACT TYPE

This procurement is a firm-fixed price performance-based-research and development contract with two phases.

C. BACKGROUND INFORMATION

1. In 1974 in excess of 8000 Americans were dying in fires annually, 80% of them in residential fires. In 1974, the report of the presidential commission on fire, *America Burning*, recommended that Americans protect themselves from fire at home by installing smoke detectors. But the codes of the time applied the same requirements on dwellings that were used in commercial buildings. Thus, a homeowner wanting a code compliant home fire alarm system had to install a heat detector in every room and one smoke detector, all connected to a control panel. At $1 to $1.50 per square foot (about what a residential sprinkler system costs today) less than 1% of U.S. homes were protected under this "all or nothing" approach.

2. Following the report, the National Fire Protection Association standards committee responsible for household fire warning equipment proposed that homeowners choose from four, "levels of protection." Ranging from a minimum system of a smoke detector outside the bedroom (Level 4) to the complete system previously required (Level 1); the homeowner could install what was affordable and (hopefully) upgrade the system later.

3. While this scheme passed the floor vote, several fire service organizations correctly voiced the concern that the reduced levels had never been shown to be adequate. To address this problem, the National Institute of Standards and Technology (NIST - then known as the National Bureau of Standards) contracted with Underwriters Laboratories, Inc. and IIT Research Institute to conduct tests of the efficacy of protecting a home with only a few smoke detectors.

4. Over the period 1975-76, seventy-six experiments were conducted in several actual homes scheduled for demolition as part of an expansion of the Indiana Dunes National Lakeshore Park. Smoke detectors being sold at the time of both the ionization and photoelectric type were evaluated along with residential heat detectors. The fire sources were actual items of furniture. The fire scenarios examined were those identified in the National Fire Incident Reporting System (NFIRS) as the leading cause of residential fire deaths.

5. These experiments, known as the Indiana Dunes Tests found that a smoke detector located outside the bedrooms and on each additional story including the basement, provided adequate escape time for most residential fires. The codes throughout the U.S. were soon revised to require "every level protection," and to require such installation in both new and existing homes.

6. In recent years, the NFPA 1 00 I Life Safety Code have required all smoke alarms in new constructions to be interconnected. The interconnected smoke alarms allow all the smoke alarms to sound if any individual smoke alarm detects smoke. This allows an increase in egress times and life protection for the occupant if a smoke alarm happens to sound in the farthest part of the home. But, this requirement was only applicable to smoke alarms powered by 120 VAC or house wiring. A large number of homes were constructed before smoke alarms were required and battery operated smoke alarms were installed later. These homes do not have the added protection of all smoke alarms sounding when a single smoke alarm has detected smoke.

7. Today's technology may allow a battery powered smoke alarm to communicate with other smoke alarms without significantly increasing the manufacturing cost or depleting the life of a standard 9-volt alkaline battery within a year.

D. OBJECTIVES

The primary objective of this research is to gain enough knowledge to demonstrate that wireless technology can be incorporated into battery operated smoke alarms. Emphasis will be placed on wireless technologies that would not drastically increase in the cost of a residential smoke alarm, retain the primary power source as a 9-volt alkaline battery, not increase the general size of the smoke alarm, and provide reliable interconnection between smoke alarms without false alarming.

E. STATEMENT OF WORK

1. The Contractor shall research wireless technologies that can be applied to current residential battery operated smoke alarms. The contract will be in two phases. Phase I is a literature search on smoke alarms, wireless technology, and alternative power sources. Phase I will also provide a list of recommended wireless technologies that would meet the objective (Section D). Phase II will demonstrate the wireless interconnected technology in a battery operated smoke alarm.

