



# The NHWC Transmission

October 2014

## CONTENTS

ALERT Network Health .....	1
Side-Looking Doppler .....	3
NHWC Workshop Info .....	5
ASFPM Workshop Info .....	6
US Hydrologic Conditions ....	6
Calendar of Events .....	7
November Focus .....	7
Parting Shot .....	7

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## A Simple Metric to Assess the Health of ALERT2 and Legacy ALERT Data Collection

Markus Ritch, P.E., Water & Earth Technologies, Inc.  
Kevin Stewart, P.E., Urban Drainage & Flood Control District

Under contract to the Urban Drainage and Flood Control District (UDFCD) in Denver, Colorado, Water & Earth Technologies, Inc. (WET) implemented a simple daily analysis tool to ascertain the health of both the ALERT2 and legacy ALERT telemetry systems.

UDFCD operates a backbone of five repeaters that process data radio traffic from over 200 ALERT stations. Four radio frequencies are utilized to route both legacy ALERT and ALERT2 data through 4 ALERT/ALERT2 concentrator repeaters to the Diamond Hill base station located in Denver. One out-lying repeater in Douglas County receives legacy ALERT data and transmits only concentrated ALERT2 packets. The telemetry backbone was designed and is currently maintained by OneRain and Telos Services.

The base station consists of a pair of receiver/decoders; one legacy ALERT and one ALERT2, which each feed two physically separate NovaStar5 base station applications. The two NovaStar5 base station computers function as a mirrored pair with automatic failover in the event one should fail to operate properly.

Since the 4 ALERT/ALERT2 concentrating repeaters receive legacy ALERT data and transmit both legacy ALERT and ALERT2 concentrated reports, we would expect to see a 1-to-1 ratio of legacy and ALERT2 reports at the base station. However, the ratio is not exactly 1-to-1, since the outlying Douglas County repeater transmits only ALERT2 concentrated reports. Under normal operating conditions the ALERT2/ALERT ratio is closer to 1.5-to-1. Tracking this simple metric on a daily basis provides valuable insight into the operational health of the telemetry system.

The NovaStar5 base stations are configured to automatically run the daily analysis script at midnight. The report includes total legacy ALERT reports received, total ALERT2 concentrator reports received, total ALERT2 self-reports (reports from remote ALERT2 stations) received and the ratio of ALERT2 concentrator reports to legacy reports. Each night an email (Figure 1) is sent automatically from both base stations containing this information. These daily email reports provide a simple and effective means to assess the health of the telemetry systems (Figure 2).

A daily ratio near 1.5 means things are working normally. Of concern are periods when the ratio

From: udfcd-ns5a@udfcd.org [mailto:udfcd-ns5a@udfcd.org]  
Sent: Wednesday, September 24, 2014 1:06 AM  
To: Markus Ritsch  
Subject: UDFCD Alert2 versus Alert legacy reports

09/23/2014  
Total legacy messages: 8938  
Total concentrator messages: 14193  
Total A2 self-reports: 11650  
Ratio of Concentrator to legacy reports: 158

Figure 1 Example Email with daily statistics sent from NovaStar5

deviates substantially from 1.5. A decrease in the ratio indicates a problem on the ALERT2 side while an increase points to a problem on the legacy side.

On June 12, 2014 the ratio dropped below 1.5 signifying a possible problem with the ALERT2 concentrator feed. Timeout alarms were triggered on June 13, 2014 from stations feeding the outlying Douglas County repeater. The initial assumption was that the ALERT2 concentrator repeater had failed. A site visit revealed no issues at the repeater, so troubleshooting efforts were refocused at the base. Further investigation revealed that UDFCD's Diamond Hill antenna had been dismantled by facilities maintenance staff because they thought it was no longer being used. Lying flat on the rooftop, the antenna was remarkably able to still receive ALERT2 and legacy ALERT data from four of the five other repeaters.

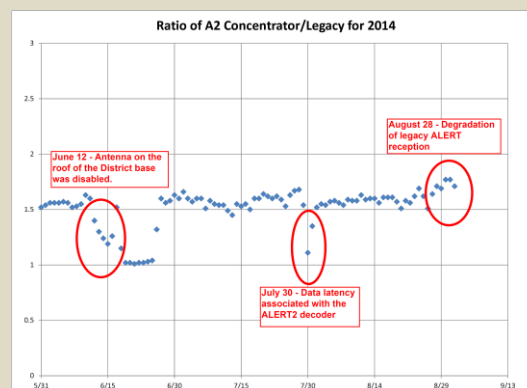


Figure 2 Daily Ratio of ALERT2 Concentrator Reports to Legacy ALERT Reports

A second incident occurred on July 30, 2014 when the ratio again dropped below 1.5 during a day of heavy rainfall. On this day the ALERT2 data feed to all servers was interrupted. The interruption was traced to a problem with the ALERT2 decoder and its network IP connection to three base stations (two NovaStar5 and one Contrail). The problem was quickly resolved.

