Stanwood Camano School District

TO: BOARD OF DIRECTORS

FROM: LIZ JAMIESON, DIRECTOR – CAPITAL PROJECTS

SUBJECT: CONTRACT APPROVAL – VARIUS

DATE: SEPTEMBER 16, 2019

TYPE: ACTION NEEDED

The Office of the Superintendent of Public Instruction notified us on July 1, 2019 that the Stanwood-Camano School District has been selected to participate in the testing of the new ShakeAlert earthquake early warning system.

The ShakeAlert system is being developed through a coordinated effort between the United States Geological Survey (USGS), California Office of Emergency Services, Caltech, the University of Washington, Berkeley, and the University of Oregon. It depends on an integrated network of USGS seismometers, which detect seismic activity along the west coast of the US, Canada and Mexico. The ShakeAlert system is tied into the USGS network and will utilize information provided to "identify and characterize an earthquake a few seconds after it begins, calculate the likely intensity of ground shaking that will result, and deliver alerts to people and infrastructure in harm's way".

There are a limited number of private partners providing the ShakeAlert technology. In our area there are two, RH2, Engineering and Varius. The Varius quote is attached and reflects a total cost for both Stanwood Elementary School and Stanwood Middle School of $19,998 for installed equipment. We intend to request monitoring for one year, which will allow us to receive feedback on system performance.

Recommendation:
We recommend the board ***move to approve the attached proposal from Varius Inc., and authorize the administration to execute the agreement with this provider.***

VARIUS INC
324 Rhodora Heights Road
Lake Stevens WA 98258
variusinc.com

Stanwood Camano School District

PROPOSAL FOR SERVICES

SHAKEALERT EARTHQUAKE EARLY WARNING – OMNIMONITOR© AND INSTALLATION

August 29th, 2019

Overview

This proposal from Varius Inc. includes the provision, installation and startup services necessary to install and activate an **OmniMonitor**© in the Stanwood Camano School District for connection to the USGS **SHAKEALERT**™ earthquake early warning system. The intent of the project is to provide the ability for the Stanwood Camano School District (District) to initiate and complete automatic machine-activated responses to the **SHAKEALERT**™ alarm.

While the range of potential and beneficial automatic responses is nearly endless, the initial installation and application is intended to provide feasibility and proof of concept for automatic actions at Stanwood Elementary School and Stanwood Middle School. The initial application will be a connection to the existing Public Address system with the ability to make an automatic school-wide broadcast of an alarm (advance notice of earthquake shaking) using the existing PA system.

> It is anticipated that the PA system connection at Stanwood Elementary school will be to a Rauland Telecenter ICS (Model ICS2BASERM) and we will interface with this device using the "Panic Button" interface wherein the Normally Open relays terminals on the OmniMonitor connect to the Panic Button terminal on the Telecenter. A ShakeAlert alarm will close the OmniMonitor relay and the Telecenter will see this as a Panic Button activation and play the pre-recorded message for the Panic button activation.
>
> It is anticipated that the PA system connection at Stanwood Middle School will be to a Bogen Model MCP 35 A Public Address system. This system will need to be modified with the addition of a Viking Model CTG-2 Tone and Message Generator which will in turn be connected to the relay output on the OmniMonitor which will initiate the message recoded on the Viking CTG-2.

Additional and future automatic actions will be initiated via two relays provided in the **OmniMonitor©** and these relays (each user-programmable for various activation thresholds) can be used to initiate any automatic process (open a door, close a valve, disconnect power, activate an alarm, turn on a light, etc.) via the proper and appropriate connection to on-site systems, devices and equipment. These future connections and automatic operations are not included in this initial installation but can be added at any time by the owner.

The work included in this contract shall be performed on a fixed-fee basis. Additional work will be performed on a time and materials basis using Varius standard rates and charges and as requested, in writing, by the District. A monthly service charge is necessary to provide heartbeat monitoring, automatic and periodic software updates, and repair and replacement services.

