



A BETTER WAY TO BUILD

ECO FOUNDATION SYSTEMS IS HELPING TO
CHANGE HOW WE THINK ABOUT CONSTRUCTION

PG. 2

GROUND SCREWS —
WHY THEY WORK

PG. 3

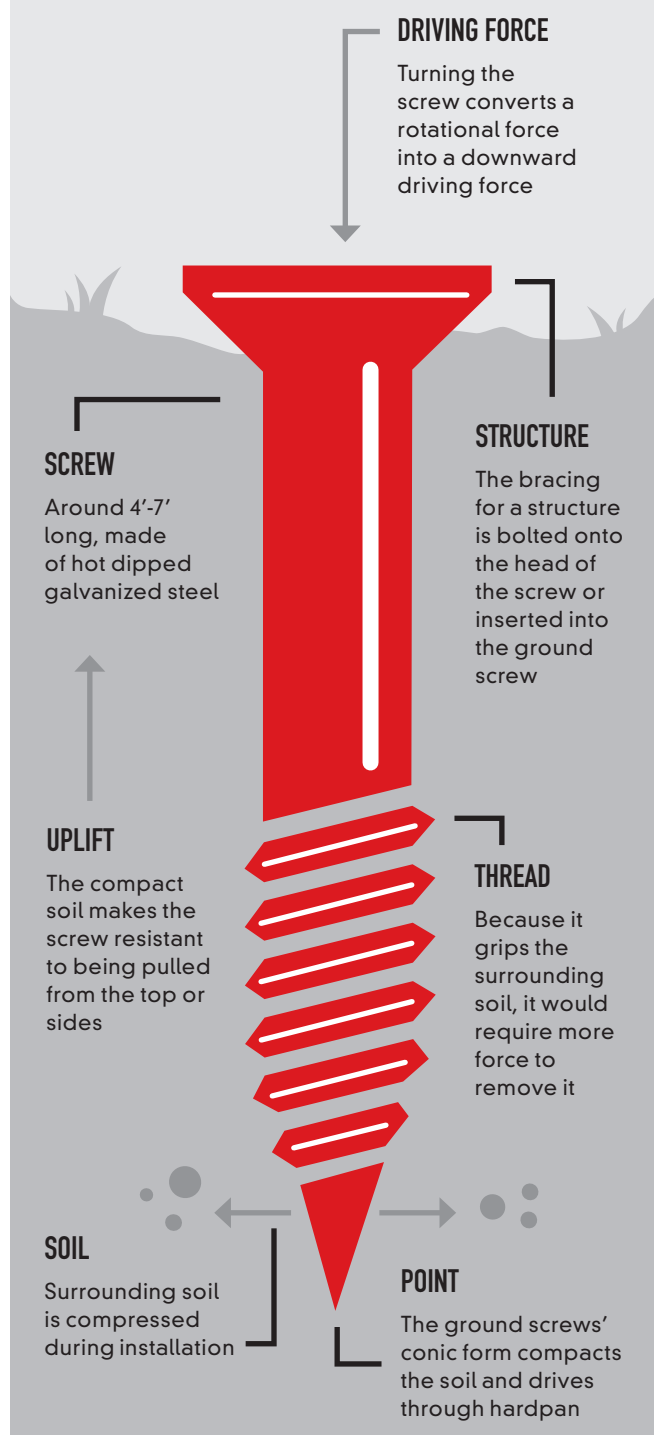
WHEN NOTHING ELSE
WORKS, SCREW IT!

PG. 6

Q&A WITH
PRESIDENT ED AYALA

How ground screws work

How can a screw that you carry in your hand be the same thing that holds up a building? Sounds crazy, but the principles at work are the same, explains structural engineer James Adrian Adams.