2. Independently, and not as an agent of the Government, the Contractor shall furnish all necessary personnel, materials, services, and facilities to perform the work set forth below; except as provided in Section H.1 GOVERNMENT FURNISHED EQUIPMENT/SUPPLIES,

   a. KICKOFF MEETING

Within fourteen (14) calendar days after the effective date of the award, the Contractor shall attend an initial meeting at CPSC Headquarters Office located in Bethesda, Maryland with the CPSC Project Officer and CPSC Staff to discuss the requirements of the procurement.

b. MEETINGS AT CONTRACTOR'S FACILITY

The CPSC Project Officer will arrange meetings with the Contractor, to be held at the Contractors facility. Other appropriate CPSC staff will attend.

c. STATUS REPORTS

ORAL STATUS REPORTS

The Contractor shall provide Monthly status reports, by conference telephone call to the CPSC Project Officer, on all phases of the contract.

d. PROJECT PLAN

Within twenty-one (21) calendar days after the effective date of award, the Contractor shall deliver an original and three (3) copies of a Project Plan. The Contractor shall provide an electronic copy of the Project Plan in a format compatible with IBM compatible equipment and Microsoft software. CPSC Project Officer recommends the use of Microsoft Project. However, CPSC can also retrieve information from Microsoft Access and Microsoft Excel. If the Contractor uses another project plan software package, he should discuss its acceptability with CPSC Project Officer. This Project Plan shall include the following:

(1) An explanation of what the contractor plans to do and how,
(2) A work breakdown schedule for each phase, and
(3) A time schedule.

e. PHASE I - SMOKE ALARM AND WIRELESS TECHNOLOGY TECHNICAL LITERATURE RESEARCH

(1) The following objectives for Phase I must be completed by the contractor in order to accomplish the primary objective as stated in Section D.

(a) Evaluate the current residential smoke alarm technology. Smoke alarms, both battery powered and 120 VAC powered, currently sold will be evaluated with regard to the power consumption, components, and method of operation.

(b) *Evaluate different methods of wireless communication.* Wireless communication can already be found in many aspects of our home (garage door opener, TV remote, security alarm, light switches, handheld computers, etc). In selecting potential wireless technologies to evaluate, the following shall be considered:

1) Can it be technologically feasible and small enough to fit within a current smoke alarm housing;

2) that it does not consume excessive power;

3) that it has low interference with other wireless communication and/or building structures;

4) and can be selectable coded to avoid nuisance tripping from other residential wireless smoke alarms;

5) that it has a high level of reliability to transmit and receive signals.

(c) *Evaluate other low cost batteries that can be used to power the smoke alarms.* It is feasible that the added electronics could cause a regular 9-volt alkaline battery to be depleted within a year. Evaluate alternative batteries that could power the new smoke alarm as primary power or as a secondary/additional power source for the wireless circuitry. As a secondary power source, the power source must last for 10 years without replacing. If a secondary power source is used, the primary power source must be a 9-volt alkaline battery. The primary power source must continue to be able to pass the Battery Test in *UL 21 7 Single and Multiple Station Smoke Alarms, Section 63 Battery Tests* (validation or verification through numerical calculations is acceptable). The battery, primary or secondary, must be of reasonable size to be able to fit inside a typical smoke alarm housing along with any additional circuitry.

(d) *Identify Wireless Technology that can be incorporated in a battery powered smoke alarm.* The identified wireless technology must be technologically feasible to fit inside a smoke alarm housing and not deplete the primary source as outlined in *UL217 Single and Multiple Station Smoke Alarms Section 63 Battery Test.* To be used as a communicating device in a smoke alarm, it must be able to communicate through typical residential walls and floors, be unique code selectable, not nuisance trip by other wireless devices, compact to fit into existing smoke alarm housing, and consume low power. The additional circuitry must still allow the battery source(s) to pass

the Battery Test in *UL 21 7 Single and Multiple Station Smoke Alarms, Section 63 Battery Tests* (validation or verification through numerical calculations is acceptable)

(2) The CPSC Project Officer will provide the Contractor with CPSC reports and studies that CPSC has either sponsored, or researched in the past, and will offer guidance toward specific information that CPSC is aware of and interested in. (See Section H. Government Furnished Equipment/Supplies). The Contractor shall perform the following:

(a) The Contractor shall provide a written Initial Draft on Current Residential Smoke Alarms and Wireless Technologies

1) Initial Draft Technical Report within ninety-nine (99) calendar days after the effective date of the award shall be provided to the CPSC Project Officer. The CPSC Project Officer will provide comments/recommendations on the draft report within one hundred six (106) calendar days after the effective calendar days of the award.

