CAMPBELL SCIENTIFIC UPDATE

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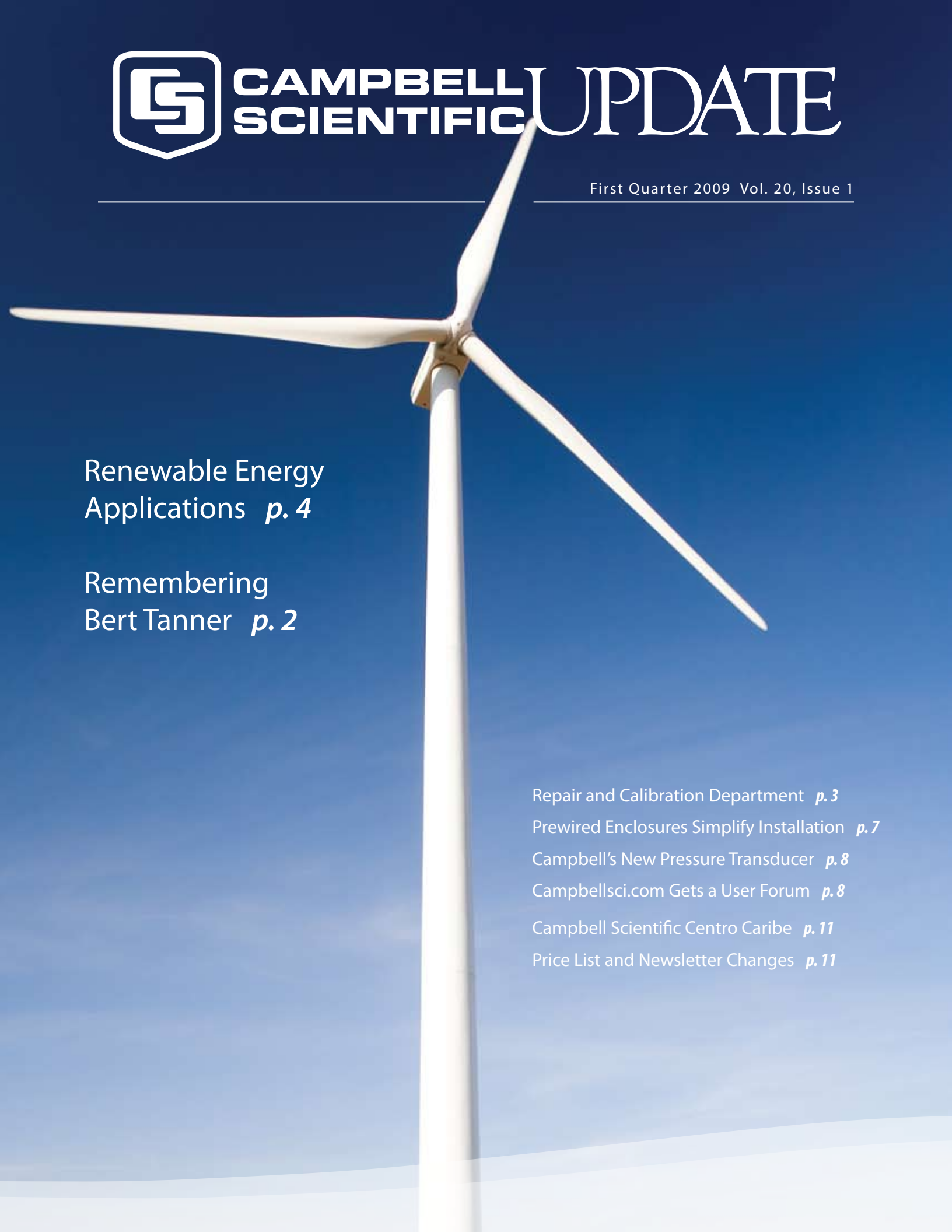

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In Memoriam—Bert Tanner

Paul Campbell, President

My dear customers and friends, with feelings of sadness and warm memories, I dedicate this message to honor the life of Bertrand D. Tanner, deceased 16 September 2008 in Salt Lake City, Utah, from esophageal cancer. For many of you, Bert was the face of the company. For many of us, he was our heart and soul.

"Oh Captain! My Captain! our fearful trip is done; The ship has weather'd every rack, the prize we sought is won…"

Bert's work ranged from Forest Service smoke-jumper in his early years to vice president of Marketing and Customer Service at Campbell Scientific, Inc., for the last 28 years of his life. He spent time with the US Army Reserve, University of Wisconsin Department of Geophysics, US Department of Navigational Oceanographics, and as a research meteorologist with the US Forest Service Central Sierra Snow Lab. Joining Campbell Scientific in 1978, he managed research and development projects as well as an effective group of application engineers and sales, marketing, and support staff.