The **OmniMonitor©** will be delivered within 6 weeks of acceptance of this proposal and will be available for startup and testing following District installation of the **OmniMonitor©** mounting board.

Costs:

The work described below in the "Included work items" shall be provided for a lump sum payment of $9,999 for each OmniMonitor© (two are anticipated for a total cost of $19,998.00). Additional OmniMonitors may be purchased at the same unit price. Payment is due within 30 days following installation of the **OmniMonitor©**. A monthly charge of $150 for monitoring and service will be assessed and invoiced monthly or may be paid annually at the discretion of the District.

Included work items:

1. Provide one **OmniMonitor©** (manufactured by Weir-Jones Associates and modified for Varius and ShakeAlert applications). Operating description attached.
2. Provide one **OmniMonitor©** mounting board, size 16" x 12" with included power connector (120 vac IEC compatible plug), included internet connection (RJ45 plug), terminal block for field connections to **OmniMonitor©**-mounted relays (two relays, N.O., N.C. and Comm. connections for each relay), security cable tray for on-board cable management and documentation pouch. (schematic attached).
3. Field mounting of the **OmniMonitor©** to the installed Mounting Board.
4. Connection of the board-mounted OmniMonitor relays to the PA system at each school. The connection is expected to occur within the same room wherein the OmniMonitor is located and the wiring will be surface mounted (not in conduit) and secured by wall mount cable ties between the OmniMonitor and the PA system.
5. One Viking CTG-2 Tone and Message Generator and installation of the circuit board into the provided slot in the existing PA system (or an equivalent product at Varius discretion).
6. **OmniMonitor©** startup services including:
    a. installation of the **OmniMonitor©** device,
    b. installation of the **OmniMonitor©** configuration file (using data provided by owner),
    c. verification of connection to the ShakeAlert Event Server,
    d. verification that the event server connection is stable,
    e. verification that the heartbeat monitoring system (provided and monitored by Varius) is active and stable,
    f. Event testing.
7. **OmniMonitor©** training for staff including up to 4 hours of orientation, real-time event simulation and response to questions.
8. **OmniMonitor©** documentation including O&M manuals, recommended test sequence, recommended troubleshooting procedures, hardware specifications and field service procedures.

Excluded work and items:

1. Installation of the **OmniMonitor©** mounting board in the final mounting location (provided by District).

2. Trouble-shooting inactive or unresponsive field devices (including the PA systems) (can be provided on a time and expense basis).
3. Organizational response procedures and policies following an alarm (can be provided on a time and expense basis).

Items provided by owner:

1. Take delivery of the **OmniMonitor©** mounting board and mount the board to a stable vertical surface using four anchor bolts or screws.
2. Power connection (120 vac) and Internet connection (RJ45) within 48" of mounting board location.
3. Field connection to each PA system via twisted pair wires.
4. Operating manual and operating schematic of the activated PA system delivered to Varius for board-level coordination with the **OmniMonitor**©.
5. Information for the initial configuration file including the following:
    a. Preferred threshold alert values (Richter) for relay 1 and relay 2 (soft and hard alarm setpoints)
    b. Email address list for each tier of email alert notification (2 tiers provided)
    c. Information included in each email alert tier (configuration and formatting for email notifications)

Attachment 1 – OmniMonitor© Features:

1. Industrial design, UL labelled, ISO 9000 certified suitable for reliable operation in harsh industrial environments.
2. Continuous, real-time, remote heartbeat monitoring included. System faults, or anomalies, are noticed in less than 5 minutes and a status update sent via email to the owner.
3. Dynamic IP addressing (rather than static IP address) makes it virtually impossible to intercept, track or corrupt the unit or data remotely.
4. SCADA or device connection via form C dry contacts for a secure and impenetrable airgap between the unit and your control or communication system or devices.
5. On board seismic sensor with broadband discrimination for local P-wave sensing and S-wave monitoring. Can be used to parse false alarms from USGS and to measure actual on-site shaking.
6. User-programmable email alerts with status and alarm condition monitoring. Used to track unit performance and seismic activity in real-time or in batches at user-defined intervals (weekly, monthly, quarterly, etc).

