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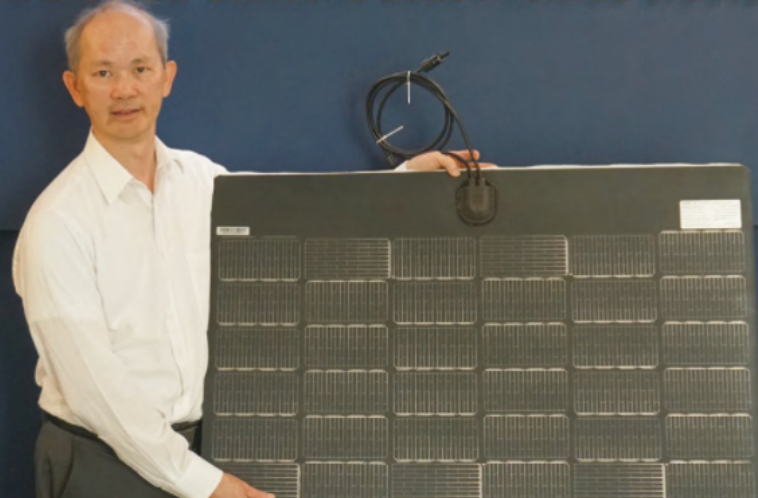
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A MISSION CRITICAL ELECTRONICS BRAND



Global Product Development Manager Albert Shuen oversees all product development for Xantrex. An electrical engineer by trade, he has been with the company for more than a decade.

Harnessing More Power from the Sun

In early 2017, Xantrex answered repeated requests from OEMs, dealers and consumers and embarked on a journey to add solar solutions to its power products portfolio. The company unveiled its new suite of rigid and flexible solar products earlier this year.

By Jennifer Brauns

For more than three decades, Xantrex has manufactured RV OEM inverters/converters. Senior Marketing Manager Mitul Chandrani says almost every type A motorhome built in the U.S. in the late '90s and early 2000s had Xantrex products inside. He says the company's Freedom 458 product, launched in 1997, is the best-selling inverter/charger of all time in both the RV and marine markets.

Answering the Call

Dealers asked repeatedly for the company to offer solar solutions. Xantrex dealers were frequently installing a Xantrex inverter and another company's solar panels in the same RV. Dealers wanted a single-supplier solution.

Chandrani says RV manufacturers such as Newmar, Thor, Forest River and Winnebago also wanted a one-source solar offering.

With the company's laser focus on power solutions, solar was a logical addition to the Xantrex product line. With existing relationships and the Xantrex brand already synonymous with RV power solutions, the team was confident the company could successfully foray into the solar market.

"Sales and Business Development Director Steve Carlson was able to make a case to management that if we had solar," Chandrani says, "we would be able to move the product very easily, both in the OEM and aftermarket space."

Chandrani says Xantrex's product sales are almost evenly divided between OE and aftermarket in the RV space.

"There are thousands and thousands of coaches with Xantrex products in them," he says. "When older units come back to the dealership (for service), it is the mindset of the dealerships to want to replace old Xantrex products with new Xantrex products."

That is one reason why the Freedom 458 still sells today with exceptional business in the aftermarket—all replacement, he says. By replacing an old inverter/charger with the same make/model, dealers may be able to use the existing remote panel, cable and other components, rather than having to replace them all when conducting a repair.

RV Aftermarket Sales Manager William Tomkinson was also a driving force in developing the solar line. He was constantly in the field meeting with dealers, Chandrani says, and Tomkinson felt strongly about adding a solar power aftermarket offering.

Xantrex Vice President Richard Gaudet took Carlson's and Tomkinson's pleas seriously, along with those of dealers, consumers and OEMs, and agreed the time to develop a solar line had come.

The Research

Gaudet, Carlson, Tomkinson and Chandrani, along with Global Product Development Manager Albert Shuen, researched customer needs and wants to deliver the right products to market.

Initial research feedback was clear: consumers wanted the ability to spend an entire weekend boondocking on just solar power and still run the appliances and electronics they normally use when camping.

The research revealed that to gain a competitive advantage, the Xantrex team needed to address reliability and durability issues. Ease of installation with present solar offerings was another thorny problem for consumers the team had to tackle.



(L to R) Senior Marketing Manager Mitul Chandrani and Product Manager Wesley Shuen inspect a Solar Max solar panel. The product team developed the flexible panel that can be rolled up and even bent up to 180 degrees without damaging solar cells.