Bert's life expressed integrity, loyalty and leadership; these will be missed by his colleagues around the world. Bert played a significant role in the growth, development, and diversity of Campbell Scientific. As vice president and director, he contributed to the company's international recognition for innovative instrumentation. Bert was noted by colleagues as one of the few who insisted that theoretical models require experimental verification. He had a sincere interest in the careers of young scientists, and a keen eye for talent at its early stages. Many environmental scientists acknowledge his influence in their careers.

Bert led in the development of automated weather stations, sonic anemometers for measuring turbulent transport in the atmosphere, eddy covariance systems, and tunable-diode-laser trace-gas-analysis systems. Beginning in 2002, Bert was instrumental in the measurement system commissioning for ChinaFLUX, an extensive network measuring CO_2 fluxes in various ecosystems in China.

In addition to his employment, Bert served on many professional committees and boards. Among those at the top of his list are service as a director on the Council on Agriculture Science and Technology (CAST) and Fellow of the American Society of Agronomy. Despite the rigors of his managerial role in a dynamic company, Bert managed to author and coauthor 15 chapters and academic papers.

At the time of Bert's death, the lines from Walt Whitman came to my mind—"Oh Captain! My Captain! our fearful trip is done; The ship has weather'd every rack, the prize we sought is won . . . ."

Bert will be missed, but he will not be forgotten. His passion for science, his quest for excellence, and his integrity are values we are committed to carry on at Campbell Scientific. As we do so, I am confident that our work and service will add to the legacy that Bert was so much a part of in the field of scientific endeavor.

The Bertrand D. Tanner/Campbell Scientific Scholarship Fund at Utah State University has been established to honor his many contributions to environmental science. If you are so inclined, you may direct donations to: Bertrand D. Tanner/Campbell Scientific, Inc., Scholarship Fund, Utah State University, 1420 Old Main Hill, Logan, UT 84322-1420. Bert was a master's graduate in biometeorology from Utah State University, and the scholarship fund will be used for graduate study in that field.

Repair Department

Dennis Anderson, Director of Business Development

At Campbell Scientific, we take pride in designing and manufacturing reliable measurement products that can be counted on, even in unforgiving environments. We maintain this dedication to quality while keeping a focus on value and economy. However, our products are not immune to every natural event, to accidents, or to the occasional component failure and may need professional repair. We also understand the role that recalibration has in keeping measurements accurate and reliable. A group of 10 dependable individuals in our Repair Department work to provide these important services.

Many companies treat their repair and calibration departments as profit centers. At Campbell Scientific, we view ours as an extension of our commitment to producing quality products. You have a significant investment in our products and our intent is to service them at reasonable rates and get them back in the field as quickly as possible.

If you think you may need a repair, the first step is always to talk to one of our application engineers. They have a great deal of experience and knowledge and do an excellent job of verifying if a repair is necessary or determining which component in a system is faulty. This reduces cost and increases efficiency for both you and us. When a problem is identified, we'll issue you an RMA (return merchandise authorization) number that you can use for returning the product.

When a product comes in for repair or recalibration, our goal is to have it serviced, tested, and delivered to our shipping department in five days or less—though there can be seasonal variation. We are very conscientious about this. We find that most of the time we meet this goal, and we meet weekly to discuss those that don't make it. Sometimes we do have to wait for paperwork to be submitted from a customer. Accessories not manufactured directly by Campbell Scientific may need to be returned to the original vendor, taking extra time.

We have a skilled staff of technicians dedicated to fixing products right. We troubleshoot to the component and identify the exact source of a problem. In the event of a high component failure rate, we communicate this information to Engineering so products can be redesigned.

Our products have a history of long-term field operation, and we provide repair for as long as we can get replacement parts. We still routinely service 21X and CR10 dataloggers—products that were first released in the 1980s.

In addition to repair, we view our calibration services as an important part of maintaining measurement fidelity. Because analog measurement drift is influenced by the environment, it is difficult to give an absolute guideline for recommended intervals of recalibration. Many units are still within specifications after five or six years if used in moderate conditions, while others are outside of specifications within a year or two of operating in extreme environments.

By comparing the *before* and *after* calibration readings, you can determine how often recalibration should occur. A sound approach is to recalibrate after two years and then extend or reduce the time interval based on the results of the recalibration.

