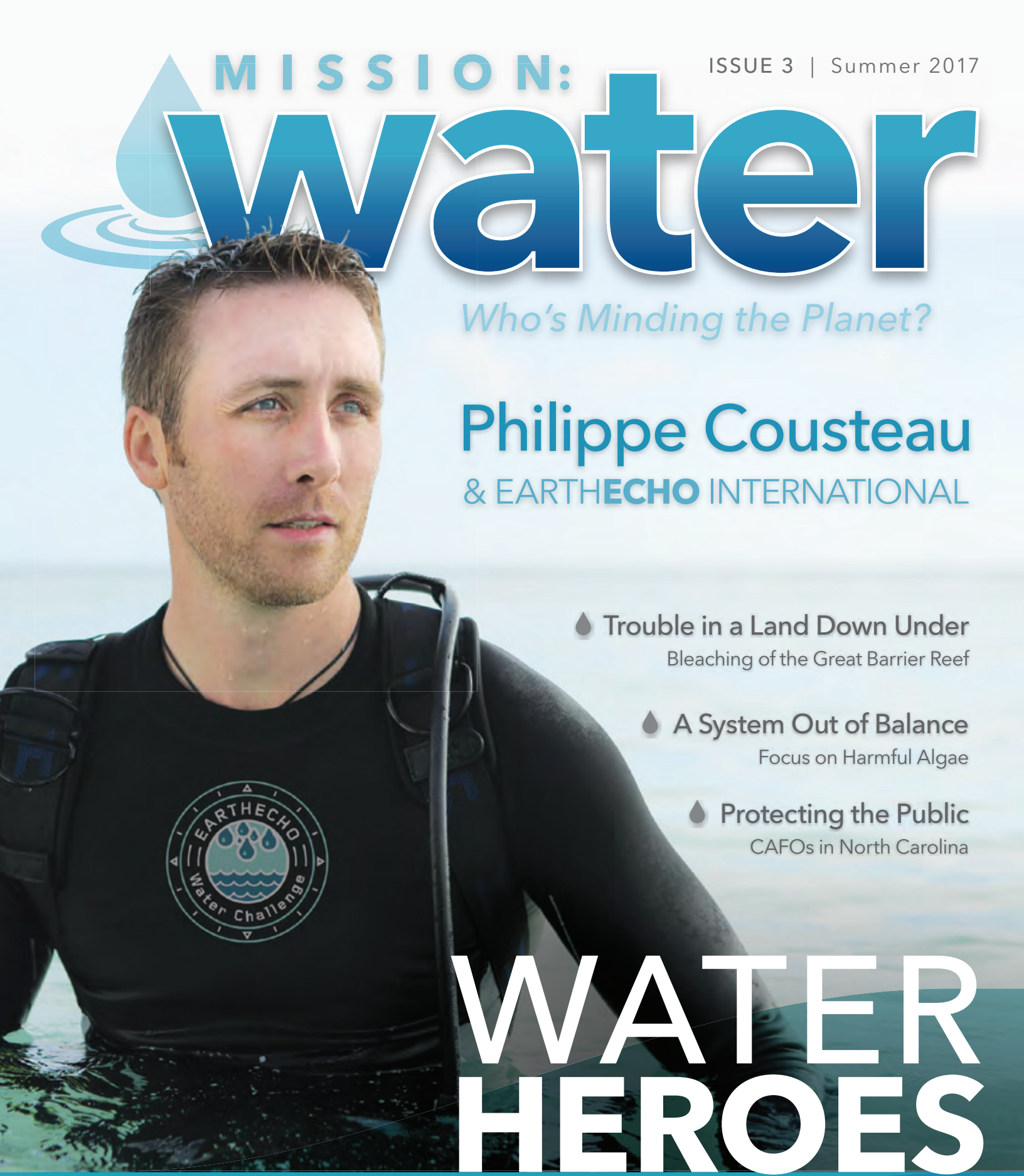
ISSUE 3 | Summer 2017

MISSION: water

Who's Minding the Planet?



Philippe Cousteau
& EARTHECHO INTERNATIONAL

- **Trouble in a Land Down Under**
  Bleaching of the Great Barrier Reef
- **A System Out of Balance**
  Focus on Harmful Algae
- **Protecting the Public**
  CAFOs in North Carolina

WATER HEROES

On the Frontier of Science & Education

An aerial view of the damaged Oroville Dam spillway as the California Department of Water Resources gradually reduced the outflow from the spillway from 50,000 cubic feet per second (cfs) to zero on February 27, 2017. The reduction allowed work to begin to remove debris at the spillway's base and reduce water surface elevation in the diversion pool.

Photo taken February 27, 2017.
Dale Kolke, California Department of Water

The Perfect Storm

Drone performs emergency survey to assess damage to California dam

MISSION: WATER STAFF

An urgent and critical need for accurate topographic data.
Oroville, California

Recent extreme flooding events in Northern California have taken a toll on the state's water infrastructure. The situation was even more dire near Oroville, California where multiple bouts of heavy rains – driven by atmospheric rivers blanketing the area – caused water levels in a nearby reservoir to drastically rise quickly.

One of these atmospheric rivers known as the "Pineapple Express" brought heavy rains to the area and led to extensive erosion and damage to the Oroville Spillway, a structure built to control the flow of water in the region. When the Oroville Dam's spillway structure was compromised, an immediate and timely assessment of the damage was needed. Emergency response teams turned to on-site surveyors and engineers to evaluate the damage. But where did these professionals turn for survey grade data in their time of need? They turned to tools and instruments they trust, because the lives of a couple hundred thousand people depended on informed decisions based on accurate data.