Chandrani and Nick Singh, a graphic design and marketing specialist, look at a newly designed display unit. Singh designs all labels, packaging and marketing materials for the solar product line.

Shuen was in charge of developing the solar product line. As an electrical engineer, he had a background in semiconductors working for the likes of Intel and Samsung.

He hired Wesley Shuen to be product manager and focus solely on solar product development.

Implementing solar involves more than grabbing a solar panel, installing it on a RV and hoping it works, Shuen says. Proper integration of AC and DC power, battery maintenance and supplementing the batteries with the solar all require consideration.

As it turns out, producing computer chips and silicon wafers is similar to making solar cells. When manufactured, solar cells also come out as silicon wafers, just like chips that run laptop computers.

For a truly optimized solar solution, he says, one partner needs to match the right panel with the right battery and the right charging. The

system must also address how the inverter/charger works when the RV is plugged into shore power in conjunction with the solar.

After collecting positive/negative feedback about various products, the team brought in product samples to study. Thorough examination of samples helped the team understand how the design of certain features made the solar offering liked or disliked.

How Solar Works

Shuen says many people believe all 100-watt solar panels are the same, but that is a myth. He says understanding how solar panels function is critical to grasping how Xantrex gets more power output from smaller solar panels.

The silicon wafers inside solar panels have a layer of positive and negative diodes (semiconductors) on the solar cells, which facilitate one-way energy flow. The incoming energy in the form of light hitting the solar panel strikes the wafer cells in the silicon

substrate. This process displaces electrons. When electrons get knocked out of the natural orbit of an atom's nucleus, it creates energy.

Each solar cell has conducting silver lines called fingers and busbars. Fingers are very thin horizontal silver lines running across the cell and busbars are slightly thicker silver lines running vertically across the cell. The solar cell fingers collect the displaced electrons and deliver them to the busbars. The captured current from the busbars flow via the positive and negative cables on the panel, sending the current to the charge controller.

From there, the controller manages the current and voltage to ensure the battery does not overcharge. Another set of cables moves the regulated energy into the battery for storage until needed.

Most solar panels in use today are rigid glass panels. When vehicles began incorporating solar power, most used the rigid variety. While they cost less than flexible panels, they are also heavier. Some RV manufacturers and consumers use both. A flexible panel is advantageous when installing a solar panel on a curved RV rooftop.

How Xantrex Solar Is Different

Most solar panels have only two or three busbars passing through their cells. If only two busbars are in each cell, with each cell being 5 or 6 inches long, electrons routinely have to travel 2 or 3 inches before hitting a busbar and being collected. The more busbars a solar panel has, the more efficiently it creates a current.

Shuen and his team opted to put five busbars per cell in their panels.

Digging deeper, solar cells are made from two types of silicon:



(L to R) Staff member David Miller, Electro-Mechanical Engineering Specialist Luke Routley, Wesley Shuen and Chandrani hold a product meeting to discuss upcoming product changes. Miller has held a variety of roles with Xantrex in the past 19 years, including director, product manager, mechanical design lead and others.

polycrystalline or monocrystalline. Polycrystalline panels are made with tiny silicon pieces melted together. They can do the job but, because the crystals are not aligned, are less efficient. Monocrystalline panel cells consist of whole silicon crystals, so they are aligned.

Shuen says identifying one type of panel from the other is easy. Polycrystalline cell panels have a background pattern that looks like triangle-shaped broken glass, and they have a bluish color. Monocrystalline panels have a uniform black background. While monocrystalline panels cost more, they are 5-10 percent more efficient.

Using five busbars per solar cell, and monocrystalline cells, Xantrex solar panels produce more power with smaller panels.

Xantrex also uses passivated emitter and rear contact (PERC) cells in the

panels. Shuen says PERC is the latest technology available in the photovoltaic (PV) industry. PERC cells have an added reflective layer of material to improve performance in three ways.

First, the reflective surface sends uncaptured light back through the solar cells for a second opportunity to be collected by the busbars.

Second, the PERC coating reflects wavelengths of light above what solar cells can use to create energy. Normally, the dark background of the panels would capture the higher wavelength light, causing the panels to heat up. The hotter solar cells become, the less efficiently they perform. PERC cell solar panels release the higher wavelength light and run cooler, contributing to a 10-20 percent efficiency gain.

Third, PERC cells minimize the tendency of moving electrons to recombine with other electrons. Minimizing recombination allows the particles

to move more freely through the solar cell, increasing the likelihood of getting grabbed by busbars and converting into energy.