Campbell Scientific has recently partnered with a laboratory accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) to better serve those who require calibration under ISO 17025. Allow at least three extra weeks for this service.

When considering your recalibration schedules, keep in mind that December, January, and February provide an opportune time to prepare for the summer field season. An RMA number is also required for recalibrations, but you do not need to talk to an application engineer.

If we can be of assistance contact us at (435) 750-9535 or visit our website at campbellsci.com/repair.

Mission Statement

We, in the Repair Department, strive to respond promptly to the customer in order to meet their needs and requests in a timely manner. We collect meaningful data and produce reports providing feedback to continually enhance product and design quality.

CAMPBELL SCIENTIFIC UPDATE

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	Patrick Burt
	Anthony Bodily

Renewable Energy

Renewable resources account for only a small percentage of the energy the world consumes. The drive to reduce our dependence on fossil fuels and produce energy from more environmentally friendly sources has led to an increasing number of projects to develop these resources.

The use of our dataloggers in renewable-energy applications is nothing new, but the recent surge of interest in renewable resources has triggered a corresponding increase in the need for quality measurements.

Because of this increased activity, we recently created a new application-engineering group dedicated to supporting those who are developing or conducting research on these critical renewable resources. Our extensive experience combined with the versatility of our dataloggers can prove valuable to those who need quality measurements for their projects.

When the success of multimillion-dollar wind or solar farms can be determined by a difference of less than one percent between measured and actual values of wind speed or sunlight, some have found out the hard way that quality measurements matter. The need for making quality measurements over long periods of time, in harsh, remote sites (where renewable systems are often located), is what has attracted people to our dataloggers for years.

Below we list typical monitoring applications in four of the most common renewable-energy areas: wind, solar, hydropower, and geothermal.

Wind

Our systems are used in every stage of wind-power operations.

- Wind-assessment systems provide data to determine the suitability of sites for wind power and the best wind turbine to use.
- Turbine-performance systems monitor power generated and available wind to help verify manufacturers' turbine specifications.
- Wind-forecasting stations placed strategically provide local meteorological data that can be combined with regional weather patterns to predict future wind and forecast power generation.

Solar

Campbell Scientific dataloggers are used in all types of solar energy applications, including photovoltaic, solar thermal, and concentrated solar power.

- Site-assessment systems quantify a site's suitability for solar energy production.
- System-performance packages correlate incoming solar radiation with DC/AC output for manufacturer-specification validation and power-production maximization.
- Comprehensive diagnostic kits pinpoint system failures, provide alarm capabilities, and collect valuable data for preventive maintenance.

Hydropower

Dams require a more diverse set of measurements.

- Reservoir level-monitoring systems above the dam provide information for operating the power plant and maintaining the dam.
- Equipment-performance systems monitor operational factors, such as RPMs on turbines, and can provide condition-based alarms.

Continued on back page

Retailer Goes Solar

Photo courtesy of Blue Oak Energy

Recreational Equipment, Inc., (REI) is a national retail chain that has made a corporate commitment to renewable energy. They have a bold plan, not only to install photovoltaic systems on their new stores, but also to retrofit existing solar installations to maximize energy production. A key component of their solar strategy is the incentive state governments pay to increase the number of solar installations.

REI chose Blue Oak Energy to design and build their solar-electric generating systems, and Draker Laboratories to develop a system to collect the electricity-production data needed to earn incentives from the State of California. Draker uses their own Sentalis 1000PV monitoring system for this. Campbell Scientific CR1000 dataloggers are at the core of these systems because of their field robustness, measurement accuracy, number of channels, and ability to communicate with power equipment in the field.

Data is collected remotely, analyzed, and formatted into Draker's performance interface for easy viewing over the web. REI uses this web-based software tool to view data essential for the incentive payments, and also to manage real-time performance of the solar power-generating system.

The standard performance package includes two pyranometers (plane-of-array and horizontal), a back-of-module temperature sensor, and a production meter. All of these sensors and Campbell's CR1000 datalogger are used in concert to clearly illustrate system performance and to send alarms to the system's operators if it is performing outside of expected values or has problems. They can then take steps to improve performance so that their systems generate as much electricity from solar power as possible.