NECESSITY IS THE MOTHER OF INVENTION

HOW A GERMAN FARMER CAME UP WITH THE MOST DISRUPTIVE IDEA FOR CONSTRUCTION IN DECADES

BY MATT JOCKS

Innovation is my passion." It's a phrase often said by German inventor Klaus Krinner who, only a few years after inventing the Krinner Christmas tree stand, brought his second product idea to life: the ground screw. A quicker and much more efficient — not to mention environmentally sustainable — alternative to common concrete foundations, ground screws are revolutionizing the construction industry. With its highly-specialized products, Krinner Schraubfundamente GmbH has become a major player in the field of mounting systems for photovoltaic power.

"He came up with the idea of a corkscrew-like base," said Ed Ayala, president of Eco Foundation Systems, the only large-scale California company using ground screws in construction. "When it worked, he began to think, if it can hold up that, it could hold up other things."

What Krinner had stumbled upon was an alternative to traditional cement-based foundations. The advantages of moving away from cement were obvious: It could be done quicker and with less manpower. It could also be more adaptable and environmentally friendly, making less of a permanent impact and eliminating the need for water.

"He went to his first trade show with one screw over his shoulder," Ayala said. "And immediately, people were asking, 'What is that?'"

Initially, the main use for the ground screw was in the solar energy industry. Its use in solar ground mounts

was a natural fit, both in terms of technology and its low environmental impact.

Since its introduction, the technology of the ground screw has been refined and its uses expanded. Krinner's main plant in Bavaria, Germany, has been augmented by a production facility in Canada.

"Right now, the solar industry is heavily concentrated in Europe," Ayala said. "We are kind of pioneering its use in the United States. It's still a very disruptive force.

It's still a question of changing the mindset of the construction business."

Here in the U.S., the ground screw's current use is replacing decaying road signs, solar footings and sheds.

"Ground screws are a perfect replacement for concrete pier footings — fast, strong and green," Ayala said.

There's hope that ground screws could have wider implications for the future of construction in our communities. Some of Eco Foundation Systems' international projects hint at other possible uses for the ground screw: Projects in

South America have included permanent housing units as well as temporary housing for those displaced by natural disasters.

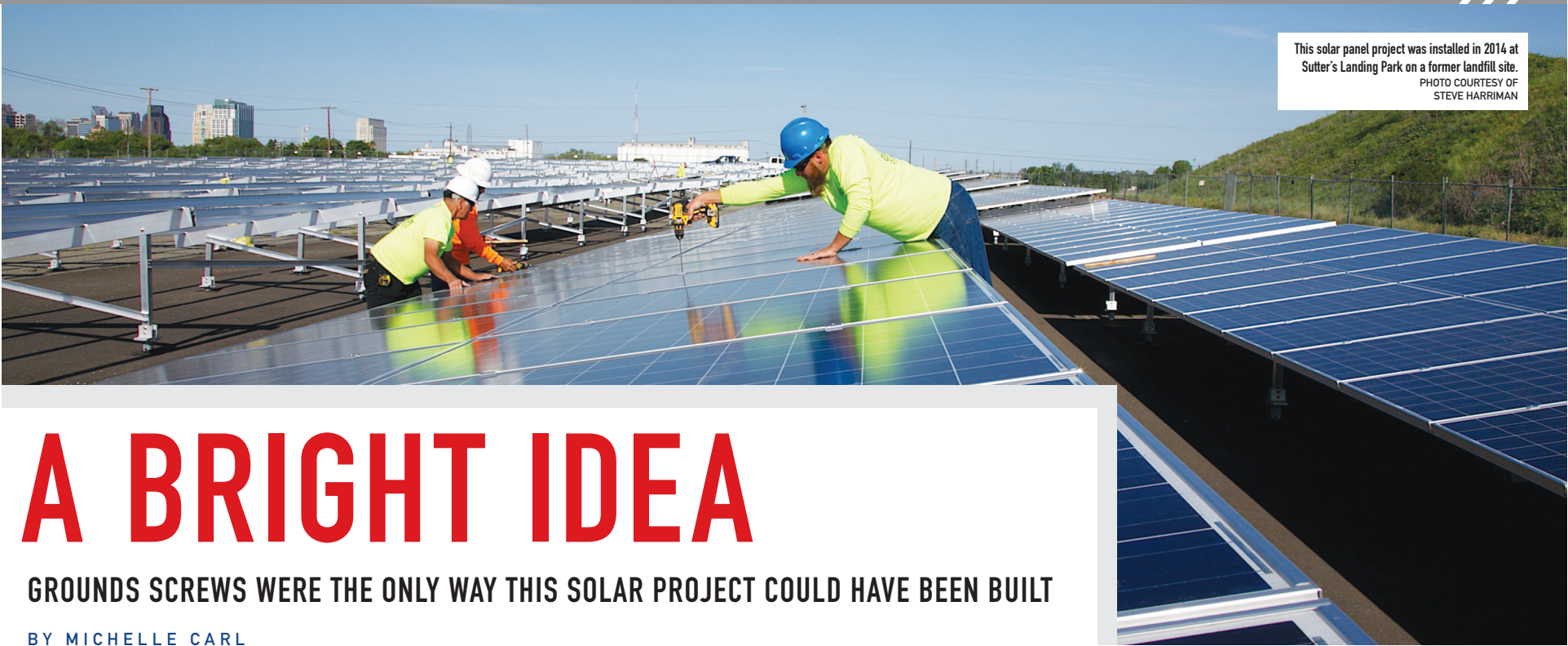
"We are undergoing testing for larger-scale buildings," Ayala said. "I believe there is a real opportunity for modular housing. That's something I'd really like to see because there is a need for affordable housing."