Attachment 2 – OmniMonitor© Operation Description

An electronic device will be used to connect District facilities to the U.S. Geological Survey (USGS) **SHAKEALERT™** Earthquake Early Warning System and provide an alarm interface and data conversion for fault-tolerant reactions within the District (such as automatically playing a message over the existing public address systems). The device is an industrial-hardened data acquisition system called an OmniMonitor© (Unit) manufactured by Weir-Jones Group in Vancouver, Canada. The Unit has been modified for Varius, Inc. (Varius) with special communication modules to connect to the SHAKEALERT™ System and to provide a cyber-safe connection to District control systems and communication systems. The device is manufactured at Weir-Jones' ISO 9000:2015 certified facility.

The Unit connects to the SHAKEALERT™ System through a conventional RJ45 internet connection. The Unit employs a dynamic IP address, making it impossible to initiate internet communications externally. In other words, the Unit must call out to you, you cannot call in to the Unit. This protects the Unit, and the District's Intranet and control systems, from hacking and other internet-related security threats.

The Unit connects to the District's control or communication systems through two on-board relays, each able to be user configurable to respond to seismic events of different threshold values. For example, Relay 1 could be configured to close (activate) at any magnitude 6.5 or larger event and Relay 2 could be configured to close at any 8.5 or larger event. Each relay is form C and is a dry contact closure, in this way it is impossible to pass digital data across the relay interface and this, in turn, provides security for the control and communication systems from internet threats. There is no ability to make a digital data connection from the control system or communication system to the internet through the Unit's connection. After alarm initiation, one of the two relays will close (based on expected earthquake magnitude) and will remain closed until the system is reset (via front-panel buttons).

The Unit includes two front-mounted pushbuttons. One is a "TEST" button which closes relay 2 and this action can be programmed to initiate a test sequence in the control, communication system or PA system. The second button is a "RESET" button which opens (deactivates) both on-board relays. Three indicator lights are provided showing "POWER" (Unit is on), "STANDBY" (the Unit is functioning properly and has a valid connection to the ShakeAlert™ System) and "ALARM" (an alarm has been triggered by the ShakeAlert™ System or the "TEST" button has been pressed).

