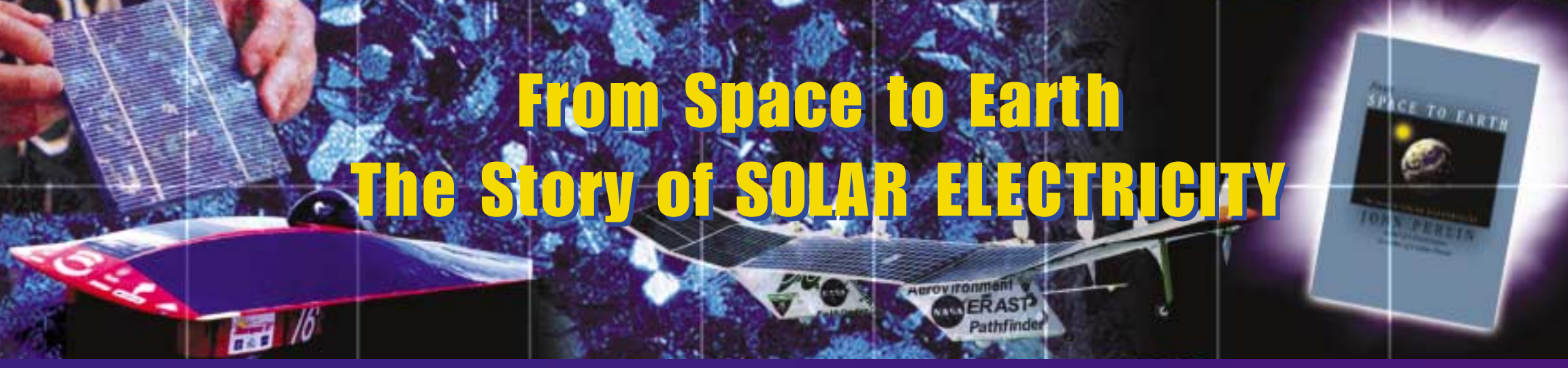
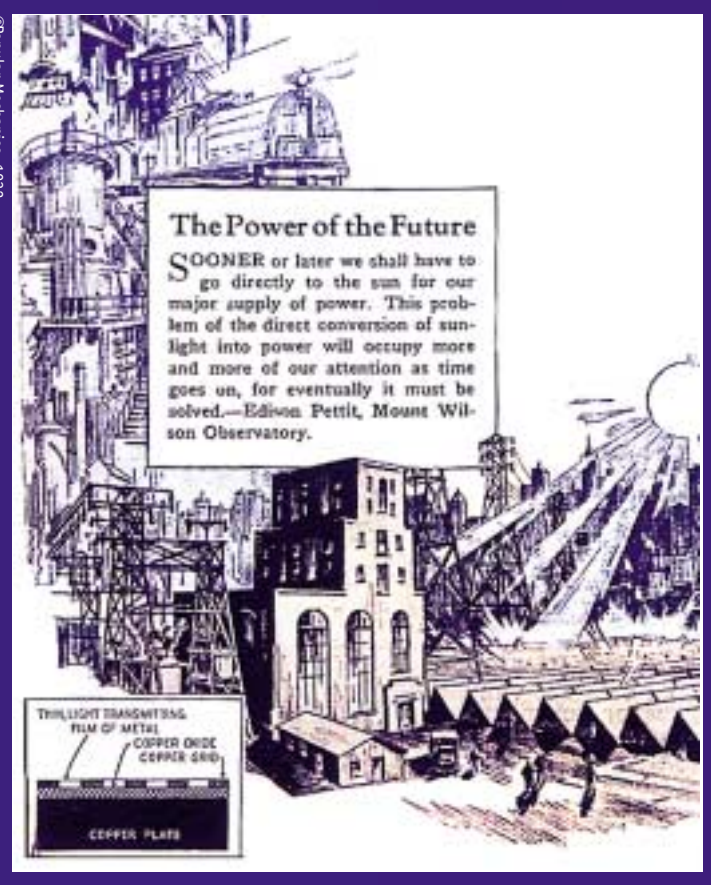


From Space to Earth
The Story of SOLAR ELECTRICITY

Photovoltaics: The Great Solar Hope

If there is a dream technology, it is photovoltaics—solar cells, made of material thinner than a human hair, that convert sunlight directly into electricity without any moving parts. Photovoltaics is a space age marvel, at once the most sophisticated solar technology and the simplest, most benign source of energy yet conceived.

Courtesy of NASA/JPL/Caltech



©Popular Mechanics, 1932

Photovoltaic Dreams

People have long dreamed of developing photovoltaics for practical purposes as this image from a 1932 issue of Popular Mechanics demonstrates.

The Dream Becomes Real

Bell scientists realized the dream in 1954, discovering the silicon solar cell, the first solar cell to produce enough electricity for useful purposes, and still the workhorse of the photovoltaic industry. This ad, appearing in the August, 1954 issue of National Geographic, celebrates the breakthrough.

SIMPLE AND EFFICIENT—The *Bell Solar Battery* is made of thin, specially treated strips of silicon, an ingredient of common sand. It needs no fuel other than the light from the sun itself. Since it has no moving parts and nothing is consumed or destroyed, the *Bell Solar Battery* should theoretically last indefinitely.

New Bell Solar Battery Converts Sun's Rays Into Electricity

Bell Telephone Laboratories demonstrate new device for using power from the sun

Scientists have long watched for the secret of the sun. For they have known that it sends us yearly as much energy daily as is contained in all known reserves of coal, oil and uranium.