The third issue of the year occurred in the end of August when the ratio climbed above 1.5 for an extended period. During this period, the legacy ALERT feed experienced interruption while the ALERT2 feed was fine. Initial assessments assumed a problem with the legacy ALERT receiver at the base but a site visit confirmed the receiver was operating correctly. Additional troubleshooting focused on one or more outlying repeaters. The source of this problem has yet to be identified.

In summary, the daily evaluation of a simple metric provides an effective tool for assessing the health of a combined ALERT-legacy and ALERT2-concentrator telemetry system. The metric is computed automatically by NovaStar5 and sent via email each night. This metric provides UDFCD with valuable insight into the operational aspects of their extensive ALERT system as illustrated by Figure 2.

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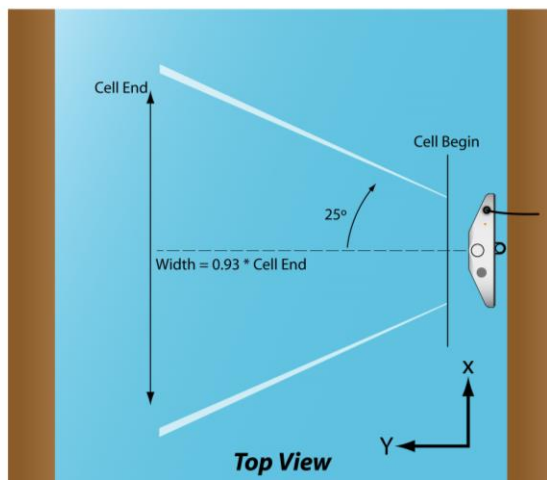
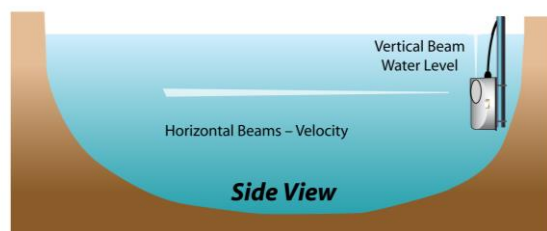
## From “SMART” Tunnels to Flood Disaster Prevention: Global Case Studies Using Side-Looking Doppler Technology for Real-Time Data Collection

Janice Landsfeld, SonTek

Side-looking Acoustic Doppler Velocity Meters (ADVMS) have long been appreciated for their versatility in gathering velocity and level data from the relative safety of riverbanks, canal sides and tunnels. That versatility, complemented by accuracy in challenging conditions, has made ADVMS highly valued tools for flood monitoring around the world.

Side-looking (SL) ADVMS are routinely employed by the U.S. Geological Survey for hydrological monitoring and reporting in real time, and have proven themselves to be excellent complements to other flood monitoring tools such as pressure sensor/gas bubble water level instruments or RiverSurveyor ADCPs used for analyzing shallow to deep water floodplains and major rivers.

SL ADVMS' horizontal beams can reach across channels for up to 20 meters (66 feet) to measure water velocity, while a vertical acoustic beam and pressure sensor measure water level. Together, those measurements can contribute to computed discharge and total volume indices—vital information for emergency and environmental management officials, as well as irrigation managers, hydropower plant operators, engineers and researchers. Mounted on piers, canal walls or slide rails, side-looking instruments are typically easier to access and safer to maintain than bottom-mounted or buoy-mounted systems.



Side-Looking Doppler systems employ three acoustic beams: two side-looking beams for velocity, and one vertical beam for water level.

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One of the most dramatic deployments of side-looking (SL) ADVMs is Kuala Lumpur's innovative Stormwater Management and Road Tunnel (SMART) system. Historically, flash floods paralyzed Malaysia's capital once or twice per decade. As the city has sprawled and weather patterns changed, crippling floods now occur almost every year. Advance notice of floods bearing down on the busy metropolis, which sits at the junction of the Kerayong and Klang rivers, can save lives and property.