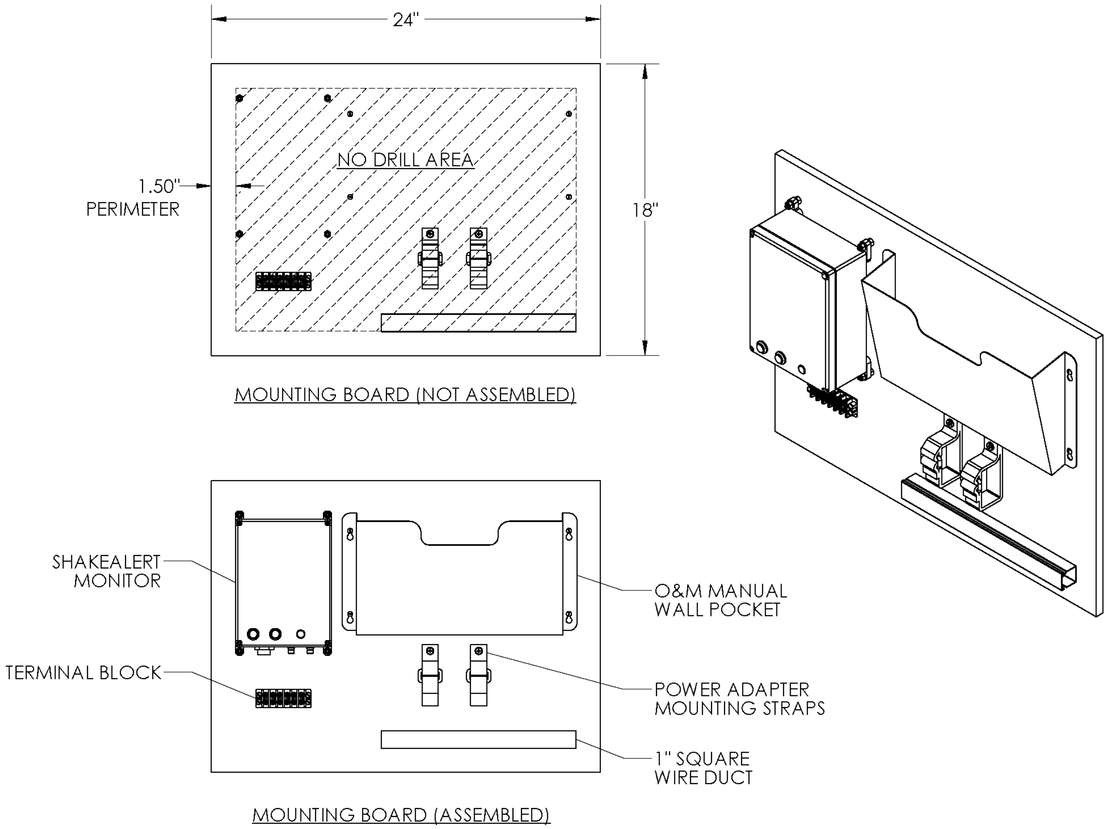
The ShakeAlert™ System initiates an alarm condition using pre-programmed threshold magnitudes (selected by USGS) and presents this alarm, along with specific alarm data, to the Unit. The Unit in turn calculates the expected time to shaking at its location (using geospatial data and on-board algorithms) and the expected shaking intensity using shake-terrain maps from USGS. This closes on-board relays based on user-defined setpoints in accordance with the table below. Each alarm setpoint can be used to initiate different automatic reactions within the District (for example; automatic public address alerts, close boiler gas valves, open automatic doors, isolate lab hazards in chemistry rooms, etc).

Relay	Standby	Soft Alarm	Hard Alarm	Test
R1	Open	Closed	Closed	Open
R2	Open	Open	Closed	Closed

The Unit is designed to communicate with a pre-defined list of contacts via email and through connection to the various District-owned control and communication systems. Following an alarm notification from the SHAKEALERT™ System, the Unit will close and latch the appropriate relay(s) and send a broadcast email to the list of contacts in the Unit's configuration file. This email will include the alarm notification, the time the alarm was received, the expected magnitude and the expected time to shaking. In addition, the Unit will periodically send an email to the email addresses listed in the configuration file with Unit status.

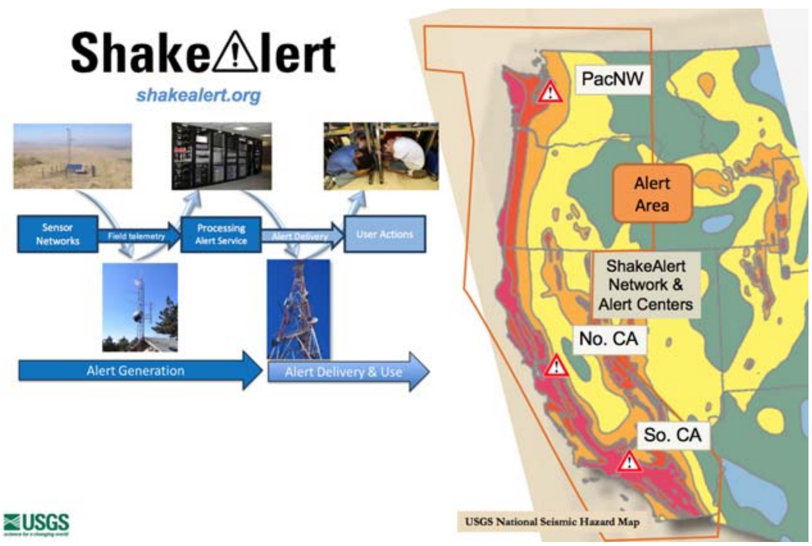
The installation of the Unit will be conducted, or overseen, by Varius staff using space that is dedicated for this purpose. A mounting board and installation manual have been developed to facilitate the Unit's installation. Varius will connect the Unit to 120VAC power and to the internet using an RJ45 connector. Varius will also provide and mount a spade-type terminal block for connection to the control or telecommunication system. Wire connections from the terminal block to the point of use (for example a public address system) must be provided by the District. Both power and internet connections must be available within 48 inches of the Unit location.