If this energy could be put to use there would be enough to turn every wheel and light every lamp that mankind would ever need.

Now the dream of the ages is closer to realization. For out of the Bell Telephone Laboratories has come the *Bell Solar Battery*—a device to convert energy from the sun directly and efficiently into usable amounts of electricity.

Though much development remains to be done, this new battery gives a glimpse of future progress in many fields. Its use with transistors (also invented at Bell Laboratories) offers many opportunities for improvements and economies in telephone service.

A small *Bell Solar Battery* has shown that it can send voices over telephone wires and operate low power radio transmitters. Made to cover a square yard, it can deliver enough power from the sun to light an ordinary reading lamp.

Great benefits for telephone users and for all mankind will come from this forward step in harnessing the limitless power of the sun.

BELL TELEPHONE SYSTEM

Photo courtesy of the AT&T Archives. Reprinted with permission of AT&T.

Exhibit based on the book

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by John Perlin

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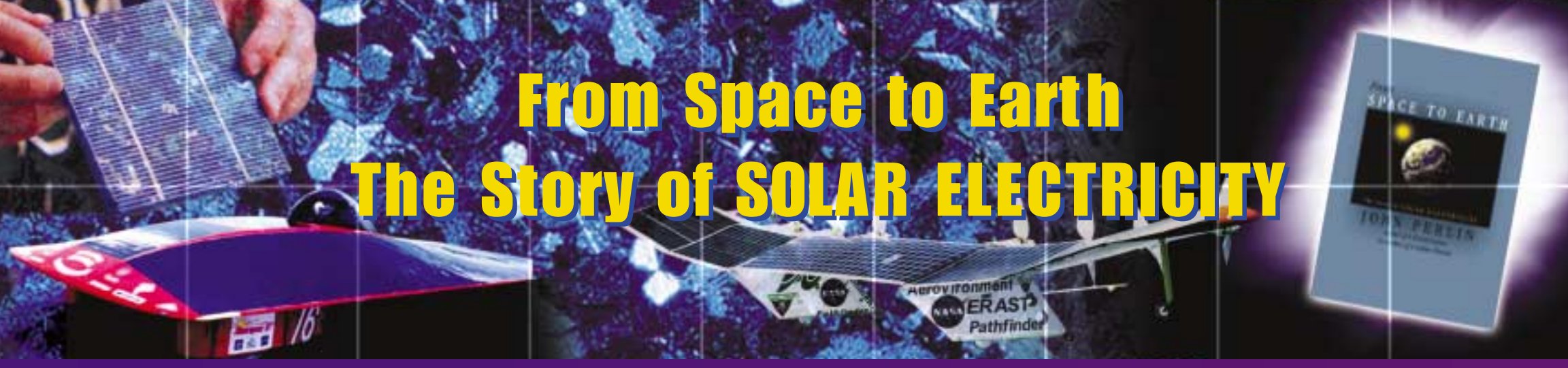

From Space to Earth
The Story of SOLAR ELECTRICITY

Courtesy of John Perlin Solar Archives

Searching for Applications

Despite great expectations for the Bell invention, the silicon solar cell initially powered only playthings.

Courtesy of John Perlin Solar Archives

Saved by the Space Race

The space race however opened an unexpected and large demand for solar cells. From milliwatts in the little Vanguard launched in 1958, to kilowatts for the International Space Station, solar cells have powered almost every satellite—indispensable for the military and global economy, as well as for science and entertainment. Without solar power, not much of our utilization of space would have ever happened.

Courtesy of NASA

International Space Station

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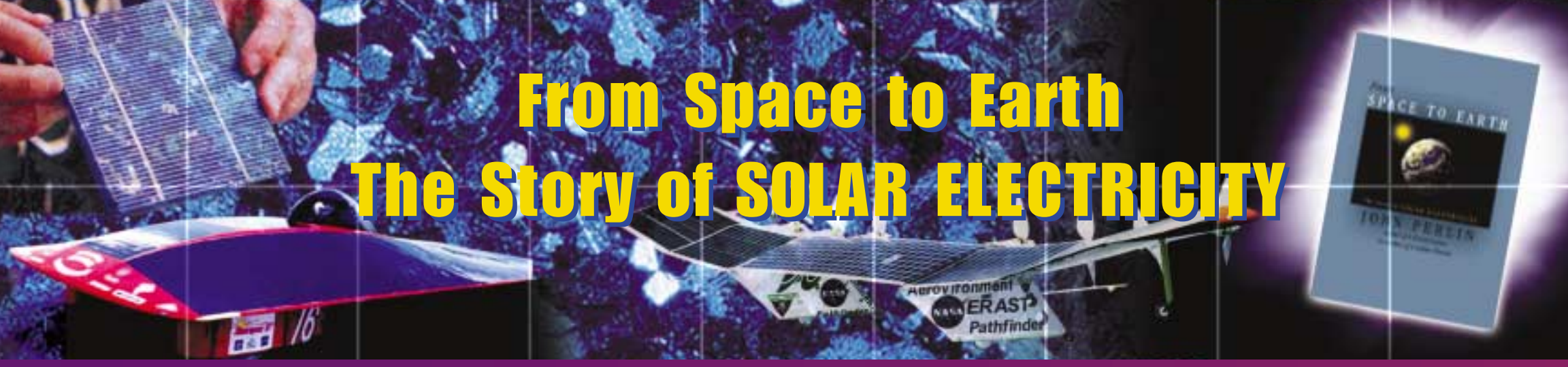

From Space to Earth
The Story of SOLAR ELECTRICITY

Bringing Solar Cells Down to Earth

With solar cells successful in Space, people began asking why can't they help on Earth. The first major user of solar cells for terrestrial applications was the oil industry, which had both the need and the money.

