Center for Innovative Technology (CIT)
In conjunction with our partners
Smart City Works, LLC and TechNexus
(SCITI Labs team)

Requests Innovators with capabilities
in the following area:

Ground-Based Wildfire Sensors at the Urban Interface

Requested responses:

1. **Company profile information form**
2. **3-5 page white paper or 10 page presentation describing sensor approach, deployment concept, and a summary of relevant company capabilities.**

Responses may be submitted by October 11, 2019 to:

Wildfire Application

or by clicking the "APPLY" button at https://www.cit.org/sciti/rfi/

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CIT
CENTER FOR INNOVATIVE TECHNOLOGY

SCITI Labs Specification:
Technology Area 4 – Wildfire Sensors at the Urban Interface

Background: The Center for Innovative Technology, in conjunction with our partners Smart City Works and TechNexus is looking for companies with technologies, solutions, and tools to achieve the goals set out in this RFI as part of the SCITI Labs program. This program is funded by the Department of Homeland Security, Science & Technology organization, and is part of a larger effort to move innovative technology quickly into operational use for first responders and other DHS component users. Companies selected as part of this process may receive a subcontract from CIT to demonstrate their functional capabilities in the requested area.

The premise of SCITI Labs is "commercial-first", looking to adapt existing commercial capabilities to government use cases while still helping innovative companies maintain their commercial product focus. Relevant technologies may include functional prototypes approaching readiness for commercialization, products developed for adjacent markets that require minimal or limited adaptation, or potentially dual-use products with existing commercial market presence. CIT's role is to help companies understand and adapt capabilities to the government use cases, and provide assistance in product adoption both as the capabilities transition to DHS component users and as products seek commercial opportunities. CIT does not charge innovation companies or take any equity, intellectual property, or other direct stake in companies for support under this contract.

Use Case Description

Responders operate in a variety of adverse conditions. Recent experience in California and elsewhere has highlighted the growing danger of wildfires at the urban interface, particularly as homes and other structures at the edges of more densely populated areas come into direct contact with forested and other areas with natural dense assortments of flammable materials. Satellite and airborne imagery can quickly identify early stage fires in the middle of national forests via smoke plumes and similar, but have much greater difficulty at the urban interface where fireplaces, outdoor grills, and in some cases outdoor leaf burns are the primary sources of smoke and particulates. The goal therefore is a ground-based sensor capability, either fixed and/or mobile, that is affordable enough to be densely deployed in danger areas and can detect and differentiate fire indicators with sufficient granularity to reduce false positives to an acceptably low level.

A simple analogy is indoor smoke/CO2 detectors in homes. The base version is battery-operated, sounds an audible alarm and relies on homeowners to call 911 for actual fire situations. More complex versions of course can incorporate automatic notifications to authorities and other features. While one could simply put these identical devices outdoors, the alarm setpoint for smoke density might not give sufficient warning in the case of wildfires and would not be able to differentiate among types of fires. Nevertheless, the availability of very low-cost consumer grade sensors that provide reasonable functionality and are deployable by homeowners is an attractive feature of this analogy.

Deployment mechanisms may include fixed deployments on houses or other structures, or on infrastructure components such as utility or power distribution poles. Deployments may also be envisioned partly or entirely on mobile platforms such as package delivery or utility vehicles that are routinely present in neighborhoods.

The goal of this capability is to provide earlier warning for people to evacuate an area, and earlier indications to responders about the existence and movement of fire and potentially other hazards (such as chemical plumes). Therefore the sensors need to be able to operate autonomously, detect continuously, and report periodically to external users. Part of the open trade space for this RFI is the tradeoff between things such as battery life, the range of chemical and/or particulate signatures detected, the frequency of reporting, and the reporting mechanism(s). While prototypes will need to include commodity batteries and communications modules, these are not the focus of this RFI.

A communications approach or architecture may be considered for this RFI, if presented in conjunction with a specific sensor approach. Presumably all sensor reporting traverses an existing network to responders. But, ad hoc connectivity at the edge, mobile phone polling of sensors within range, and similar types of approaches for reporting and alerting may all be part of the operational consideration. As one example, communication between adjacent sensors may assist both in reducing false positives and in providing supplemental information such as the rate and direction of spread of a fire.

While both sensor deployment platforms and a variety of sensors currently exist in the commercial market, these have not been integrated in a way that fully support this urban wildfire use case. This technology area is focused on integrating capabilities (perhaps from several vendors) and producing a commercial-ready prototype for these types of use cases.

Scope of Technology: The scope of this RFI encompasses sensor technology such as particulate or chemical sensors adapted to detect and differentiate wildfires at the urban edge. The expectation is that existing sensing elements will be adapted for this purpose, so development of new sensor phenomenologies or significant sensor performance or sensitivity improvements over current capabilities is *not* anticipated. Prototypes must also include commodity power, communications, and mounting/attachment capabilities suitable for the intended deployment envelope, as well as a specific deployment concept(s). Deployment concepts that rely on more advanced communication elements such as ad hoc networks, or more extensive signal processing at the sensor must include the appropriate computational, storage and/or communication components in the prototype.