Attachment 3 – Mounting Schematic



Attachment 4 – OmniMonitor© Brochure

ShakeAlert: An Earthquake Early Warning System for the West Coast of the United States



ShakeAlert® is an earthquake early warning (EEW) system that detects significant earthquakes so quickly that alerts can reach many people before shaking arrives. ShakeAlert is not earthquake prediction, rather a ShakeAlert indicates that an earthquake has begun and shaking is imminent.

The U.S. Geological Survey (USGS) along with a coalition of State and university partners is developing and testing the ShakeAlert System for the West Coast of the United States. Before general public alerting can begin long term operational funding must be secured and the speed and reach of mass alerting technologies must be tested and improved. Many partnerships to test ShakeAlert in authentic environments such as utilities, hospitals, transportation systems, and educational environments are active today and more are being developed. The USGS has set the goal of

ShakeAlert Phase 1: Version 2.0 is now live!

Be a ShakeAlert Partner or Host a ShakeAlert Sensor

Primary Institutions

USGS science for a changing world

Cal OES Governor's Office of Emergency Services

Caltech

W

expanding these applications in 2019 and beginning public notifications as soon as mass notification pathways can support them.

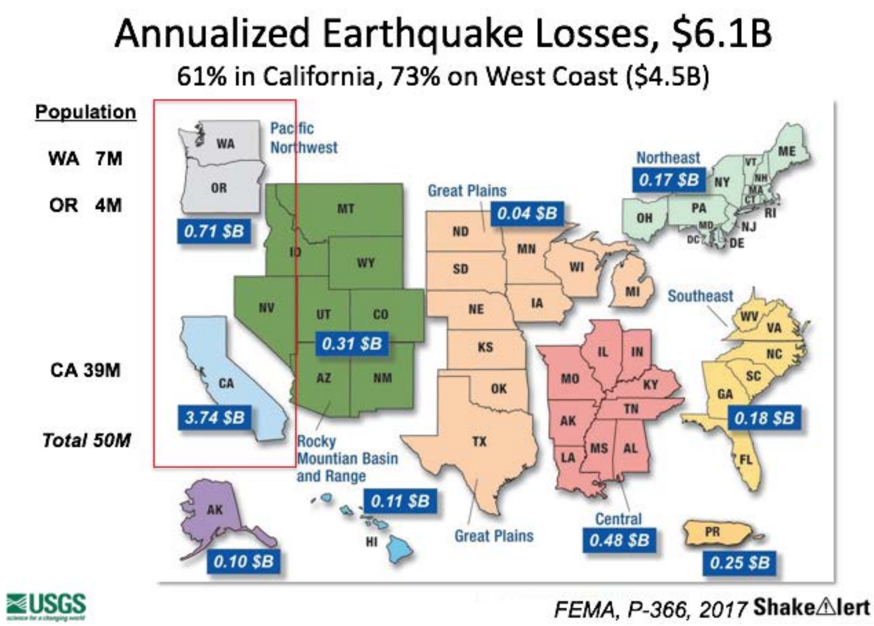
Watch a video describing how ShakeAlert works in English or Spanish.