(b) The Initial Draft Report on Current Residential Smoke Alarms and Wireless Technologies Technical Literature Research (Phase I) shall include the following items:

1) Description of Each Current Residential Smoke Alarm. - Each smoke alarm description shall include the following information:

a) Name and type of smoke alarm

b) Theory of Operation

c) Technical Specifications (sensor type, power source(s), type of processing chip, power consumption (stand by and under alarm), method of interconnecting if applicable, and processing chip timing waveforms,

d) References,

e) Diagrams,

f) Pictures, and

g) Other items as researched.

2) Description of Each Wireless Technology. - Each wireless technology description shall include the following information:

a) Name and type of wireless technology

b) Theory of Operation

c) Technical Specifications (transmission and receiving type, power source(s), power consumption (stand by and active), level of immunity to interference, and frequency range if applicable).

d) References,

e) Diagrams,

f) Pictures, and

g) Other items as researched.

(c) Descriptions of each potential low cost and compact alternative battery source, either as a primary or secondary power source. The description shall also include a typical national brand 9-volt alkaline battery. Each potential alternative battery source description shall include the following information:

1) Name and type of battery

2) Technical Specifications (battery type, battery size (ANSI), voltage, typical application, amp hours, shelf life, and cost)

3) References,

4) Diagrams,

5) Pictures, and

6) Other items as researched.

(d) Identified Potential Application Design of Wireless Technologies that could be incorporated into a Battery Powered Residential Smoke Alarm.

1) For each of the identified technologies listed in Section **E.2.e.(2)(E)1)**, the Contractor shall provide potential methods where the wireless technology can be incorporated in a battery powered residential smoke alarm. The Contractor shall consider the follow list of guidelines for determining a potential wireless technology, but is not limited to these:

a) Can be technologically feasible and small enough to fit within a current smoke alarm housing (all additional printed circuit boards must not contain more layers than what presently exists in smoke alarms).

b) Does not deplete the primary and/or secondary power source (9-voll alkaline battery or identified alternative low cost battery) so that it will not pass the *UL 217 Single and Multiple Station Smoke Alarm Section 63 Battery Test.* The added (wireless) circuitry may be powered by a secondary power source on the condition that the secondary battery does not need replacing for 10 years and the primary power source is a 9-volt battery.

c) Has low interference with other wireless communication and/or building structures,

d) Can be selectable coded to avoid nuisance tripping from other residential wireless smoke alarms

e) Has a high level of reliability to transmit and receive signals.

(e) For each of the identified wireless technologies, the contractor shall provide the following information:

1) Description of the wireless technology applied to smoke alarms,

2) Block diagram of the wireless technology incorporated in the smoke alarm (How will it fit in the smoke alarm housing?

What is the level population in the smoke alarm housing or circuit board?)

3) Wireless technology application performance specifications (How does the wireless technology communicate? How well?),

4) Performance specifications as a unit (How well does it work? What is the power source and consumption before and after modifications? How long will it last or be powered? What is the likelihood of nuisance tripping from false or foreign signals?),

5) Bill of Materials (parts list) for the wireless application design,

6) Diagrams illustrating the physical installation of the wireless technology in a smoke alarm,

7) Schematic (if electrical components are used),

8) Algorithmic requirements,

9) Any testing results,

10) Estimate of increased manufacturer cost for additional feature, and

11) Operation and maintenance requirements.