Beyond solar, housing and other traditional footings, ground screws are limited only by our resistance to change.

"Ground screws are a perfect replacement for concrete pier footings — fast, strong and green."

Ed Ayala
President of Eco Foundation Systems

On the cover: Vice President of Sales David Drake and President of Eco Foundation Systems Ed Ayala. PHOTO BY ANNE STOKES



This solar panel project was installed in 2014 at Sutter's Landing Park on a former landfill site. PHOTO COURTESY OF STEVE HARRIMAN

A BRIGHT IDEA

GROUND SCREWS WERE THE ONLY WAY THIS SOLAR PROJECT COULD HAVE BEEN BUILT

BY MICHELLE CARL

Back in 2010, the City of Sacramento wanted to install solar panels at Sutter's Landing Park near the American River. Solar energy could have benefits for the city and the land had no other useful purpose.

The trouble was, the land they wanted to put it on was a dump — literally.

The proposed site for the solar project was the former 28th Street Landfill, which was closed in 1997. A “cap” of soil and other materials was placed on top of the garbage and the city is responsible for maintaining the site through the year 2027.

“Basically you have this big piece of land sitting there for 30 years that there's not much you can do with,” says Steve Harriman, who was a solid waste manager with the City of Sacramento at the time. “So there was an idea at one point to cover the entire parcel with solar panels. But that proposal got a lot of criticism, and it actually would have created some technical challenges.”

As Harriman explains, one of the main objectives when managing a closed landfill is to maintain the integrity of the cap so that water cannot

penetrate into the garbage and leach out into surrounding soil.

“When you look at drilling holes or putting equipment or doing things to the cap, there's a good chance that you're going to do some damage,” he said.

“I would say it saved the project.”

Steve Harriman

Former solid waste manager who used ground screws in solar installation

An early design for the solar installation called for 1,200 heavy cement blocks on the site, but Harriman was concerned that the weight of the blocks could dent the cap and lead to water pooling on the ground. The project was in danger of stalling out.

“So we learned about the earth screw as a potential alternative to cement blocks,” Harriman said. “I would say it saved the project.”

Eco Foundation Systems was contracted to install the footings for the ground-mounted solar panels. Ground screws allowed crews to install footings without disturbing the cap and without the weight of concrete. The area around each screw was sealed to prevent water penetration. The screws also have the unique ability to be installed at various depths, allowing the solar panels to be neatly aligned, despite the site's uneven topography. Ground screws also allow maintenance crews to disassemble the mounts and access the cap, should they ever need to.