The primary project partners include:

- United States Geological Survey
- California Governor's Office of Emergency Services (Cal OES)
- California Geological Survey
- California Institute of Technology
- University of California Berkeley
- University of Washington
- University of Oregon
- ETH Zurich (SED)
- Gordon and Betty Moore Foundation

The Earthquake Threat

Earthquakes pose a national challenge because more than 143 million Americans live in areas of significant seismic risk across 39 states. Most of our Nation's earthquake risk is concentrated on the West Coast of the United States. Federal Emergency Management Agency (FEMA) has estimated the average annualized loss from earthquakes, nationwide, to be $6.1 billion, with 73% of that figure ($4.5 billion) coming from Washington, Oregon, and California, and 61% ($3.7 billion) from California alone. In the next 30 years, California has a 99.7% chance of a magnitude 6.7 or larger earthquake and the Pacific Northwest has a 10% chance of a magnitude 8 to 9 megathrust earthquake on the Cascadia subduction zone.



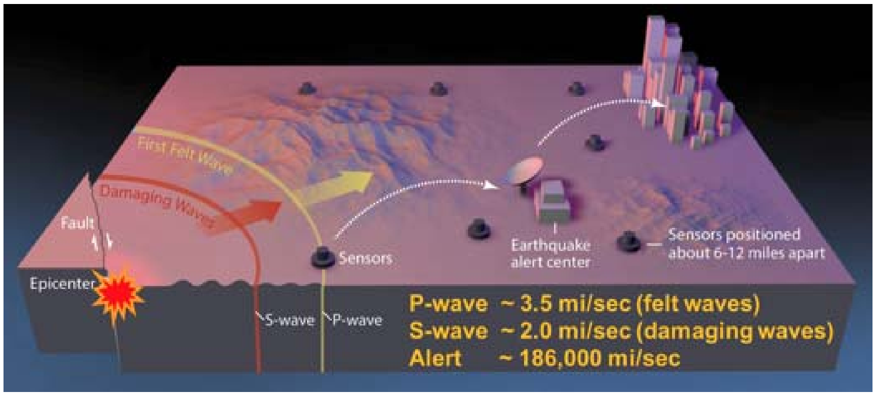
Part of the Solution

Today, the technology exists to detect earthquakes, so quickly, that an alert can reach some areas before strong shaking arrives. The purpose of the ShakeAlert System is to identify and characterize an earthquake a few seconds after it begins, calculate the likely intensity of ground shaking that will result, and deliver alerts to people and infrastructure in harm's way. This can be done by detecting the first energy to radiate from an earthquake, the

Funding Partners

More about ShakeAlert research:

- United States Geological Survey
- California Institute of Technology
- University of California, Berkeley



- University of Washington
- University of Oregon

Internal Research (login required)

ShakeAlert Utilities (login required)

Primary (P) wave energy, which rarely causes damage. Using P-wave information, we first estimate the location and the magnitude of the earthquake. Then, the anticipated ground shaking across the region to be affected is estimated and a warning is provided to local populations. The method can provide warning before the Secondary (S)-wave arrives, bringing the strong shaking that usually causes most of the damage.

Studies of earthquake early warning methods in Washington, Oregon, and California have shown that the warning time would range from seconds to a tens of seconds. ShakeAlert can give enough time to slow trains and taxiing planes, to prevent cars from entering bridges and tunnels, to move away from dangerous machines or chemicals in work environments and to take cover under a desk, or to automatically shut down and isolate industrial systems. Taking such actions before shaking starts can reduce damage and casualties during an earthquake. It can also prevent cascading failures in the aftermath of an event. For example, isolating utilities before shaking starts can reduce the number of fire initiations. For every earthquake, there is a region near the epicenter where alerts will not arrive before shaking begins because the system needs time to detect the earthquake and for USGS partners to distribute the alert.