Courtesy of Solar Power Corporation

Courtesy of Solar Power Corporation

Courtesy of Shell Solar

Courtesy of BP Solar

The U.S. Coast Guard had the ideal use for photovoltaics—powering its many buoys and lighthouses. Today, solar electricity runs 99% of all aids to navigation used by the Coast Guard.

Courtesy of Automatic Power, Inc.

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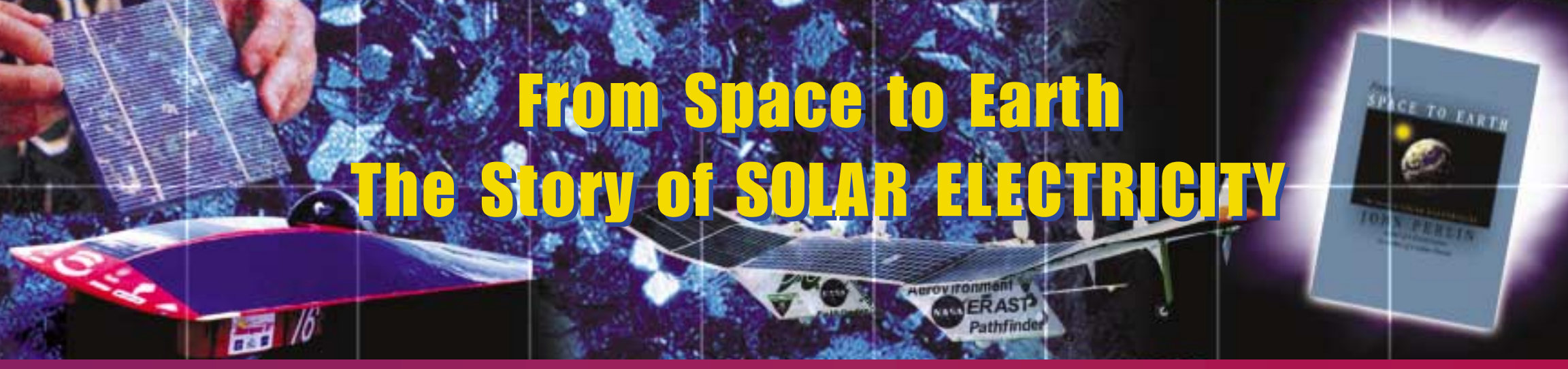

From Space to Earth
The Story of SOLAR ELECTRICITY

Courtesy of U.S. Army

Long Distance for Everyone

The US Signal Corps saw the value of photovoltaics long before any other organization. Its engineering group designed the solar arrays placed on the Vanguard. To celebrate its centennial, the Corps used photovoltaic panels to serve as the power source for the first solar-powered transcontinental radio broadcast from its headquarters at Ft. Monmouth, New Jersey to El Monte, California, where Hoffman Electronics manufactured solar cells for the Signal Corps.

Courtesy of U.S. Army

By simplifying the electronics in microwave repeaters, John Oades (below right), in 1974, used solar power to bring long-distance telephone service where rugged terrain made normal cabling impossible. A decade later solar became, and today still remains, the energy source of choice for remote telecommunication networks.

Courtesy of John Perlin Solar Archives

Hunts Mesa, Arizona

Courtesy of John Perlin Solar Archives

Working on the Railroad

Thanks to advances in communication technology, railroads no longer need telephone lines and poles along railway tracks, though signaling and switching devices necessary for track safety still need power.

Transporting that electricity from the closest utility lines, once those following the tracks have been taken down, can cost tens of thousands of dollars. Solar panels will do the same job for far less.

Courtesy of GE Transportation Global Signaling

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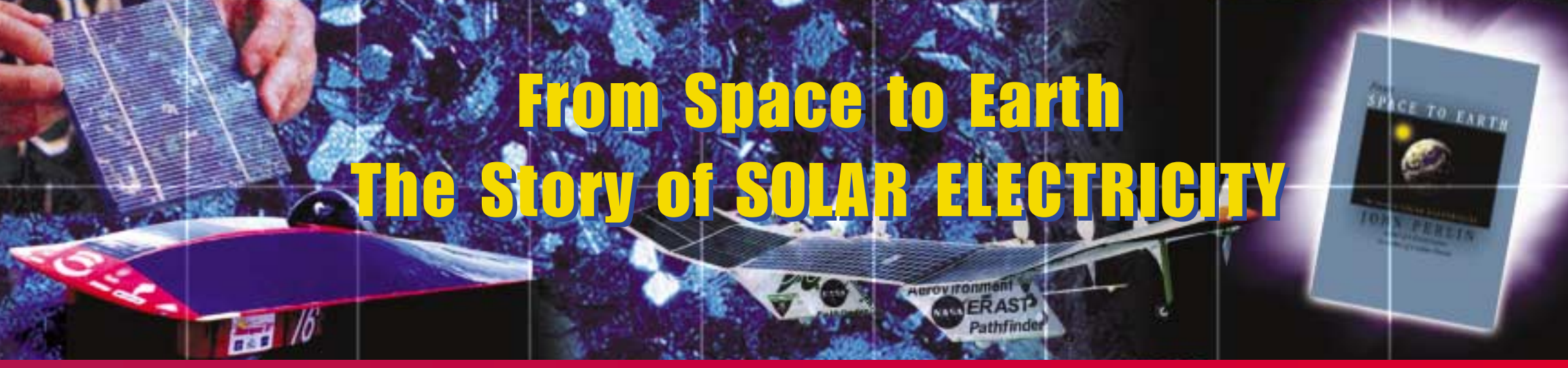