The combination of verifying incentive qualification and maximizing system production is critical to ensuring REI's return on investment. The real-time access to field data collected by the CR1000 and presented over the web allows for rapid response to issues and minimizes down time. Draker's customers have come to trust the reliability of the CR1000 and the ease of use of the data it provides.

campbellsci.com/rei-solar

Improved Voice Modem Available

Campbell Scientific's COM320 Voice-Synthesizer Modem is smaller, lighter, and costs less than its predecessor, the COM310. The COM320 gives speech capability to a CR800, CR850, CR1000, or CR3000 datalogger, thus enabling the user to call the datalogger for a spoken summary of real-time or historical data. When used as a standard phone modem, the COM320 can communicate faster than the old COM310, which transmitted data at 9600 bps. Communication rates up to 115.2 kbps between the COM320 and datalogger are supported. (Your phone lines may limit transmission rate.)

Case Study

The Train in Spain . . .

Dr. Joan Girona of the Institute of Agroalimentary Research and Technology in Catalonia, Spain, studies irrigation and the water and nutrient needs of fruit trees. In a recent study, he wanted to measure the absorption of photosynthetically active radiation (PAR) for use in analyzing growth and fruit production issues. Transpiration from fruit trees and overall evapotranspiration in orchards is closely related to absorption of solar radiation by the tree canopy, so this study would help researchers more accurately measure these processes.

The more measurements he could make, the truer Dr. Girona's results would be, so he tried a few methods to accurately capture the needed data. First he set up a network of 32 sensors at various points on the ground around the fruit trees to measure light as it came from many angles. Dr. Girona and his co-researchers found that the values were too distant from each other for good modeling of sun movement. To get enough measurements in a net of this sort, they would need more than 1200 sensors, along with the associated dataloggers and multiplexers—impossible with the resources available.

As they thought about how to get measurements from so many points, they came up with a way to move the sensors around the measurement area precisely and quickly. They mounted the instruments—Apogee pyranometers and Campbell Scientific dataloggers—on small-scale model trains and ran the system on carefully laid-out tracks covering a large area around trees in an orchard. They placed metal markers every couple of inches along the track, and electromagnetic detectors on the train sensed these markers and signaled the datalogger to take a measurement at each point. Dr. Girona tried both Campbell Scientific's CR800 and CR216, but settled on the CR800 because of the higher reading frequency he needed.

The thousands of measurements taken each run are downloaded to a computer and provide a bounty of data for the researchers. This innovative solution to a measurement need proved so productive that the scientists are building a new system with a few improvements, and plan to run it on many different orchards in 2009.

campbellsci.com/spain-train

New Product

Faster GPS Receiver

Garmin's GPS16X-HVS Global Positioning Satellite (GPS) Receiver has replaced the GPS16-HVS on our price list. The new receiver is easier to install in the field and is configured to output data at a faster baud rate. Installation is easier because its cable terminates in stripped and tinned leads that connect directly to the datalogger. The cable of the older model was fitted with an RJ-45 connector, which required an adapter to connect it to the datalogger. Campbell Scientific also configures the GPS16X-HVS to output industry-standard RMC and GGA data strings at 38400 bps instead of 1200 bps. Our dataloggers can directly read the RMC and GGA data strings.

Prewired Enclosures Simplify Installation

No time to wire your Campbell Scientific system? Let us do it for you. Campbell Scientific's new PWENC-series enclosures combine flexibility with ease of use. You still have the flexibility to choose your system components, but installation is easy because the sensors are simply attached to prewired connectors on the outside of the enclosure—eliminating the sometimes tedious chore of wiring sensor leads into the datalogger's terminal strips. If you want to simplify your setup even more, Campbell Scientific will even creates a custom datalogger program.

We offer the enclosure in our three largest standard sizes. Connectors, communication ports, and the enclosure mounting bracket are chosen as options. You order the datalogger, sensors, power supply, communication option, and instrument mount separately. Compatible sensors, peripheral cables, and solar panels have a *–PW* extension on their model name. The cables for these products are fitted with connectors that mate with the enclosure's connectors. You can attach the enclosures to any of our tripods or towers, or to a user-supplied pipe.

Connectors eliminate the work of wiring sensor leads to the datalogger's terminals. Right: sensor side of a connector (outside the enclosure). Left: datalogger side of the enclosure (inside the enclosure).

Present-Weather Sensor

The PWS100, manufactured in the UK by Campbell Scientific, Ltd., determines precipitation and visibility parameters for road, marine, and airport automated weather stations. A unique optical system and a laser-based light source allow the PWS100 to accurately determine the velocity and size of falling precipitation. Two separate detectors and laser-Doppler anemometry techniques improve upon current present-weather sensors and enable the PWS100 to accurately determine individual particle velocity and size to within 5 percent.