During fair weather, the 12-km (7.5-mile) SMART tunnel includes a 3-km (2-mile) traffic route that provides motorists a convenient bypass of busy city roads. When floods are imminent, traffic is evacuated from the tunnel, which then captures and stores water throughout its length, forming a 12-meter (39-foot)-by-12-km reservoir to buffer the impact of floods. As river levels recede, water is safely released into the Kerayong from the tunnel and surface reservoirs.

The SMART system is predicated on constant monitoring, finely tuned models and the continuous flow of highly accurate data. Twelve SonTek Argonaut ADVMs are positioned at

specific heights in the rivers and floodways of the city's watershed, providing updates of level and velocity data to the SMART nerve center via Ethernet signals every 60 seconds or VHF links on 5-to-10-minute cycles.

When tidal action from the nearby Andaman Sea causes backwater flow on the Klang, the acoustic Doppler units become the principal source of data for the SMART controllers because ADVMs measure the depth, velocity and direction of discrete parcels of water with their acoustic cells, they are delivering actual readings of water flow rather than relying on the calculated depth/discharge relationships necessary with pressure sensor data.



Malaysia's SMART tunnel provides a traffic diversion under Kuala Lumpur during good weather. When floods hit the city, traffic is diverted and the entire tunnel, 12 km long and 12m in diameter, becomes an underground reservoir.



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A new generation of side-looking ADVMs introduced this year by SonTek integrates the company's SmartPulse HD automatic switching technology to increase accuracy in rapidly changing flows, delivering data up to a full order of magnitude more accurate than previous ADVMs. These third-generation (3G) instruments—SonTek-SL (3G) ADVMs, which are replacing the manufacturer's Argonaut line—are capable of generating pulse-coherent, broadband and incoherent (or narrowband) signals, each of which is optimized for different channel conditions. The ADVM system constantly assesses level, velocity and water conditions and



A side-looking (SL) acoustic Doppler velocity meter (ADVM) mounted on a concrete bank provides accurate data on water velocity and level from a position that makes it easy to access and maintain.

automatically selects the most appropriate signal, helping to ensure seamless, high-quality data gathering even in highly dynamic situations.

The impact of switching among Doppler techniques was demonstrated during a beta test in England's Fossdyke Canal last spring. Shifting Doppler techniques repeatedly to optimize its signal, the ADVM clearly documented changes in velocity and stage from opening and closing of the main floodgate as well as the far more subtle effects caused by management of gates downstream.

Adoption of side-looking instruments for emergency monitoring continues to rise. In the Philippines, where natural disasters such as last year's devastating Typhoon Haiyan are a recurring threat, the government recently adopted side-looking ADVMs for its Nationwide Operational Assessment of Hazards (NOAH) program. The program includes hundreds of water level monitoring stations in 18 river basins. Doppler velocity and level monitoring is key among the Philippines' tactics for aggressively monitoring future flood danger and providing warning and evacuation alarms hours or days in advance of flood events that threaten lives and property.

As the third generation of side-looking ADVMs come on-line, these instruments will become even more integral in tracking floods, droughts and other natural disasters. 🌊

**Time is running out! Don't miss the**

## **Pacific Northwest Advanced Flood Warning System Workshop**

**October, 21-22, 2014, Great Wolf Lodge, Grand Mound, Washington**

The NHWC Pacific Northwest workshop on advanced flood warning system technologies and communication strategies is almost here and the final agenda is ready at [www.hydrologicwarning.org](http://www.hydrologicwarning.org).

Attend the workshop to gain insights to the western weather extremes that drive major flood events in the region. You'll hear about new observational systems being implemented to monitor Atmospheric Rivers, a frequent factor in major flooding in the Pacific Northwest.

Experienced flood warning system operators from North Carolina, Tennessee, and Colorado will join local operators to share lessons learned and best practices. Emergency flood managers will discuss their experiences with recent disasters, including the landslide in Oso, WA, and last year's epic flood along Colorado's Front Range.

Risk communication, flood insurance, public education, and social media are all on the agenda. You'll be amazed at how Twitter is being used to track rainfall events and leverage public engagement.

Join the National Hydrologic Warning Council in Grand Mound along with our event sponsors SonTek and Ott Hydromet, and our federal partners, the National Weather Service, the NOAA Earth Systems Laboratory, the US Bureau of Reclamation, and the United States Geological Survey. Our sponsors SonTek, Ott Hydromet, and exhibitors including High Sierra Electronics, HydroLynx, Aquatic Informatics, and WEST Consultants will be there to show you the very latest in flood warning system technology.