Photovoltaics in Everyday Life

Even when the utility lines stand a few feet away, photovoltaics prove more cost effective than digging up pavement and/or sidewalks to cable in newly installed emergency call boxes, flashing warning lights, illuminated bus shelters, or any other devices requiring power.

Courtesy of John Thornton

Courtesy of John Perin Solar Archives

Courtesy of John Perin Solar Archives

It didn't make headlines. But all those mobile road signs, the ones on trailers that tell you, "Slow Down to 40 MPH," or "Caution: Lane Closed Ahead," or warn you about other temporary road problems, have changed from diesel to photovoltaics thanks to the development of light emitting diodes (LEDs), a lighting technology requiring very little power.

Courtesy of John Perlin Solar Archives

Mt. Everest Expedition – Nepal

When disaster strikes, the electrical infrastructure many times collapses, leaving entire regions without power. Emergency personnel can quickly carry in ultra light solar panels, and set them up in minutes to reestablish electricity for vital needs.

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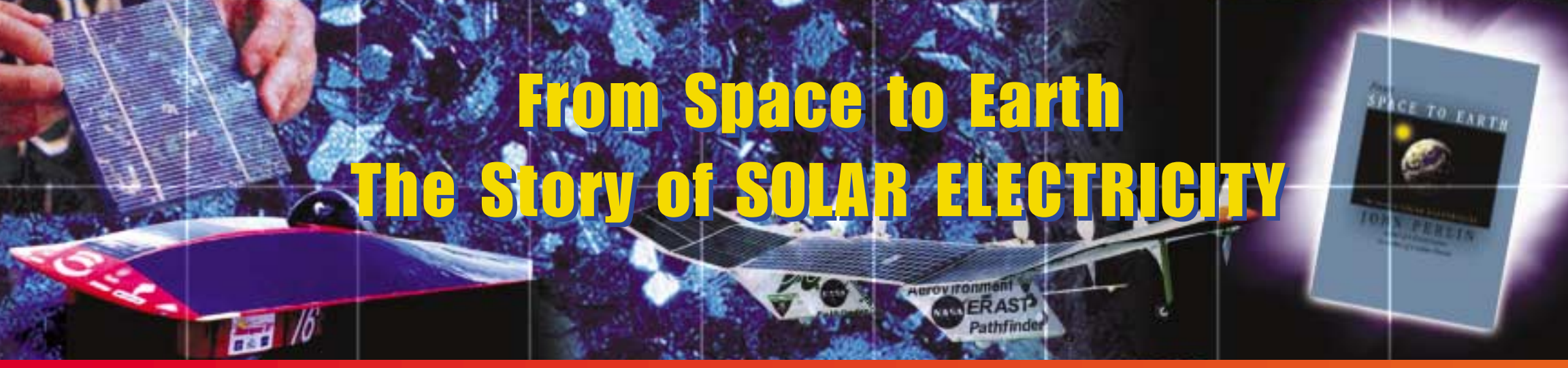


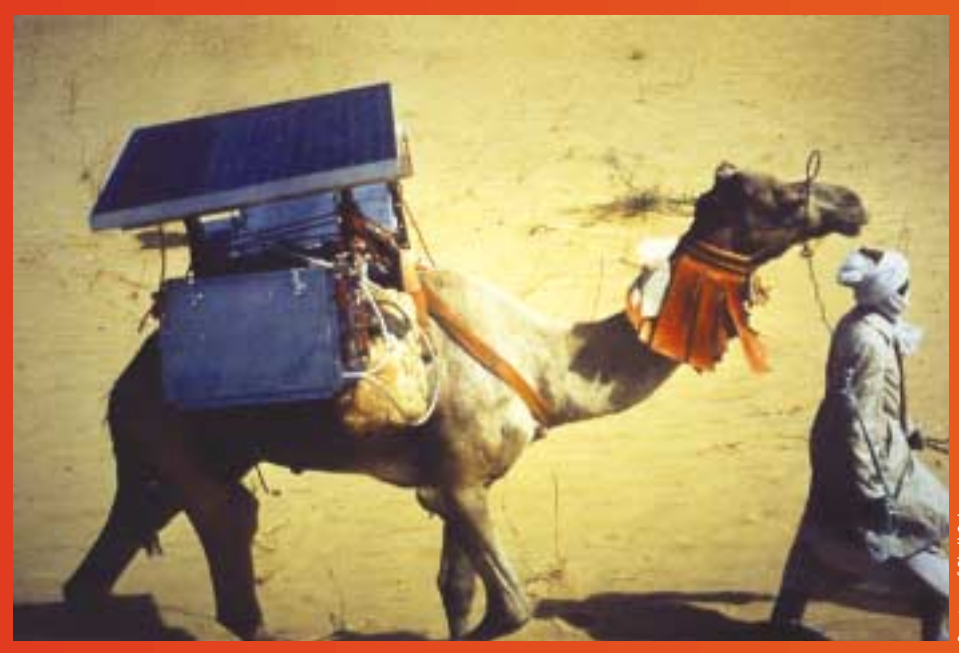
From Space to Earth
The Story of SOLAR ELECTRICITY

Bringing Electricity to Those Without

About 2½ billion people live without access to electricity. Unlike utility power that requires years for the generating plant and distribution lines to go up, solar electric panels providing decades of electricity can be immediately dispatched to the point of need by animal or vehicle and be up and running in a matter of hours.