(3) Presentation of the Literature Research on the Current Residential Smoke Alarms and Wireless Technology

Within one hundred thirty-six (136) calendar days after the effective date of the award, the Contractor shall provide to CPSC Project Officer and CPSC staff with a presentation of their literature search on Current Residential Smoke Alarms and Wireless Technology to be held at CPSC Headquarters Office in Bethesda, Maryland.

(4) Discussion of Prototype designs For Phase II

Within one-hundred-thirty-six (136) calendar days after effective date of award, the Contractor shall meet with the CPSC Project Officer to discuss

Phase II prototype designs either at CPSC Headquarters Office in Bethesda, or via telephone as determined by the CPSC Project Officer.

f. PHASE II - DEMONSTRATE WIRELESS TECHNOLOGY IN A BATTERY POWERED RESIDENTIAL SMOKE ALARM

(1) Within one-hundred-fifty-seven (157) calendar days after the effective date of the award, the CPSC Project Officer will choose one of the Applications Designs presented by the Contractor in Phase I (**See Section E.2.e.(4)**). The CPSC Project Officer will notify the Contractor in writing of the selected Application Design choice and will instruct the Contractor to build/construct the prototype.

(a) Written Draft on Wireless Technology in a Battery Powered Residential Smoke Alarm (Phase I & II).

(b) Within one-hundred ninety (190) calendar days after the effective date of the award, the Contractor shall provide to the CPSC Project Officer an original and three (copies) of the written Draft on Wireless Technology in Battery Powered Residential Smoke Alarms Report (Phase I & II). The report shall include the following:

1) Both Phases of the Project,

2) Completed Reports on all major activities, and

3) All supporting documentation.

(c) CPSC Project Officer shall review the Draft on Wireless Technology in a Battery Powered Residential Smoke Alarm Report (Phase I & II).

1) The CPSC Project Officer will review the draft report within two hundred and four (204) calendar days after the effective date of the award and provide the Contractor with CPSC Project Officer and CPSC staff comments/recommendations.

(d) Written Final Report on Wireless Technology in a Battery Powered Residential Smoke Alarm (Phase I & II).

1) Within two-hundred twenty-eight (228) calendar days after the effective date of the award, the Contractor shall provide to the CPSC Project Officer an original and three (copies) of

the written Final Demonstration of Wireless Technology in Battery Powered Residential Smoke Alarms Report. The final Report on Wireless Technology in a Battery Powered Residential Smoke Alarm Report (Phase I & II) shall include the following:

a) All documentation and reports on all the major activities.

b) Both Phases of the Project,

c) All supporting documentation and reference materials

d) Test results, and.

e) Conclusions.

(e) *Demonstration of the Prototype Smoke Alarm*

1) Within two hundred twenty-eight (228) calendar days after the effective date of the award, the Contractor shall provide a presentation of the selected Application Design Prototype on the Wireless Battery Powered Smoke Alarm. The contractor shall have three working prototypes for demonstration. The location of the Presentation will be the CPSC Headquarters Office in Bethesda, Maryland, or at a location designated by the CPSC Project Officer. The Contractor shall demonstrate the prototype product as follows:

a) The integration of the wireless technology into an actual smoke alarm. The wireless technology is not required to be enclosed in the smoke alarm housing but it must be technologically possible.

b) Demonstrate the wireless communication in operation for the CPSC Project Officer and CPSC staff:

(1.) When the test button of any of the smoke alarm is pressed it sounds the other two smoke alarms,

(2.) When any of the smoke alarms are exposed to "smoke in a can" it sounds the other two smoke alarms,

(3.) When demonstrated, a minimum 50-ft and two internal walls must separate the smoke alarms (this portion of the demonstration may take place at a suitable location chosen by the contractor and approved by the CPSC Project Officer).