## ASFPM National Flood Mitigation and Floodproofing Workshop

Flooding is the nation's #1 hazard. Add to that a lot of infrastructure and development that is either at moderate or high risk of flooding. How do we mitigate against this flood risk? How do we make sure what is being developed now isn't at risk in the future?

The National Flood Mitigation and Flood- Proofing Workshop focuses on these questions.

For full workshop details and the registration form please visit the workshop [webpage](#).

## ALERT2 Training

A three day ALERT2 training symposium is being offered December 9<sup>th</sup> – 11<sup>th</sup>, 2014.

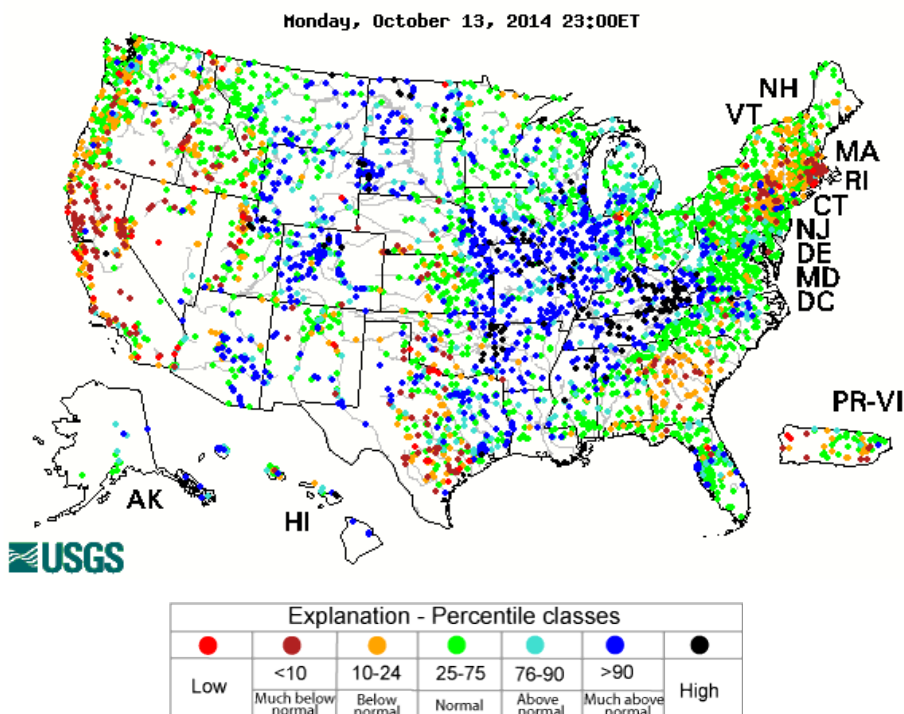
The training is critical for the transition of ALERT2 in Southern California and will be beneficial to all Southern California agencies operating ALERT systems even if not transitioning to ALERT2 at this time. The training will cover the transition to ALERT2, information on equipment options, how to upgrade and much more.

A block of 15 rooms has been reserved under "Ventura County Flood Control". Make your room reservations by November 14<sup>th</sup> to receive a discount:

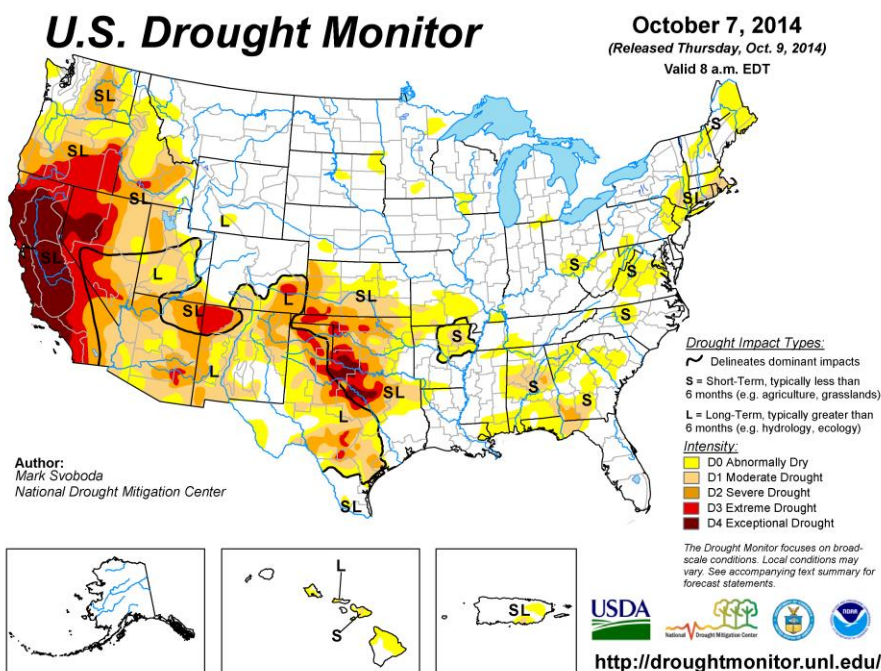
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Please also RSVP to  
[ron.marotto@ventura.org](mailto:ron.marotto@ventura.org) by  
November 14<sup>th</sup>.