Solar to the Max

Chandrani says a perception exists among dealers that flexible panels are less durable than solid ones. While this is true with some types of flexible panels, Shuen's team specifically designed the Solar Max product to address this concern.

The silicon wafers in solar cells can be thin and somewhat fragile. Rigid glass panels, with a hard back and glass front, provide a sturdy frame to protect the wafers. Standard flex panels are less limber, so they risk being damaged when handled improperly. Bending a standard flexible panel 90 degrees will likely break the silicon wafer inside.

Solar Max is available in 80-, 165- and 220-watt kits. Chandrani says Solar Max is currently the most advanced

solar panel on the market. One unique Solar Max feature is a mesh grid inside the panel to provide nearly 2,000 points of contact per solar cell. This feature provides 20 percent more solar harvesting capabilities, making the panel perform better in low-light or shaded conditions.

The mesh gives the Solar Max panels up to 180 degrees of flexibility. Users can roll the panels like carpet without damaging them. Xantrex Solar Max panels are 50 times more durable than standard flex panels with busbars.

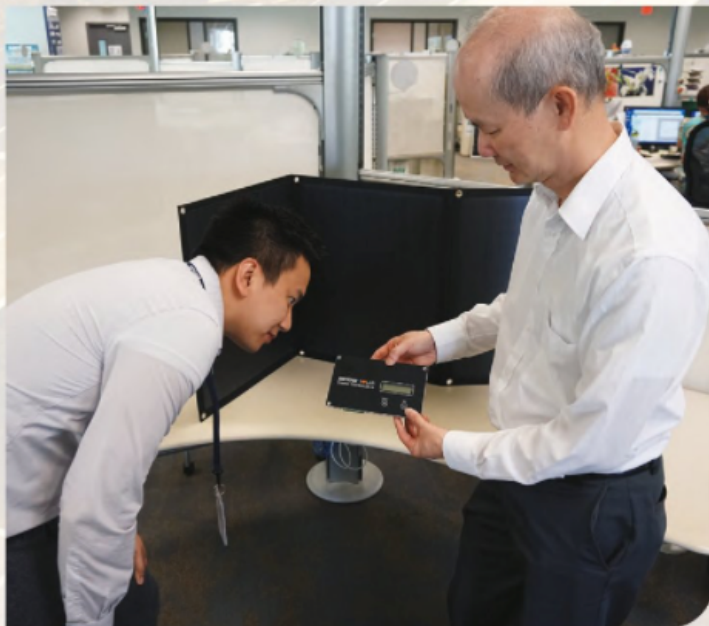
To further address the durability issue, the solar development team designed a protective layer for its solar cells. The protective material, called ethylene tetrafluoroethylene (ETFE), provides corrosion/weather/stain resistance and better light transmittance, compared with semi-flexible panels without ETFE.

To simplify installation, the panels also feature a peel-and-stick installation, using a 3M adhesive, eliminating the need to drill through a RV roof.

When the company launched the Xantrex suite of solar products at RVX in Salt Lake City, the suite contained both roof-mounted and portable offerings. The roof-mounted offerings include both rigid glass panels and two types of flexible panels.



Miller tests a solar charge controller board. He is the lead mechanical staff person for all solar charge controllers.



(L to R) Wesley Shuen and Albert Shuen inspect a solar charge controller unit. Wesley Shuen joined the company a year ago as solar product manager.

Portable Solutions

In the portable solar line, Xantrex also provides rigid glass and flexible options. Chandrani says the flexible, 100-watt kit is the lightest in the line, weighing only about 9 pounds. The flexible, portable panel is foldable and includes a vinyl case for storing. Currently, portable flex panels are available only in 100-watt models.

The heavier, rigid, portable kits are available in 100- and 160-watt models and also have a carrying case.

Chandrani says unlike other products on the market, Xantrex solar kits come with all necessary cables with built-in fuses. Other products in the market provide only one set of cables, and no fuses, he says. Users have to buy additional components to install most other solar kits.

Xantrex kits include mounting brackets, screws, cable ties, clamps, a charge controller and everything required to complete installation. Expansion kits provide branch connectors, solar panels, cable ties and mounting screws.

With a single 30-amp charge controller, consumers can connect four 100-watt panels in parallel.

What Dealers Need to Know

RVers must first determine how much energy they require. Xantrex created a guide to help calculate power needs. The company will soon launch a series of YouTube videos to help with calculations as well.

First, a consumer must list all the electronics and appliances in the RV and decide how long they need to run off solar. From there, calculations must be completed to estimate the amount of required power. RV dealers are likely involved in this process before purchase and installation.