Courtesy of Soluz

Dominican Republic



Courtesy of Shell Solar

Niger

Photovoltaics brings many benefits to those who have lived without electricity. In 1976 the French introduced the first working photovoltaic pump. Since then, tens of thousands of such pumps have provided people with safe, clean water as well as water for livestock.

Courtesy of John Perlin Solar Archives

The first working solar pump in Corsica in 1976.

Courtesy of John Perlin Solar Archives

Photovoltaics bring water to drought-stricken Mali, Africa.

Courtesy of John Perlin Solar Archives

Mali, Africa.

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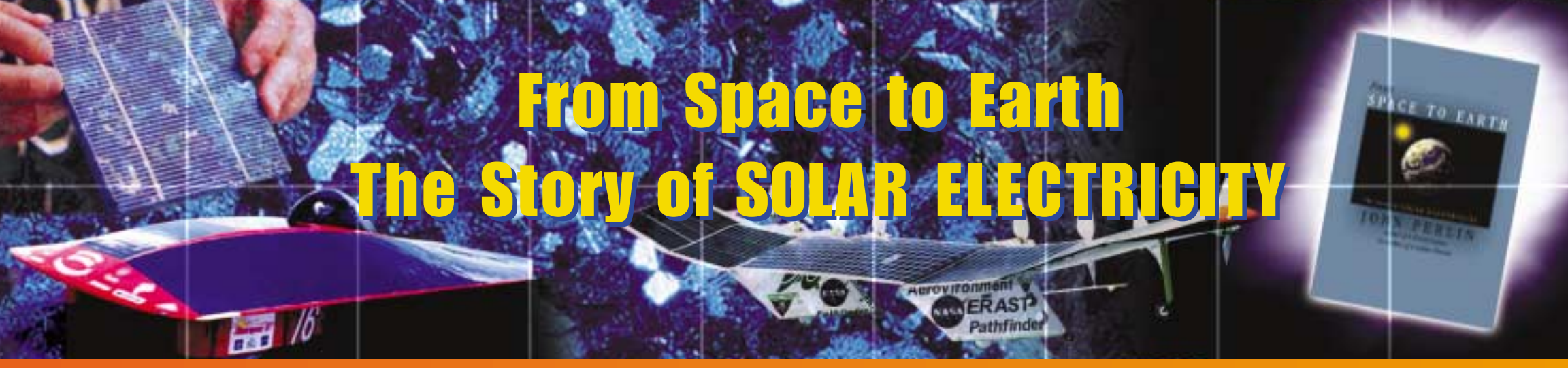


Bringing Electricity to Those Without
(continued)

Solar home systems bring high-quality lighting to those formerly without. The introduction of high-quality lighting raises grades by 60% and more effectively reduces birth rates than contraception campaigns.