F. *REPORTING REQUIREMENTS*

1. The Contractor shall submit the following reports to the Project Officer, with a copy (written reports only) of the cover letter to the Contracting Officer:

   a. Monthly Oral Status Reports for all Phases of the Contract

      (1) The Contractor shall provide oral status reports by telephone to the CPSC Project Officer as follows:

         (a) Progress relative to the schedule,

         (b) Proposed changes to the schedule,

         (c) Proposed resolutions to problems encountered,

         (d) Requests for CPSC assistance, and

         (e) Other matters pertinent to the contract.

      (2) The Format for the Final Report shall be as follows. The content of the final report is as described elsewhere.

         (a) Type – binder cover

         (b) Table of Contents

         (c) Size -Standard 8-1/2 by 11 inch paper with one-inch margins

         (d) Typewritten & reproducible using word-processed in a format compatible with Microsoft Word

         (e) Provide information concerning

            1) The contract pursuant to which the report is prepared and

2) The name of the Contractor preparing the report pursuant to such contract.

(f) The Contractor shall provide an electronic copy of the final report. The electronic copy shall be in a format acceptable to the CPSC Project Officer. CPSC uses windows based computers, microsoft word and adobe acrobat reader.

b. Phase I – Smoke Alarm and Wireless Technology Literature Research Reports

(1) Written Project Plan (See Section **E.2.d.** for requirements)

(2) Written Description for each Smoke Alarm (See Section **E.2.e.(2)(b)(1)** for requirements)

(3) *Written Description of each Wireless Technology (See Section* **E.2.e.(2)(b)(2)** for requirements

(4) Written Description of each Potential alternative battery or secondary *battery sources (See Section* **E.2.e.(2)(c)** *for requirements)*

(5) Identified Wireless Technologies List (See Section **E.2.e(2)(d)** for requirements)

(6) Draft Report for the Phase I – Smoke Alarm and Wireless Technology Technical Literature Research (See Section **E.2.e.(2)(b)**

c. Phase II - Demonstration Reports

(1) Draft Report – Smoke Alarm and Wireless Technology (Phase I & II)(See Section **E.2.f.(1)(a)**)

(2) *Final Report for Phase I – Smoke Alarm and Wireless Technology* Technical Literature Research (See Section **E.2.f.(1)(d)**)

G. PERIOD OF PERFORMANCE

Performance of work shall begin on the effective date of this contract and shall not extend beyond two-hundred-and-twenty-eight (228) calendar days.

H. GOVERNMENT FURNISHED EQUIPMENT/SUPPLIES

CPSC will provide the Contractor with CPSC reports and studies that CPSC has either sponsored, or researched in the past, and will offer guidance toward other specific information that CPSC is aware of and interested in.

I. DELIVERY OR PERFORMANCE

The following items must be performed or delivered in accordance with the following schedule:

ITEM	QUANTITY	DELIVERY & PERFORMANCE
1. Kick-off Meeting	One (1)	14 Calendar days after award
2. Contractor Facility Meetings	To be determined	To be determined
3. Oral Status Reports	Monthly	First oral report one (1) month after award then every month thereafter.
4. Project Plan	One (1)	21 calendar days after award
5. Technical Report on Phase I (Draft)	One (1)	99 calendar days after award
6. Literature Search Report & Presentation	One (1)	136 calendar days after award
7. Phase II Prototype Design Meeting	One (1)	136 calendar days after award
8. Wireless Technology in Battery Powered Residential Smoke Alarms Report (Phase I & II). (Draft Report & Presentation)	One (1)	190 calendar days after award
9. Wireless Technology in Battery Powered Residential Smoke Alarms Report (Phase I & II) (Final)	One (1)	228 calendar days after award
10. Presentation of Selected Application Design Prototype On the Wireless Battery Powered Smoke Alarm (Final)	One (1) One (1)	228 calendar days after award 190 calendar days after award