General Requirements: The general requirement for this effort is demonstration of a prototype capability of increasing relevance to the use case over the course of a 6-8 month period of performance. Three prototype demonstrations will be expected during this period (along with limited supporting documentation), correlating with initial, mid-term and final Quarterly Reviews at mutually agreed locations. Intended contracts are fixed price subcontracts to CIT, and none, one or several of these may be awarded. In prior SCITI Labs Technology Area efforts, the initial fixed price subcontracts were $50,000 to each performer.

The goal of this Phase is demonstration of a limited number of sensors in a realistic environment; actual numbers will depend on coverage area and cost, but will be realistic within the cost constraints of the program. Other requirements are specified below; limited exceptions to these requirements may be considered on a case-by-case basis if the overall set of proposed capabilities is deemed to be of high value to the responder community.

Technical Parameters

This RFI seeks potential approaches responsive to a set of identified needs for Wildfire detection at the Urban Interface. This is a complex technical trade space with considerations for cost, coverage, complexity and communications all coming into play. While this RFI does not direct any particular portion of the trade space, we expect responses to indicate how these parameters are considered, target specifications for various parameters of interest, and where the innovator sees opportunity for optimized solutions.

For example, a full-spectrum high accuracy chemical detector ("industrial-grade") that costs an order of magnitude or more than a simpler, less accurate but useful detector that homeowners could purchase and deploy might be a better point solution but not a better regional deployment solution given small sensor budgets. Battery powered sensors have lower installation costs than fixed, powered installations, but battery replacement may not be feasible. A mobile deployed network of sensors (on various fleets of vehicles for example) may provide good opportunistic coverage but may not be available at specific times or places. Smaller sensors have more deployment opportunities than larger sensors, so size, weight and power are considerations.

It is anticipated that good coverage of a region will require a mix of industrial-grade and commercial-grade, fixed and mobile sensor suites, and that the optimal configuration will incorporate capabilities from several vendors. The goal of this RFI is to solicit capabilities that can support an integrated prototype of consumer-grade and/or industrial-grade sensors or families of sensors that are easily integrated (open APIs and standards) and deployed across wide at-risk areas. The deployments may be in one or more modes (fixed/mobile, powered/battery-operated, various communication modes) in response to a set of identified gaps, shown below.

Responses are sought for the primary gaps related to ignition and fire characteristics in Table 1. Crowd-sourcing or common operating picture approaches that do not address the fire characteristic and sensor deployment features are not adequate. Solutions that do not address all gaps or requirements but that do provide important functionality relevant to one or more of these gaps will be considered; if selected, such respondents may be encouraged to team with others providing synergistic capabilities. As part of any issued subcontracts, selected performers will be engaged in one or more iterations of prototype experimentation to demonstrate capabilities and interact with the end user community and other stakeholders, in order to refine the experimental suite of integrated capabilities.

The gaps and requirements of interest have been excerpted from a larger DHS report that is posted here and on the CIT web site. However, SCITI Labs is a research activity and not a full Government procurement. As such, items identified as "Requirements" in these tables should be considered as potential end-customer needs rather than mandatory contractual items, and these may be substantially refined over the course of the end-user interactions and experimentation that are a core component of the SCITI Labs process.

Table 1: Relevant Identified Gaps, Referenced to Requirements

G11	Ignition Detection	Detection of Wildfire at the Urban Interface (WUI) fire ignitions is not accurate or fast enough	R15, R17, R18
G12	Ignition Data Dissemination	Insufficient dissemination of ignition detection data to all response partners	R16, R19, R20
G13	Perimeter Tracking	Real-time perimeter tracking is often unavailable	R21, R26
G14	Fire Characteristics	Lack of tracking data on a fire's parameters to include speed, crowning, spotting, and wind	R22
G15	Crowdsourced Information	Non-traditional, crowdsourced information and communications (e.g., social media) are not frequently incorporated into the WUI fire common operating picture	R24
G20	Geographically -Targeted Warnings	Lack of systems and procedures that deliver notifications and warnings to a targeted geographic area	R31

Table 2: Requirements

R15	Need real-time and continuous identification of heat sources and smoke to detect ignition location
R16	Need widespread, automatic dissemination of detection data
R17	Need integrated data for baseline risk factors (e.g., weather, fuel, topography, fire history) with real-time updates
R18	Need to exploit all source information (e.g., social media) for ignition detection
R19	Need to deconflict and process ignition data into actionable information
R21	Need real-time and continuously updated tracking of fire perimeter
R22	Need real-time and continuously updated tracking of fire characteristics (e.g. intensity, spotting, crowning, spread)
R24	Need to exploit all source information to inform WUI Fire tracking
R26	Need tracking capabilities able to penetrate smoke cover and other WUI fire conditions
R31	Need geographically targeted notification and warning to specific areas

Additional technical details on the types of chemical compounds in fires can be found here. The document is:

Deric C. Weiss and Jeff T. Miller, *A Study on Chemicals found in the Overhaul Phase of Structure Fires using Advanced Portable Air Monitoring available for Chemical Speciation*, State of Oregon Governor's Fire Service Policy Council and Tualatin Fire &, 25 February 2011