Power output depends on a variety of factors. Chandrani says geography is one of the most important considerations. Arizona summers have an average of six to seven peak hours of sun daily. Whereas RVers in Seattle experience more cloudy days, which limits solar's capabilities.

If a consumer needs 150 amp-hours per day, a 100-watt Xantrex panel provides 5 amps per hour. If conditions enable six peak sun hours each day, a 100-watt panel would produce a total of 30 amp-hours per day in that area. To calculate the number of required panels, divide the needed power by max amps produced per day ($150 \div 30 = 5$). In this example, a consumer would need five 100-watt panels.

New Ownership

Last November, Huntington Beach, California-based Mission Critical Electronics (MCE) announced it had acquired Xantrex from Schneider Electric. Although how the acquisition would affect Xantrex was uncertain, Chandrani says the transition has been quite smooth.

Other than billing address changes, he says the way Xantrex interacts with customers is no different. Mission Critical Electronics retained the Xantrex brand name in key markets.

All product management, marketing, engineering, quality control and operations functions remain in the company's Burnaby, British Columbia, head office. A customer service and technical support call center is also in Burnaby.

The Elkhart warehouse location, with approximately 15 employees, is an OEM support office. The warehouse stocks key products that manufacturers need. The company also houses a technical support call center and technicians who examine returned products.

Xantrex products are available through all major distributors. OEMs will have new units rolling out with Xantrex solar installed in the near future.

Lithium-ion Compatibility

With the influx of lithium-ion RV batteries, Xantrex has a full line of lithium-ion compatible products. However, charging sources must be configured to be lithium-ion compatible.

Xantrex has a lithium-ion charging source and offers its own lithium-ion batteries. Currently, the company supplies Xantrex lithium products to Coachmen, Winnebago and Newmar. Xantrex has no aftermarket lithium-ion



Vice President Richard Gaudet has been with the company for more than 20 years. He was instrumental in bringing the solar line to market.



Wesley Shuen shows an entire Solar Max flex kit.

offering, yet, but will in the near future, according to Chandrani.

He says the Xantrex lithium-ion battery is the only battery in North America with Underwriters Laboratories (UL) 1973 certification. It cost the company an estimated \$250,000 to test and certify this battery offering, but UL certification was critical to Xantrex, Chandrani says.

The optional Freedom eGen battery system is available on Coachmen type C motorhomes completely eliminating the need for a generator.

He says most converters on the market lack a configurable charging profile that is compatible with lithium-ion batteries, but Xantrex products do. The Freedom SW inverter/charger and the Freedom XC inverter/charger are both lithium-ion compatible.

The more expensive Freedom SW is a heavy-duty transformer-based product. Users can stack two Freedom SWs to double the output. The SW can work with an OE generator.

With the addition of its solar line, Chandrani says Xantrex can provide every needed RV power solution. He predicts that in the next few years, every RV and boat will be lithium-powered.

Chandrani says meeting the standards customers expect from a Xantrex-branded product was important for the solar products.

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Xantrex Vice President Richard Gaudet's long-range goals include

expanding the breadth of the company's power solutions to create more value for its customers.

The company's goal is to keep the world energized while reducing its collective carbon footprint, by delivering power solutions where quality and responsiveness matter.

"Expanded solutions will more greatly enable our customers to work securely, live comfortably, lower their operating costs and total cost of ownership, while also reducing their own carbon footprint," Gaudet says. "We will continue to develop innovative products tailored to the RV market..."

"Our parent company, Mission Critical, shares a common vision and goals with quality and customer satisfaction being at the forefront," he says. "Together, we increase our purchasing power, and (we) are sharing best-in-class processes and technology across the MCE portfolio of companies. Each company has its own area of specialized expertise and knowledge base; combined, that is a powerful database."

Gaudet says Xantrex's OEM customers can expect the company to remain entrenched in Elkhart and grow its footprint in the RV segment.

"We recently hired an additional sales team member with the hiring of Bob Tooker as our RV OEM sales manager, based out of Elkhart," Gaudet says. "This new role is dedicated to supporting our existing RV OEM customers, while also growing the business..."

"It was a firm requirement for us to find an experienced Elkhart-based individual. We are very excited to have Bob join our team. We continue to also strengthen our service and repair team and have two dedicated sales engineers to support OEM and aftermarket parts managers and service technicians. We will also continue to partner with Tom Manning & Associates and expand our marketing and merchandising tools to better serve the RV dealers across the country."

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