New Portable 30-ft Mast

Campbell Scientific now has a portable, 30-ft instrument mount. The CM375 consists of five 6-ft galvanized pipes, a stainless-steel base, guy cables, duck-bill anchors, and a guy-wire tensioning kit. All of the components fit inside an 80-in.-long bag that is included with the mount.

The CM375 is fast and easy to set up. Two people can assemble the pipes and tilt up the mast within minutes. To reinforce the mount, the CM375 is guyed at 12-ft and 24-ft heights. Duck-bill anchors and the guy-wire tensioning kit ensure proper guying.

New Peripheral Cables

Campbell Scientific has developed five new generic cables for connecting to peripheral devices. These cables have a rugged Santoprene jacket instead of a PVC jacket. The number of conductors ranges from two to five, allowing you to choose the cable that fits your specific application. By default, the conductors are stripped and tinned. The new cables can also be fitted with a connector for attachment to a prewired enclosure (see article above).

- CABLE2CBL—22 AWG, 2 conductor
- CABLE3CBL—22 AWG, 3 conductor
- CABLE4CBL—22 AWG, 4 conductor
- CABLE5CBL—24 AWG, 5 conductor
- CABLEPCBL—16 AWG, 2 conductor

Campbell's New Pressure Transducer

Over the years, we've offered submersible pressure transducers from various manufacturers for measuring pressure, depth, or level in hydrological applications. This year we are pleased to announce that we have designed and are now producing our own pressure transducer, the CS450. We designed the CS450 with the goal of offering a high-quality instrument and providing shorter lead times for ordering and recalibration.

The new transducer measures pressure with a static accuracy within 0.1% full-scale total-error band over a 0° to 60°C temperature range.

The CS450 generates a precision excitation, then outputs a value that corresponds to the water pressure. It outputs either a digital SDI-12 or an RS-232 signal. All of our contemporary dataloggers, as well as many retired dataloggers, are compatible.

The standard CS450 is 8.4 in. long, and has a stainless-steel case; a titanium case is available for use in corrosive environments.

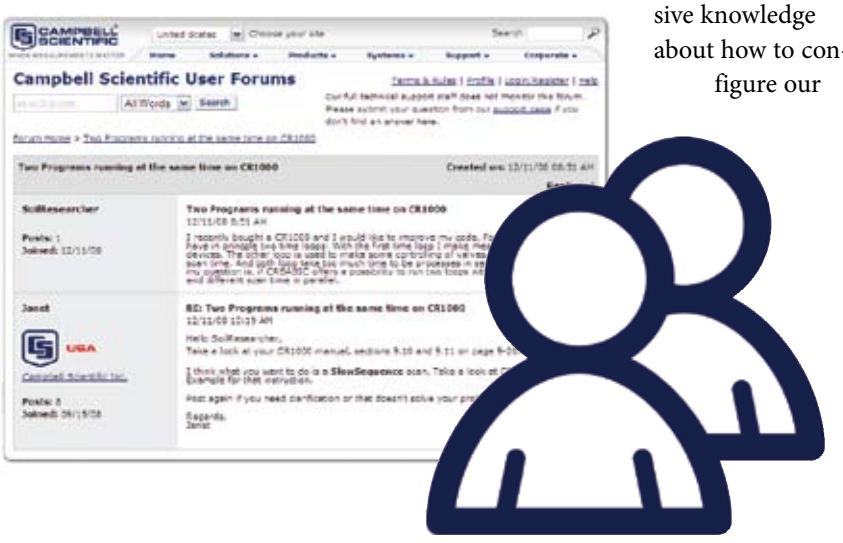
Wind Sentry Upgraded

RM Young's 03002 Wind Sentry set is now available from Campbell Scientific for measuring wind speed and direction. Wind Sentry sets consist of a three-cup anemometer and a wind vane mounted to a small crossarm. A junction box was added to the new 03002, which allows one cable to connect the entire wind set to the datalogger. The old 03001 used two cables—one for the anemometer and one for the wind vane.

Campbellsci.com Gets a User Forum

We're pleased to announce that we've added a new user forum to our website to help you collaborate with other users of Campbell Scientific equipment. If you are familiar with other forums on the Internet, you know what this means—the ability to ask your questions, answer others' questions, and collaborate with users around the world to share knowledge and experience.

The new resource is a user-to-user forum, so while you'll see some input from the various Campbell Scientific offices, over time you'll notice more external users participating. Many long-time Campbell users have extensive knowledge about how to configure our products. Many also have extensive application-specific knowledge and experience.