Courtesy of Shell Solar

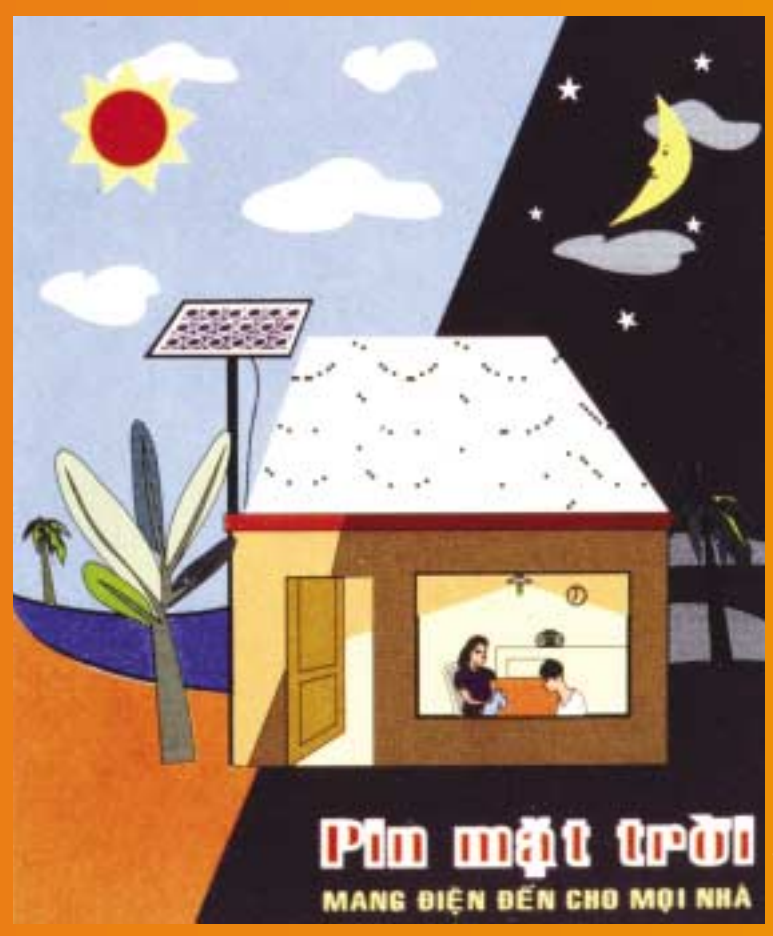
Mongolia

©1994 Richard H. Acker

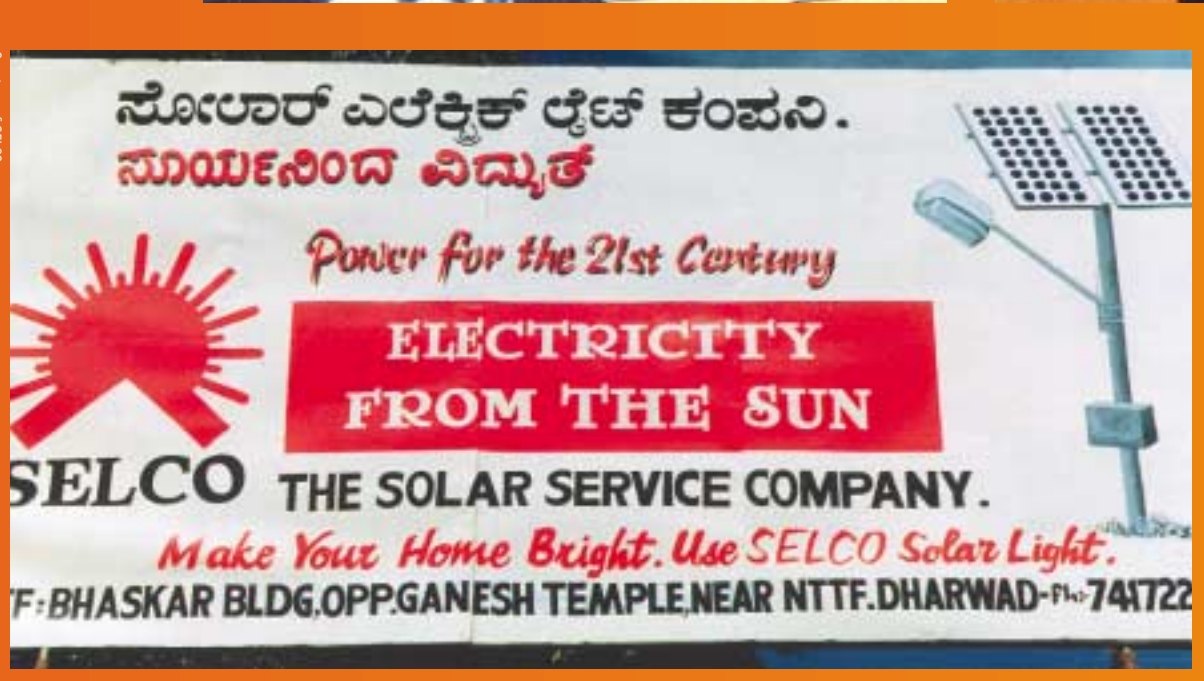
Kenya

No matter what language people speak, solar modules translate into a better life for those who had previously lived without electricity.

Courtesy of Soluz



Courtesy of SELCO



Courtesy of SELCO

Courtesy of Suntech Power Co.

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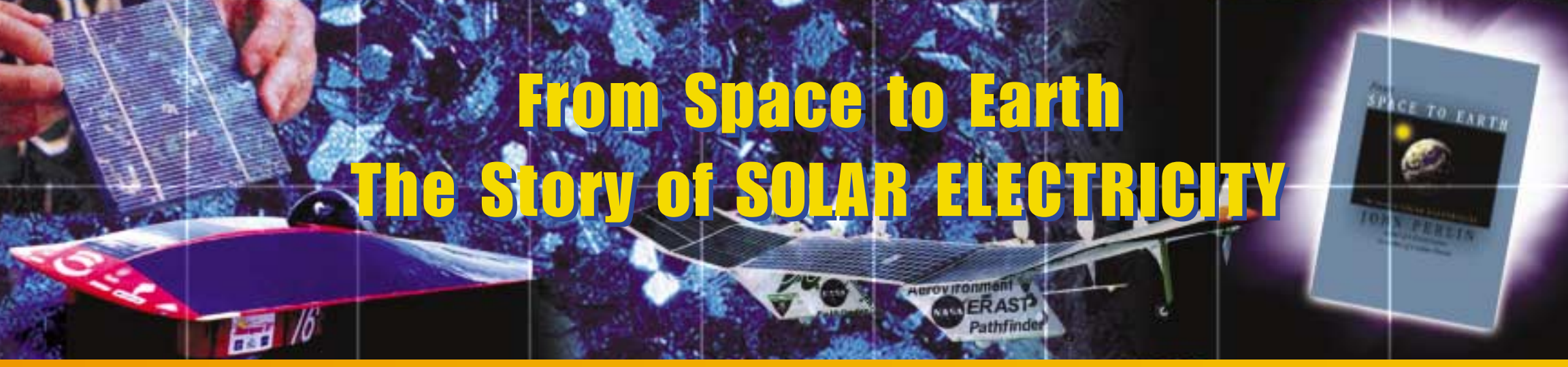

From Space to Earth
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Courtesy of Powerlight

At the Santa Rita jail in Dublin, California, solar panels work together with a reflective roofing material to keep the inside of the facility cooler.