ShakeAlert System Goal

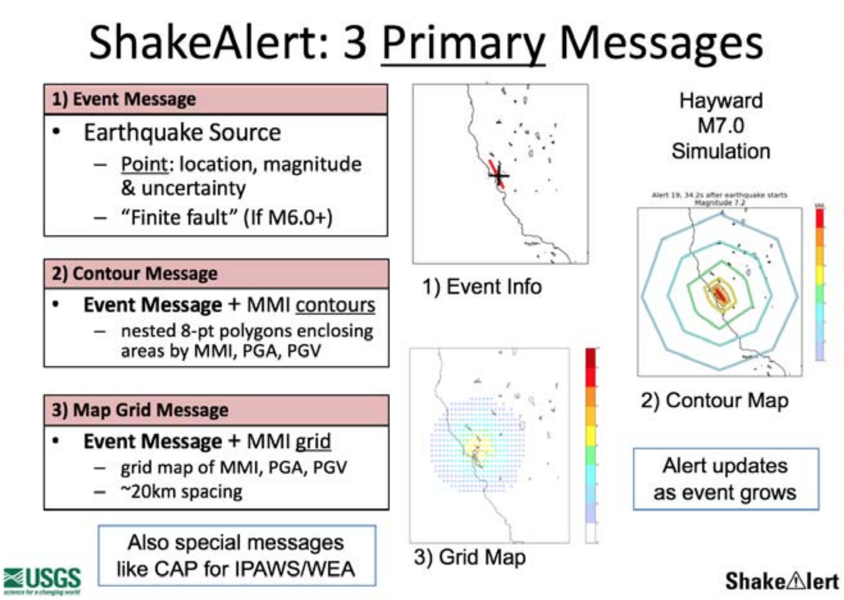
The USGS will issue public warnings of potentially damaging earthquakes and provide warning parameter data to government agencies and private users on a region-by-region basis, as soon as the ShakeAlert System, its products, and its parametric data meet minimum quality and reliability standards in those geographic regions. The USGS set the goal of beginning limited public notifications in late 2018 at the magnitude 5.0 level through alerting pathways that are fastest enough to be effective. In the longer term, ShakeAlert availability will expand geographically to ANSS regional seismic networks with sufficient seismic instrumentation to support timely alerts.

Current Status

In the fall of 2018 the West Coast ShakeAlert System became sufficiently functional and tested to begin Phase 1 of alerting in California, Oregon, and Washington. Several commercial and institutional users are alerting personnel and taking automated actions; an important step in a strategy of phased roll out leading to full public operation.

Broader public alerting at the magnitude 5.0 level will begin when existing mass alerting technologies are able to deliver alerts at the speed or scale needed for effective earthquake early warning. The ShakeAlert partners are working with both public and private mass alert system operators including FEMA, cellular carriers, mass notification companies, and others to provide that functionality. Finally, the public has not yet been educated about the system and how to respond to alerts when they are delivered.

In addition to these Phase 1 implementations, technical improvements in the system are also part of the story. The sensor network has reached target density in the Los Angeles, Bay and Seattle metro regions and version 2.0 of the ShakeAlert production system has been deployed. This updated version of



the ShakeAlert System is produces both point source and line source earthquake solutions, has added ground motion estimation products, and the number of false and missed events has been reduced. The version 2.0 system has also satisfied government cybersecurity requirements and includes improved operational procedures.

The ShakeAlert System is being developed by expanding and upgrading the infrastructure of regional seismic networks that are part of the Advanced National Seismic System (ANSS), the Pacific Northwest Seismic Network (PNSN) and the California Integrated Seismic Network (CISN). CISN is made up of the Southern California Seismic Network (SCSN) and the Northern California Seismic System (NCSS). This enables the USGS and ANSS to leverage their substantial investment in sensor networks, data telemetry systems, data processing centers, and software for earthquake monitoring activities residing in these network centers. The ShakeAlert System has been sending live alerts to "beta" users in California since January of 2012 and in the Pacific Northwest since February of 2015.

Authorities
The USGS will develop and operate the ShakeAlert System, and issue public notifications under the authorities of the National Earthquake Hazard Reduction Program, as enacted by the Earthquake Hazards Reduction Act of 1977, 42 U.S.C. §§ 7704 SEC. 2.