Online forums become more useful as their user base grows and as the amount of useful information that's archived grows. As more find out about the new forum, we expect it to develop into a useful resource with an active community behind it.

Please note that the new forum is not a technical support forum and does not replace any of our current technical support channels. For technical support, you are still free to call us or visit campbellsci.com/questions—though you shouldn't hesitate to look for answers first on the forum or to post your question there.

If you would like to participate in the forum, you can register by visiting campbellsci.com/forum.

Monitoring a Sinking Highway

When the Ohio Department of Transportation (Ohio DOT) was preparing to widen Interstate 77, they discovered that part of the highway located over an abandoned underground coal mine was subsiding. To stabilize the roadbed, they decided to backfill the mine voids with cement grout while traffic was maintained on the highway. Due to the potential for additional mine subsidence during remediation work, Ohio DOT required the installation of a real-time monitoring system to activate an alarm when movement or settlement of the road base occurred. Ohio DOT retained GeoTDR (based on their extensive experience) to design, install, and monitor a time-domain reflectometry (TDR) system.

A TDR system works by sending a voltage pulse along a cable. At each location where the cable is deformed, a reflected pulse is returned to the unit. The ratio of the reflected pulse magnitude shows the magnitude of cable deformation, and the location of the deformation is determined by the reflected pulse travel time.

GeoTDR installed coaxial cables in a trench and also in horizontal holes drilled 5 ft or more beneath each lane of the entire section of highway. They connected the cables to an SDMX50 coaxial multiplexer and interrogated the cables using a TDR100 Time-Domain Reflectometer, both from Campbell Scientific. A Campbell CR10X datalogger controlled the automated monitoring system, including callback capability with the COM300 Voice-Synthesizer Modem. Whenever cable deformation exceeded a preset alarm threshold, the datalogger initiated a call to GeoTDR personnel, indicating the location of the alarm condition.

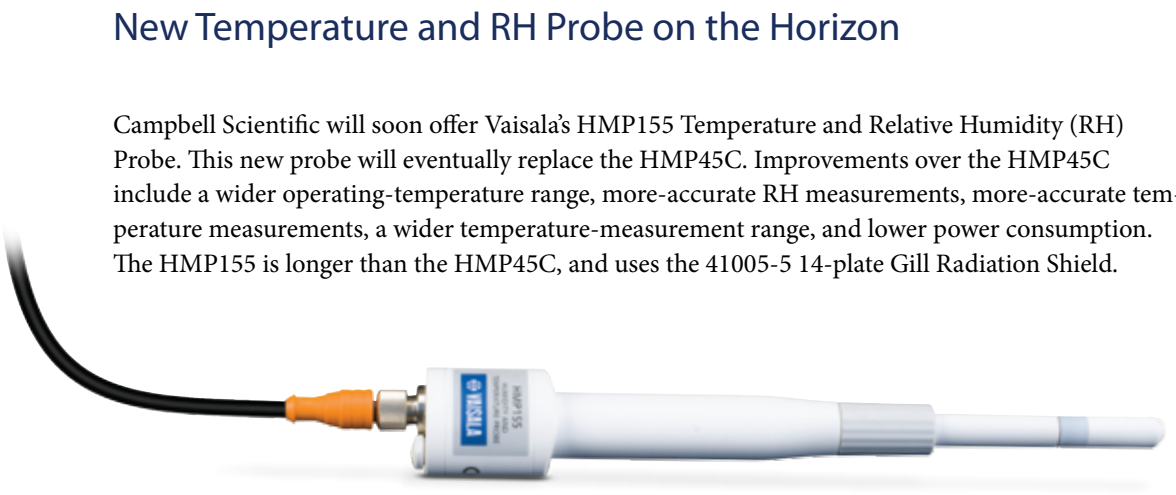
The system's operation was proven valid when the road repair construction work would occasionally deform or sever cables as crews drilled grout holes. That would send alarm calls, and GeoTDR personnel confirmed that alarm sources were consistent with locations of construction activity.

Not only did this system safeguard the Ohio highway, but provided valuable lessons for alarm systems on subsequent projects. The most recent of these TDR systems use CR1000 dataloggers and wireless communication.

campbellsci.com/odot

New Temperature and RH Probe on the Horizon

Campbell Scientific will soon offer Vaisala's HMP155 Temperature and Relative Humidity (RH) Probe. This new probe will eventually replace the HMP45C. Improvements over the HMP45C include a wider operating-temperature range, more-accurate RH measurements, more-accurate temperature measurements, a wider temperature-measurement range, and lower power consumption. The HMP155 is longer than the HMP45C, and uses the 41005-5 14-plate Gill Radiation Shield.