Courtesy of SFPUC

An extensive solar monitoring network indicates that much of San Francisco receives enough solar fuel to put the sun to work throughout the City.

Solarizing the Electrified

Combining added insulation underneath solar panels for roofing gives buildings like the Moscone Convention Center two benefits for the price of one—electricity and protection from solar heat in the summer.

Courtesy of SFPUC

Workers install solar panels on the Moscone Center.

Courtesy of Pilkington Solar International

Photovoltaics can also serve as angled skylights or curtainwall on the south side of buildings. Not only do the panels shade the interior from the excessive heat of the summer sun, they also provide electricity for those inside.

Courtesy of Pilkington Solar International

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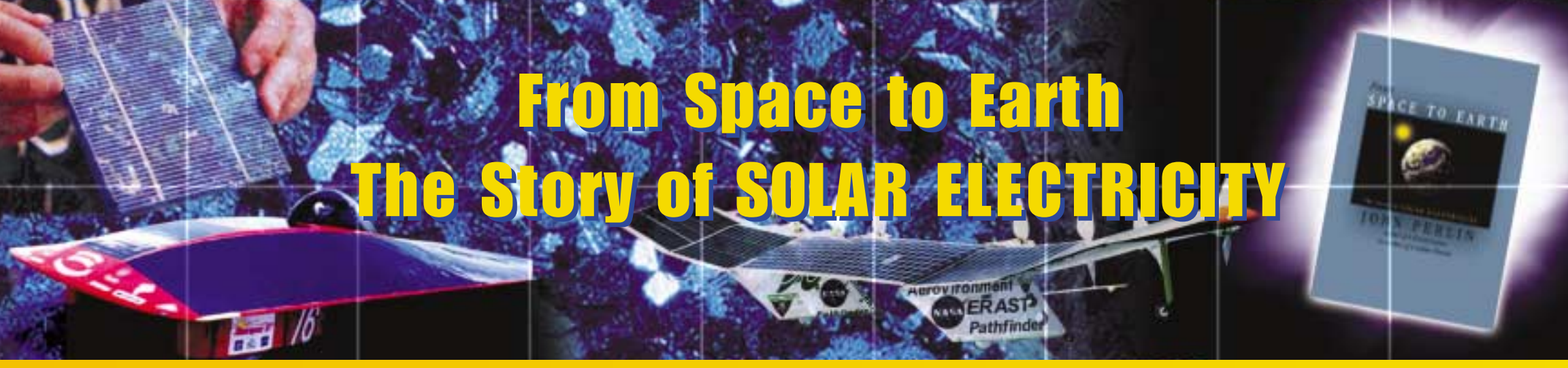


From Space to Earth
The Story of SOLAR ELECTRICITY

Solarizing the Electrified (continued)

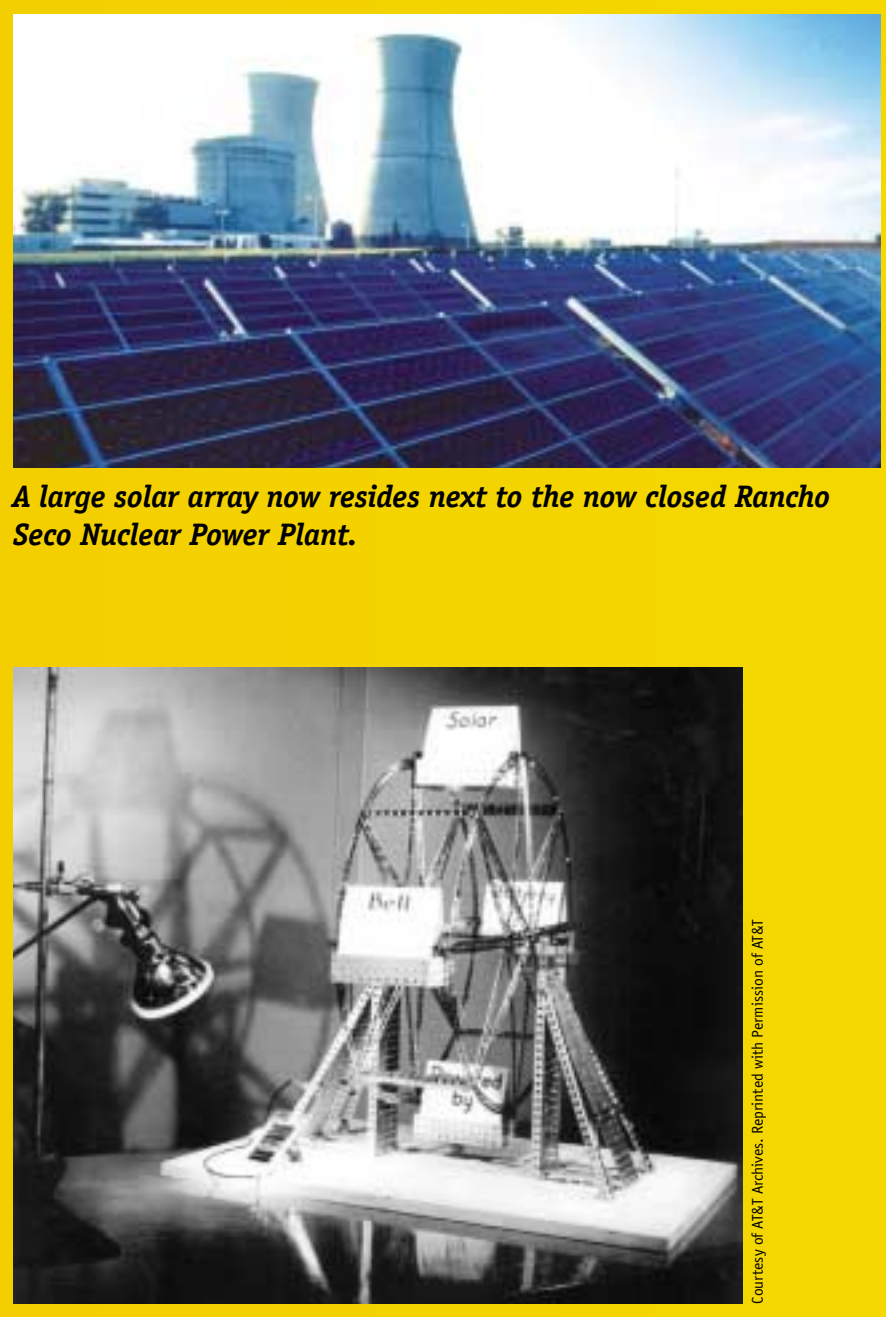
Photovoltaic panels protecting otherwise open parking lots also bring multiple benefits, protecting cars from the elements while generating electricity. This Solar Carport at Los Angeles Department of Water & Power's headquarters also acts as charging station for electric vehicles.