Conergy built and maintains the 1.5 megawatt array and electricity is sold to SMUD, which gives a portion of revenues to the city. The project was completed in 2014 and stands as a shining example of how solar can fit into an urban landscape — all thanks to ground screws.

“It basically allowed a really cool project to proceed,” Harriman said. “This was a solution that was inexpensive, easily implemented and provides more flexibility through the life of the project.”

Advantages to solar contractors

Saving money — it's the reason why most people want solar panels. Ground screws enable solar contractors to complete more jobs at less expense, and win more bids. Here's how:

- Ground screws save money and time
- Turn 4 days of work into 4 hours
- No need to change your process (concrete pier swapped for a ground screw)
- Start building racks the same day (no waiting for concrete to cure!)
- We're problem solvers — you can put ground-mount solar in any terrain
- Double your ground-mount production without increasing your overhead!

Eco Foundation Systems can reduce the cost of your next bid! Call 916-913-0603 to find out how.

CREATIVE USES FOR GROUND SCREWS

BY MATT JOCKS



The Yard at Mission Rock
SAN FRANCISCO, CALIF.

The Yard is a collection of repurposed shipping containers that have been converted into a small village of venues offering food, drink and even a dance floor. Located on Pier 48 adjacent to AT&T Park, the home of the San Francisco Giants, the project posed some challenges for project engineer Bruce Alexander and ground screw installer Gabe Ross of Gabe Ross Construction.

“We did a pull test and a torque test,” Ross said. “Using concrete would have cost three times the money. We felt that ground screws would be a much better footing.

“It was a unique job for us, doing it right before the playoffs,” he continued. “And it’s a really neat space.”



Greenhouse System
OXNARD, CALIF.

Construction of a large greenhouse near the Southern California coast presented a couple of challenges, namely earthquakes and wind. Those factors and cost all made the decision to use ground screws an easy one, according to James Fryn of Greenhouse Systems USA.

“It was very cost-effective,” Fryn said. “We were able to put up a 230,000-square-foot facility with two guys working five days total. With concrete, that would have been at least three weeks with four or five guys.”

The structure was also required to withstand winds of 100 mph, which Fryn says they were able to meet.

“For us, this made sense immediately,” he said.



Pyramid Sculpture
CAL STATE LONG BEACH

Located near the campus’ Pyramid sports arena, a large sculpture that references the space frame system of that building was constructed in 2014, mounted on ground screws. Initially intended to be temporary, it still resides on campus with no immediate plans for removal.

“Because of the nature of ground screws, it can be disassembled much easier,” said Heather Barker, assistant professor of design at the university. “That made it easier to get a commitment. Part of the university is also located on Native American sacred burial areas. That makes disturbing the ground an issue. Ground screws are far superior to digging a big hole that disturbs the site, and the cost issue was also a great benefit.”

The gold standard: International Code Council

As a relatively new technology, ground screws are still in the process of gaining universal acceptance. Although they have been evaluated by agencies overseas, ground screws are currently being reviewed by the International Code Council Evaluation Service, the “gold standard” for setting construction standards in the United States.

“If you can say something meets ICC standards, it usually doesn’t go further than that and they will expedite the permit,” said structural engineer James Adrian Adams. “Without that, you will need a full engineer’s report and that slows the process and also makes it much more expensive.”

Technical specifications for how a device will handle conditions — slopes, hard rock, resistance to pressure — are needed to give engineers the data to incorporate ground screws into their designs. The ICC tests devices to determine these specifications.

“Then it’s really just a matter of calculating the load, what you need and spacing them out,” Adams said.

Once an evaluation of ground screws is complete, they could find more uses in the U.S., including habitable structures like homes and businesses.

HOW DO SCREWS STACK UP?