Case Study

Marine Meteorology on the Red Sea

The northern head of the Gulf of Eilat is an ecologically unique marine system of utmost environmental and economic importance. The unique setting of desert converging with coral reefs has brought about accelerated development of the tourist industry. At the same time, the marine ecological system has undergone a gradual decline. The reasons behind the decline observed in the marine habitats of Eilat are not fully understood, but may include waste and disturbance of the ecosystem by the Eilat sea port, tourism, marine aquaculture, and urbanization of Eilat.

A cooperative Israeli-Jordanian effort through the Interuniversity Institute for Marine Sciences at Eilat (IUI) determined that a permanent, accessible database of meteorological measurements would facilitate the formation of scientific recommendations to preserve the delicate marine ecosystem of the gulf.

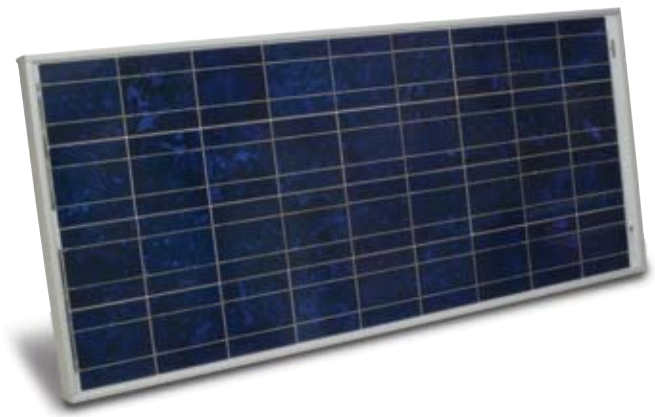
IUI contracted with Meteo-Tech to integrate and install a system to measure the meteorological conditions needed for the database. The program required continuous measurements, both at a coastal station and an open-water station, of air temperature, relative humidity, wind speed and direction, and water temperature. The coastal station also measures barometric pressure, solar radiation, and sea level.

The coastal station is situated on the IUI pier, about 30 m off shore. At the core is a Campbell Scientific CR1000 Measurement and Control Datalogger. The station started operating on September 2006, and twice a year Meteo-Tech performs preventive maintenance, including accuracy checks, cleaning, and bearing replacement.

The open-water station is situated on a floating buoy about 1 km off shore. It is based on a Campbell CR800 Measurement and Control Datalogger. The station started operating on July 2008. Unfortunately, a commercial ship collided with the buoy and heavily damaged it. The station was insured, so a rebuilding of the station is expected soon. Over time, the database will grow into a valuable resource for climatological analysis in the region.

campbellsci.com/eilat

New Product



Larger Solar Panel Available

The new SP70 solar panel has a 70-W typical peak power; its predecessor, the SP65, had a 65-W typical peak power. This new solar panel recharges the user-supplied 12-V flooded battery used in systems with large power requirements, such as eddy covariance systems. An external regulator is required to connect the SP70 to the battery. Two SP70 solar panels can be attached to the same regulator to double the power output.

New Affiliate—Campbell Scientific Centro Caribe

Campbell Scientific recently opened a new office in Central America. The new entity is known as Campbell Scientific Centro Caribe, S.A. (CSCC). *Centro* as in Central America, and *Caribe* as in Caribbean, indicate the territory of this new affiliate office. The countries covered by CSCC are: Belize, Guatemala, Honduras, El Salvador, Nicaragua, Costa Rica, Panama, and the Dominican Republic. These are territories where Spanish is the principal language or a key language.

Otton Brenes (to the left of Paul Campbell in photo) has been named president of the new office. He has been our Costa Rican representative for 15 years.

Typical uses of Campbell Scientific gear in this territory are hydrology, meteorology (especially hurricane prediction instruments), and agriculture.

Price List and Newsletter Changes

Price List

Instead of mailing a printed copy of our price list, we are now making it available on line. This will provide a searchable file that is always up to date, and reduce paper consumption. We're calling the area where we make the price list available our Customer Center, and we'll be offering other services there that will help you manage your dealings with us.

Newsletter

We're also making some changes to this newsletter, the *Campbell Update*. For years we've mailed two issues per year—one in January and one in July. This year we're moving to a quarterly schedule and changing to an email and online format. However, our first quarter issue will still be available in print. You can manage your newsletter subscriptions in the new Customer Center.