Downstream of the Oroville Dam is a region of northern California that is home to hundreds of thousands of citizens. Estimates report that if the Dam failed, a nine meter wall of water would be unleashed onto these communities. This precarious condition prompted the evacuation of an estimated 180,000 people from their homes, as experts feared a complete structural failure would result in catastrophe. Valiant work crews kept up the fight to stabilize the dam but in the end, Mother Nature won, forcing a sequence of events that left severe damage to the Oroville Dam Spillway.

Heroic work crews were able to stabilize the structure long enough to see, firsthand, the forceful damage caused from the event. The remains of the spillway left many of the first responders in awe at the power of Earth's most precious resource, water. Crews immediately began the enormous task of formulating a mitigation plan to stabilize the earth near the spillway. However, any plan would not be effective unless supported by accurate data and the expertise to collect and interpret such information.

This was a very dangerous area, with steep terrains, obstacles, and a loose foundation of waterlogged earth. Initially, traditional survey methods were implemented using field crews, but it quickly became apparent other tools were needed to assess the damage in order to keep the team safe.

Thus, began the story of how a little blue drone (coincidently resembling a flying hard hat) assisted surveyors and engineers in their quest for survey grade data; important data that would produce the critical information needed to help rebuild the Oroville Dam and protect the residents downstream.

The **NEXUS 800 Unmanned Aerial Vehicle (UAV)** powered by **HYPACK** was designed to handle these exact scenarios. Its foundation is built upon the underlying principle of turning data into tangible information by leveraging the power of real time sensor fusion. Marrying LiDAR sensing and photogrammetry simultaneously limits the "dead time" by streamlining the process of transforming data to meaningful models of the landscape.

During events like these, crews weren't just searching for any tool, but rather, they were looking for the right tool. And when the job demanded a high level of data quality with a heightened safety awareness and precision operational execution, they chose the NEXUS. This complex geography was littered with eroded areas, marked with multiple gulleys and deep crevasses. By leveraging the real time spatial monitoring of an aerial vehicle, the team kept the survey crews out of harm's way, deploying response teams safely and effectively around the unstable terrain.

Upon acquiring all the necessary data from the dam, the team then utilized HYPACK software to rapidly process it. The software automatically registers any spatially referenced images to build a 3D map, which was then exported into several different formats, required by the engineering teams. That information was then used to predict the stability of the area and the risk of public harm.

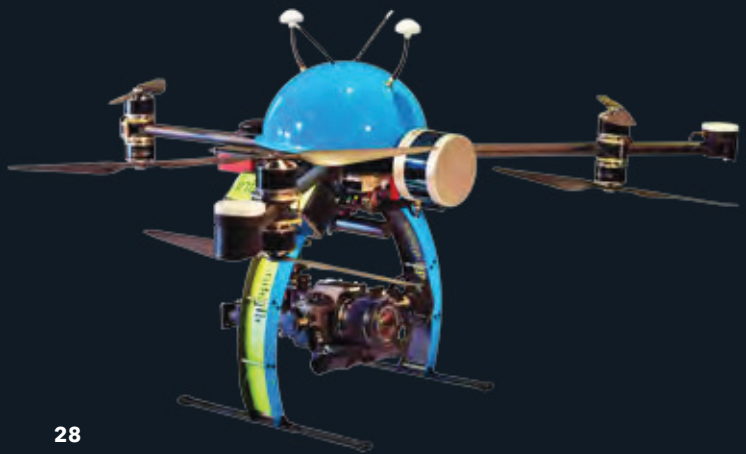
To the surveyors and engineers who worked at the Oroville Dam - job well done! Xylem is honored and proud to support your important work. As the California Department of Water Resources works to rebuild the infrastructure at the Oroville Dam and other dams in the state, your continued guidance will be critical for protecting the public.

An aerial view of Lake Oroville at 83 percent of capacity or 104 percent of historical average, while the California Department of Water Resources released water at 35,000 cubic feet per second (cfs) from the flood control spillway.

Photo taken on April 21, 2017.
Kelly M. Grow, California Department of Water

It's all about the data.

When licensed professional surveyors and engineers from eTrac, SurvTech Solutions, and Brunswick Engineering needed a LiDAR enabled UAV, they leveraged the NEXUS 800. The acquired data were expeditiously processed and disseminated to the mitigation teams for action within a span of 36 hours—an incredible feat. More importantly, the data set acquired by the NEXUS 800 agreed to within 5.5 centimeters of LiDAR data that overlapped in other areas where traditional survey crews had previously collected data.



Understanding Atmospheric Rivers

The U.S. National Oceanic & Atmospheric Administration (NOAA) defines atmospheric rivers as narrow regions in the atmosphere that are responsible for most of the horizontal transport of water vapor outside of the tropics.

These events are responsible for 30-50% of annual precipitation in the west coast of the United States and can transport up to 15 times the average flow of the Mississippi river to a region.

Learn more about atmospheric rivers at:
esrl.noaa.gov/psd/atmrivers

AERIAL SURVEYING

Powered by HYPACK®

Take your aerial mapping to the next level with the NEXUS 800!

This innovative end-to-end solution represents a new paradigm in Unmanned Aerial Vehicle (UAV) data collection by seamlessly harmonizing LiDAR data with photogrammetry.

Applications:

- Aerial mission planning
- Aerial mapping
- Product creation
- Data acquisition
- Post processing

For more on the **Nexus 800** Powered by HYPACK®:

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