Courtesy of Pilkington Solar International

Courtesy of Astropower

One of many homes in California now with solar electricity. This solar array, installed on a patio trellis, provides shade while producing energy to power the home.

In 1989 Sacramento voters decided to close the Rancho Seco Nuclear Power Plant and instead, chose to invest heavily in solar electricity. The action led the Sacramento Utility District (SMUD) to set the precedent for forward thinking utilities throughout the country to sponsor solar electric projects in their territory. Sacramento is now home to over 10 Megawatts of solar electrical systems, mostly placed on rooftops throughout the city.



Courtesy of Sacramento Municipal Utility District

A large solar array now resides next to the now closed Rancho Seco Nuclear Power Plant.

The first power solar cells invented at Bell Laboratories in 1954 could only generate enough electricity to run this 21-inch Ferris wheel while today, solar panels drive a real Ferris wheel on the Santa Monica, California pier, demonstrating how far the photovoltaic industry has grown over the last 50 years.

Courtesy of John Perlin Solar Archives

Courtesy of AT&T Archives. Reprinted with Permission of AT&T

The sky is the limit for the future of photovoltaics as this solar-powered airplane demonstrates. It has flown higher than any other aircraft, reaching an altitude of 96,000 feet.

Courtesy of NASA

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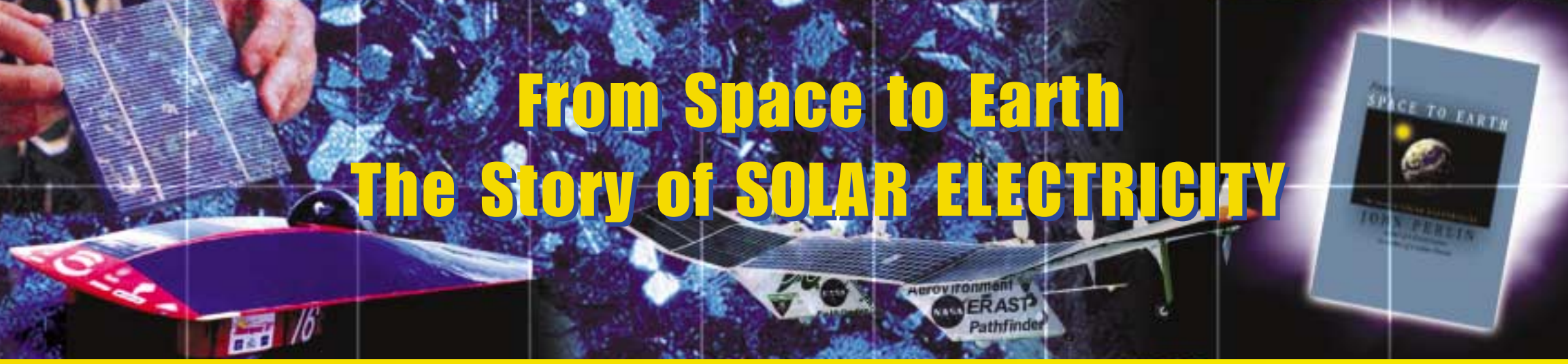

Courtesy of Erickson Equine Images

For this Eureka, California building, flexible panels are attached to a standard roof deck.

PIER Research

The Public Interest Energy Research (PIER) program of the California Energy Commission works with the solar industry to help develop improved ways of using photovoltaics. Better integrating solar systems with buildings helps to reduce concern over the appearance of photovoltaic systems and makes them standard material for housing. In fact, many housing developments throughout California now use photovoltaics on their rooftops.

Courtesy of Unisolar

The flexible panels become the primary roofing material, as shown in this rendering.

Courtesy of Astropower

Solar Panels seamlessly integrated with a concrete tile roof.

Courtesy of RWE Schott Solar

A free-standing solar panel roofing material that just sits on the roof without any adhesion, without drilling supports into the roof, and yet can withstand winds of over 110 miles per hour.