Customer Center accounts are available to employees of organizations that have purchased equipment from Campbell Scientific. To register, visit campbellsci.com/register.

USB Spread-Spectrum Radios Coming

We are releasing three new spread-spectrum radios: the 900-MHz RF430, 922-MHz RF435, and 2.4-GHz RF440. These radios are functionally the same as our RF401 series, but have a USB port instead of the CS I/O port. The USB port allows greater compatibility with today's computers. The radios connect with the datalogger via the RS-232 port. Because a CS I/O port is not provided on the radios, they cannot be attached to some of our older dataloggers. However, networks can contain a mixture of RF430/440-series and RF401-series radios.

Metric Version of Rain Gage Now Available

Campbell Scientific now offers the new TB4MM Hydrological Services tipping-bucket rain gage in addition to the TB4 and CS700. The new TB4MM is a metric version of the TB4, and measures rainfall in 0.2-mm increments instead of 0.01-in. increments. As with the other Hydrological Services rain gages, the TB4MM includes a siphoning mechanism that allows the rain to flow at a steady rate regardless of rainfall intensity. The siphon reduces typical rain-bucket errors and produces accurate measurements over a range of 0 to 700 mm/hr.

Calendar

January		
11-15	TRB 88th Annual Meeting	Washington DC
11-15	American Meteorological	Phoenix, AZ
14-16	Four States Irrigation Council	Fort Collins, CO
28-29	Unified Wine & Grape Symposium	Sacramento CA
February		
3-5	DistribuTECH	San Diego, CA
5-7	Golf Industry Show	New Orleans, LA
12-14	World Ag Expo	Tulare, CA
13-16	TechAdvantage	New Orleans, LA
15-18	Aquaculture America 2009	Seattle, WA
22-24	Heli-Expo 2009	Anaheim, CA
March		
03-06	Rural Water Association of Utah	St. George UT
April		
07-09	USGS – WTRAC Data Conference	Salt Lake City, UT
20-23	Western Snow Conference	Canmore Alberta, Canada
May		
4-6	AWRA Spring Specialty Conference	Anchorage, AK
4-7	WindPower 2009	Chicago IL
17-21	ASCE/EWRI	Kansas City, MO
18-22	Great Lakes Research	Toledo, OH
18-21	National Hydrologic Warning Council	Vail, CO
June		
3-6	US Committee on Irrigation and Drainage	Reno, NV
14-17	International Bridge Conference	Pittsburgh, PA
14-17	WEDA 29	Tempe AZ
16-19	A&WMA	Detroit, MI
21-24	ASABE 2009	Reno, NV
July		
26-29	Fatigue Fracture 2009	Philadelphia, PA
27-30	WaterPower XVI	Spokane, WA
August		
1-5	APS Annual American Phytopathology	Portland. OR
2-7	94th ESA Annual Meeting	Albuquerque NM
16-20	StormCon	Anaheim CA
23-27	National Rural ITS Conference	Seaside, OR
September		
27-1	Dam Safety 2009	Hollywood FL
24-25	AWEA Wind Assessment Conference	
October		
04-07	Geothermal Energy Expo	Reno, NV
18-21	GSA 2009	Portland, OR
26-29	Oceans 2009 MTS/IEEE	Biloxi, MS
27-29	Automotive Testing	Novi, MI
28-30	NALMS	Hartford, CT
November		
1-5	ASA 2009 Annual Meeting	Pittsburgh, PA
1-5	CERF 2009	Portland, OR
December		
2-4	Irrigation Show 2009	San Antonio, TX
14-18	AGU	San Francisco, CA
11-13	Performance Racing Industry	Orlando, FL

Visit our web site for training class schedules and additional listings.

CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

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Renewable Energy

Continued from page 4

- Water-quality systems monitor parameters such as temperature and turbidity to help minimize the impact on fish and other wildlife.
- Structural-monitoring systems keep an eye on bore holes and cracks to help identify problems with dams.

Geothermal

Geothermal applications typically involve measuring water temperature, level, and flow.

- Monitoring systems at observation wells define the flow of groundwater and the hydraulic effects on the surrounding area—helping to determine a site's suitability for geothermal projects or to plan well spacing.
- Temperature-profiling systems provide data on temperature gradients in well casings.
- Monitoring systems track time/temperature data, water levels, and water quality parameters, providing valuable decision-making data.

We look forward to providing key components that help develop renewable resources. Our new group will be actively creating resources to facilitate the use of measurement and control systems in this area. If you would like more information, please visit campbellsci.com/renewables.