For More Information:

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ShakeAlertLA App inquires should be directed to:

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Follow ShakeAlert on Twitter: @USGS_ShakeAlert

Learn more about EEW Research

ShakeAlert Revised Technical Implementation Plan (2018)

Overview

Increased focus on worker and public safety has dramatically increased condition monitoring and failure prediction in safety critical applications. These applications have varying sensing requirements although the basic operational requirements of the condition monitoring and event prediction system is similar. As such, Weir-Jones has introduced the **OmniMonitor™** - low cost, stand alone embedded hardware platform that may be used in a variety of safety critical applications for condition monitoring and failure prediction. Each application has the same data acquisition and control hardware with the exception of the connected sensors and software algorithms.

System Details

The **OmniMonitor™** consists of three separate technologies combined to operate as a flexible condition monitoring and event prediction system – data acquisition technology, sensor technology and event prediction software technology. A diagram of the system and environment is shown below:

The system software consists of proven condition monitoring and event/failure prediction algorithms for many applications.

Operating System	Linux
Network protocol	TCP/ P v4 with dynamic IP address
Architecture	Multi-tasking in one of two modes: continuous real-time data acquisition and recording or event triggered data acquisition and recording
Alarm events	Capable of distinguishing many event signatures and failure mechanisms. Thresholds are programmable and remotely configurable over the Internet with set levels of control.
Self diagnostics	Basic health monitoring of system, daily check-in with system health and data exceeding thresholds. Auto-alarm by exception if monitoring system component is damaged or compromised.
Power modes	The device will automatically switch from low power mode to full power mode if data exceeds thresholds and remain in this mode until the observation is acknowledged by a response from an external server. In low power, the device will check in once per day and push necessary data to a predetermined remote server.
Applications Software	Selection of standard data acquisition, analysis, graphing and dashboard software, or fully customizable application specific software.

The data acquisition system has to following features ensuring reliable operation in harsh environments.

System	Microprocessor based continuous real-time data acquisition and recording with capability to be set for event-based recording only
Microprocessor	Capable of sampling and storing data at a rate up to 1 kHz while simultaneously transmitting stored data to a remote server through a wired or wireless network connection
Memory	Sufficient memory to store up to 1 year of data locally (6 channels at 1 kHz)
Wireless connectivity	Configurable for cellular 3G or WiFi
Wired connectivity	Ethernet, common wired railway communication standards, and CAN bus
GPS	10 m accuracy for position, 0.1 µs accuracy for timing
Operating temperature	-40°C to 85°C (-40°F to 185°F)
Power supply	110 Vac standard with UPS backup and charge control, 9 to 36 Vdc with battery backup and charge control, 24 Vdc solar power option
Power modes	Supports full power or low power modes
Analog inputs	13 analog inputs (6 channels with 16 or 24 bit resolution, 7 channels with 12 bit resolution)
Analog outputs	2 analog outputs (12 bit resolution)
Digital I/O	8 digital configurable I/O channels, with up to 4 dry contact relays
Sampling rate	Maximum 1 kHz on all channels
Size	5.9 x 7.9 x 3 in (130 x 175 x 75 cm)
Enclosure	IP67 rated with NEMA 6 enclosure
Humidity	95% (non-condensing)
Mounting	I-beam clamp, screws, bolts and nuts, or steel band
Installation	To be performed via unskilled field labour and requires no more than 2 hours using standard hand tools. Sensor installations in vehicles will take into account the vehicle's working environment.
Air quality	Extreme dust
Outdoor conditions	Rain, dew, lightning, wildlife
Vibration	High vibration and shock

The system has a wide range of applications, including Earthquake Early Warning (EEW), security, structural monitoring and a multitude of industrial applications. As noted below, it can run a number of sensor applications:

Sensor types

Temperature
Hall effect
Single tri-axial velocity sensor (3C geophone) or piezometric patch
Strain
Visual
Acoustic
Acceleration
Pressure
Flow
Humidity
Or any 4 - 20MA sensor input