## Hydrologic Conditions in the United States Through September, 2014



Latest stream flow conditions in the United States. (courtesy USGS)



Latest drought conditions in the United States.  
(courtesy National Drought Mitigation Center)

## November Newsletter Articles Focus: Hydrology

The NHWC is requesting articles that focus on hydrology - the science behind the work we do.

Please consider preparing a short article about new discoveries in hydrology or a recent significant hydrologic event.

Submit your article to:

[editor@hydrologicwarning.org](mailto:editor@hydrologicwarning.org)

November 5<sup>th</sup> is the deadline for inclusion in the November issue.

## Future Newsletter Articles Focus

To give you more time to prepare articles, below is the article focus schedule for the next four months:

Nov - Hydrology  
Dec - Hazard  
Communication &  
Public Awareness  
Jan - Modeling/Analysis  
Feb - Data Collection

## NHWC Calendar

October 21-22, 2014 - [Pacific Northwest Advanced Flood Warning System Workshop](#), Great Wolf Lodge in Grand Mount, Washington

June 15-18, 2015 - [NHWC 2015 Training Conference & Exposition](#), Indianapolis, Indiana

## General Interest Calendar

October 16, 2014 – [ALERT User's Group 2014 Fall Workshop](#), Riverside County Flood Control and Water Conservation District, 1995 Market Street, Riverside, California 92501

October 27-30, 2014 – [ASFPM National Mitigation Flood Proofing Workshop](#), Broomfield, Colorado

November 5-7, 2014 – [Arizona Floodplain Management Association Fall 2014 Conference](#), Prescott, Arizona

December 9-11, 2014 – Southern California ALERT2 Training Symposium, Ventura, California (See page 6 for details)

(see the [event calendar](#) on the NHWC website for more information)

## Parting Shot

Field Technician's Reward  
Lake Erie Sunset, September 28, 2014

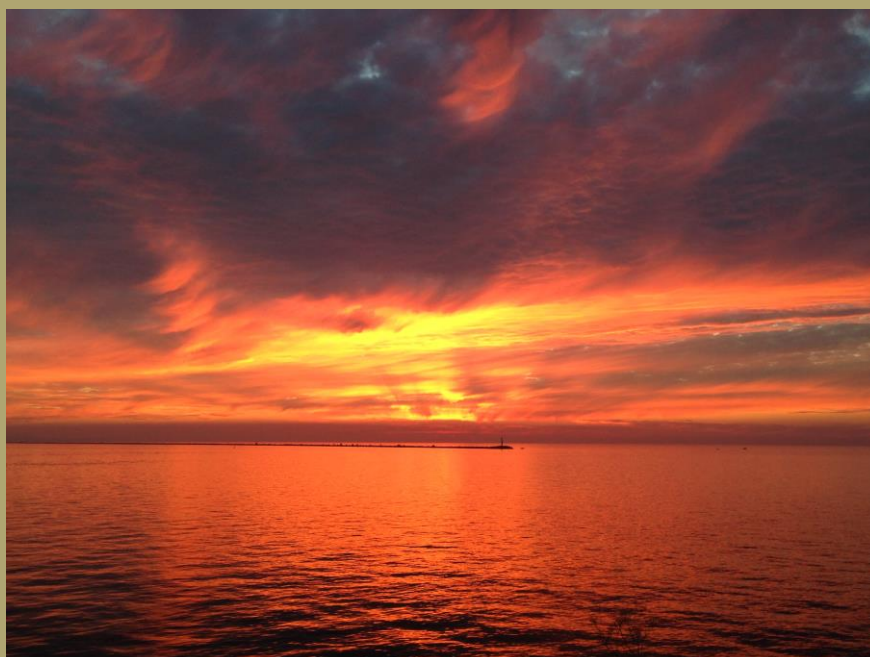


Photo by Denis Zaharija, Northeast Ohio Regional Sewer District

## National Hydrologic Warning Council

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Property, and the Environment*

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