A SIDE-BY-SIDE COMPARISON

	 CONCRETE FOUNDATION	VS.  SCREW FOUNDATION
Planning 	The site must be prepped, soil excavated and graded before work can begin.	Just show up!
Weather 	High temperature could cause concrete to dry too quickly and rain/snow could delay work.	Work can happen in all conditions.
Time 	There are more steps to complete (excavation, formwork), and concrete takes time to cure.	Can turn a 4-day job into a 4-hour job.
Labor 	More manpower needed to work quickly with the concrete.	Less manpower needed over fewer hours.
Cost 	Materials are less expensive, but longer job time leads to increased labor costs.	Time savings result in reduced labor costs.
Terrain 	Hard rock, sloped grades and contaminants in the soil could cause problems for digging.	Works in all terrains (sand, hard rock — even existing foundations) and smaller machinery can get to hard-to-reach job sites.
Environmental Impact 	Uses more natural resources (water, limestone), releases CO2 into atmosphere, and requires transportation of materials, adding to carbon footprint.	There's no concrete, no disruption of surrounding soil, plus installation creates less noise pollution.
Removal 	Foundation must be removed by jackhammer and materials disposed of in landfill.	Screws are quickly removed and recycled, rendering the site in great condition for other uses.
Performance 	Durability and strength can be compromised by many factors outside of contractors' control.	Onsite testing can instantly verify a screw's performance.



Q&A: ED AYALA

BY MATT JOCKS



THE TWISTS AND TURNS THAT LED TO ECO FOUNDATION SYSTEMS

Ed Ayala, the founder and president of Eco Foundation Systems in Sacramento, has gone from skeptic to evangelist on the power of the screw. Here he talks about that trip.

What is your experience as a contractor?

I got my degree from UC Berkeley in landscape architecture and eventually started a design-build firm in Sacramento. I was working on projects for the Sacramento Housing and Redevelopment Agency for several years when the financial crisis occurred. The State of California reclaimed the redevelopment funds and my business literally shut down. I was done. I remember telling my wife, “I’m not digging anymore, screw it!”

Which brings us to the next step. How did you get involved with ground screws?

My friend, Cesar Ramirez Martinell of Barcelona Housing Systems, got in touch with me and said, “Have I got something for you.” He told me about the ground screw. As I listened somewhat apprehensively, the concept indeed began to make great sense. Eventually, I took a trip to Germany and saw its implementation and I was blown away. It was so simple, I thought, why hadn’t anyone thought of it before?

What was the next step?

Finding funding was impossible at that time. I sold a lot of equipment from my business, sold personal items, and I have a very patient wife. I used the money to support myself and to experiment with the ground screw. I wanted to fail, so I could see the limitations before I

took it to market. After two years, I was very comfortable with the product. I would go to trade shows and try and educate companies. Later, after explaining the business to my friend David Drake, he immediately wanted to become a part of ECO. I hadn’t considered having a partner, but David’s enthusiasm and passion was compelling. He brought an influx of capital and ECO had a V.P. of Sales.

How much resistance did you get?

There was a lot! It’s hard to change time-honored systems with disruptive technology. Contractors have systems in place that they develop over time. But since we can also implement it rapidly, we devoted a lot of time to demonstrations. Once people see and hold the ground screw and observe how it performs, it is rare that we don’t convert a new customer. Improving systems should always be on the table for any business.

Were you discouraged by the skepticism?

I never thought “What have I done?” Never. I have gone after this with a passion because I know it works. Because of how quickly this can be done, I can tell someone: “With zero increase in your overhead, you can double your output.” How many times can you say that?

Your initial comment to your wife is pretty interesting now.

When you have no liabilities and you’re just dreaming about the business, you think of marketing and T-shirts and logos. I already had my slogan: “Stop digging ... just screw it!”

Any terrain, any time

The unique attributes of the ground screw make it adaptable to many different environments and conditions. Weather causes delays for most foundation methods, but inclement weather won’t limit ground screw installation. Hard rock is also not a problem. Pre-drilling prior to

ground screw installation emulates the patented Tapcon screw process.

The ground screw process also requires less manpower and smaller equipment, allowing for work in hard-to-reach terrain.

“We just did a job in San Benito County, in a canyon 25 miles off the

main road,” said Ed Ayala, president of Eco Foundation Systems. “I don’t know how that would have been done with concrete or something where you needed heavy equipment.”