J. DISCLOSURE OF INFORMATION:

1. NRL shall not disclose any information concerning any work performed under this agreement without the express written permission of the Commission. The NRL shall submit to the Commission any report, manuscript or other document containing the results of work performed under this Agreement, before such document is published or otherwise disclosed to the public, to assure that there is no pending investigation associated with the sample tested and to assure compliance with Section 6(b) of the Consumer Product Safety Act (15 U.S.C. Section 2055(b)), Commission regulations (16 C.F.R. Part 1101), and a Commission directive (Order 1450.2). These provisions restrict disclosure by the Commission or its agents of information that (1) permits the public to identify particular consumer products or (2) reflects on the safety of a class of consumer products. Prior submission allows the Commission staff to review the information and comply with the applicable restrictions. CPSC should be advised of the NRL's desire to submit or publish an abstract or a report as soon as practical.

3. Any publications of or publicity pertaining to, the work performed under this Agreement shall include the following:

"This project includes or is based on data that was acquired with funds from the Consumer Product Safety Commission. The content of this publication does not necessarily reflect the views of the Commission, nor does mention of trade names, commercial products, or organizations imply endorsement by the Commission.

K. CPSC PROJECT OFFICER:

Consumer Product Safety Commission
Directorate for Engineering Sciences
Division of Electrical Engineering
Room 611
Washington, D.C. 20207

Arthur Lee
Telephone: (301)504-0508 ext. 1393

L. CPSC FINANCIAL OFFICER:

Consumer Product Safety Commission
Directorate for Administration
Accounting Operations
Room 522
Washington, D.C. 20207

M. AGENCY PAYMENT OFFICER:

Ms. Cecelia R. Smith
Telephone: (301)504-0018 ext. 1137

N. NRL PROJECT MANAGER:

Naval Research Laboratory
Navy Technology Center for Safety and Survivability
Code 6180
4555 Overlook Ave., NW
Washington, DC 20375

Project Manager: Dr. Fred Williams
Telephone: (202)767-2476
Faxsimile: (202)767-1716

O. PERIOD OF AGREEMENT:

From date of fully executed agreement through 228 days.

P. DISAGREEMENTS

In the event that CPSC and NRL have a disagreement arising under this interagency agreement, the parties shall cooperatively seek to resolve the disagreement by themselves. If the disagreement cannot be resolved between them, the parties agree to seek the assistance of a third party in resolving the disagreement.

Q. BILLING:

NRL shall provide a quarterly billing for the cost of tests performed during the preceding quarter to the CPSC Agency Payment Officer (see Section M). It is mutually agreed that these billings shall represent the best estimates of actual costs of the services and articles provided, since it may not be possible to itemize and account for individual articles and services.

R. FUNDING AND ACCOUNTING DATA:

The transfer of funds should be through the On-Line Payment and Collection (OPAC) system.

TRANSFER TO:

NRL Accounting and Appropriation Data:

Appropriation:
CAN:
PMS:
Object Class:
Agency Location number:

TRANSFER FROM:

CPSC Accounting and Appropriation Data: $172,000.00

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S. AUTHORITY:

1. General Authority: Economy Act of 1932, as amended 31 USC 1535;

2. CPSC Authority: Section 27(g) of the Consumer Product Safety Act, 15 USC 2076(g);

T. FASA COMPLIANCE:

As the servicing agency, NRL agrees to act in full compliance with Section 1074 of the Federal Acquisition Streamlining Act (FASA)of 1994 entitled ECONOMY ACT PURCHASES.

APPROVED AND ACCEPTED FOR THE UNITED STATES CONSUMER PRODUCT COMMISSION

BY: Donna Hutton

SIGNATURE: Donna Hutton

TITLE: Contracting Officer

DATE: 9/25/02

APPROVED AND ACCEPTED FOR THE NAVAL RESEARCH LABORATORY

BY: Frederick W. Williams

SIGNATURE: Frederick W. Williams

TITLE: Director, Navy Technology Center for Safety & Survivability

DATE: 9/19/02