Ground screws are ideal for many scenarios, including:

- high temperatures
- rain
- hard rock
- sand
- existing foundation
- environmentally sensitive substrate
- slopes
- urban areas (less noise)
- remote areas with limited road access



COULD THIS BE THE FUTURE OF HOUSING?

GROUND SCREWS HAVE BECOME A SOLUTION FOR MORE AFFORDABLE HOUSING IN SOUTH AMERICA

BY MATT JOCKS

When the United Nations gathered public officials in Quito, Ecuador, last year to look at the future of urban development, they couldn't see the revolutionary idea that could make affordable housing more attainable. But it was right under their feet.

During the U.N.'s Habitat III conference, officials toured a project built by Barcelona Housing Systems, a company that has turned to ground screws as a solution to build housing quickly and cost-effectively while lessening the impact to the environment.

"Our focus is to build affordable housing for expanding cities," said Cesar Ramirez de Marti, a research and development engineer with Barcelona Housing Systems and son of BHS Chairman Cesar Ramirez Martinell. "The concept is to produce factory-assembled panels and use a very light steel frame."

When it comes time for one of their buildings to go up, the work starts at the bottom. That's where ground screws satisfy three huge requirements — cost, time and a low environmental impact. The first two requirements are directly linked.

"Time is money," Ramirez de Marti said. "With a concrete slab (foundation), you have the time it takes to put it in, but then you have to wait up to a month or month and a half for it to settle and dry. With ground screws, you can go do it in hours and be ready to go."

"Our focus is to build affordable housing for expanding cities."

Cesar Ramirez de Marti
Research and development engineer with Barcelona Housing Systems

Ramirez de Marti said the difference in environmental impact is also large.

"There is a lot of CO2 (carbon dioxide) involved in concrete — extraction, heating, mixing," he said. "And, if you want to remove the building, (with ground screws)

there isn't the slab to deal with. That kind of impact is totally against our philosophy."

As for sturdiness and safety, BHS's first major project was a four-story, 48-unit affordable housing project in the Chilean desert. In February 2016, Eco Foundation Systems was subcontracted to install 825 7-foot screws for the structure. The work took 10 days — faster than the surveyors at the site could finish their job. Chile is a major earthquake zone, but the ground screw foundation passed all tests.

"We definitely did a lot of study," Ramirez de Marti said. "I think they resist much better (than a concrete foundation) because they are flexible."

Ramirez de Marti says the technology "is the future" and would be well-suited to smaller or temporary housing for the poor and displaced. But the possibilities could go beyond our planet.

"I've even thought about if we ever get to Mars, you'd need light materials," he said. "Some people might laugh, but sometimes I think about those things."

Saving \$, Doing More

Reducing the cost of construction not only saves money, it can transform communities.

If more municipalities used ground screws, it could reduce the cost of projects and stretch public dollars to accomplish other badly needed infrastructure improvements. Eco Foundation Systems can help cities, counties and other jurisdictions save money on common projects including:

- road signs and other signage
- fencing
- maintenance sheds
- traffic lights
- solar arrays
- shade structures

READY TO GIVE US A TURN?

ECO FOUNDATION SYSTEMS CAN WORK WITH
CITIES, COUNTIES, GOVERNMENT AGENCIES AND SOLAR CONTRACTORS
TO SAVE MONEY ON PROJECTS AND MAINTENANCE NEEDS SUCH AS:

ground-mounted solar	sheds
road signage	greenhouses
power poles	fences
ground coverings	containerized structures

"Stop Digging — Just Screw It!"



INCREASE PRODUCTION —
WITHOUT INCREASING YOUR
OVERHEAD!



SAVING TIME =
SAVING MONEY



"GIVE US A TURN" INTRODUCTORY
PRICING AVAILABLE ON
FIRST-TIME BIDS



Call for a FREE presentation and demonstration
on how ground screws can become part of your
next project! Contact President Ed Ayala at
ed@ecofoundationssystems.com or 916-913-0603.

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N&R Publications, www.nrpubs.com