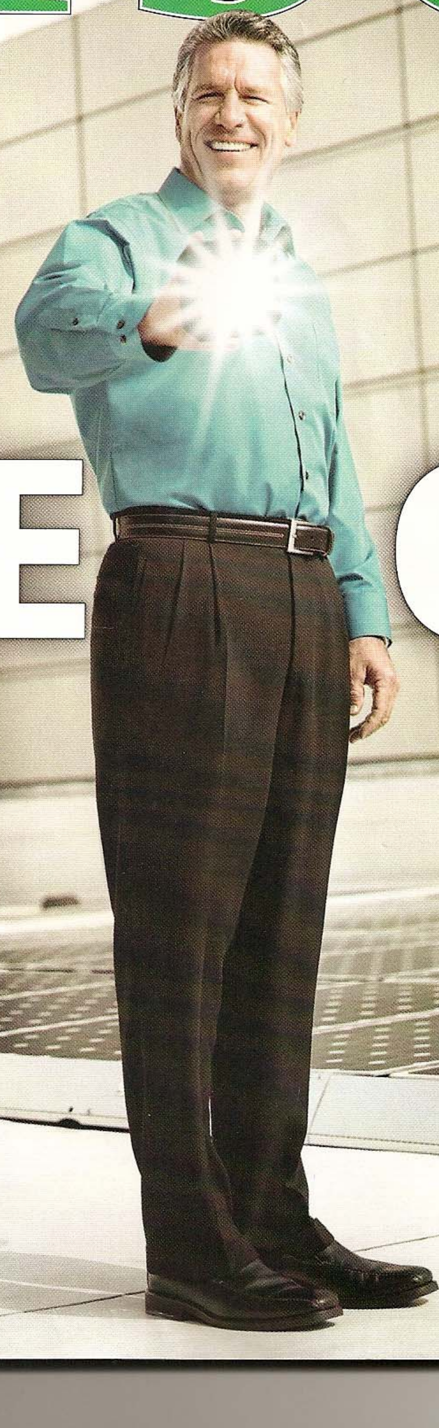
**BEST BIZ SCHOOLS**
**PARTY ON! DARTMOUTH'S STILL #1**

**A New Cholesterol Superdrug**
**Will China Save Chrysler?**
**6 Turnaround Stocks**

# Forbes

SEPTEMBER 3, 2007 | WWW.FORBES.COM



# SHINE ON!

## THE NEW PLAYERS IN SOLAR POWER GENERATE GOLDEN RETURNS (REALLY)

$4.99 | CANADA $6.99

MICHAEL SPLINTER
CHIEF, APPLIED MATERIALS

# A Trick of the Light

For Christiana Honsberg and Allen Barnett, the pot of gold isn't at the end of the rainbow. It's in ripping the rainbow apart to make the world's most efficient solar cells.

In late July University of Delaware researchers Honsberg, 40, and Barnett, 67, set a world record for solar efficiency, converting 42.8% of the sun's radiation into electricity with their prototype cell. That's almost three times as efficient as commercial solar cells.

**Allen Barnett & Christiana Honsberg**
**U. of Delaware**
World's most efficient solar cell

"We think we can do 50%," says Barnett. He and Honsberg are working to build practical devices by 2010, with support from the U.S. military and an industrial group led by DuPont.

The first crushing problem they aim to solve is lightening a soldier's load. Soldiers are walking power supplies, lugging 20 pounds of batteries that last barely a week. Two years ago the Defense Advanced Research Projects Agency challenged researchers to create an affordable, rechargeable solar cell, about the size of a postage stamp, which could crank out a half-watt of power.

Honsberg and Barnett were eager to try; it would be their first joint project in almost 20 years. Honsberg first worked on solar cells in the mid-1980s as an undergraduate at the University of Delaware, in Barnett's lab. After earning her doctorate, she wound up at Australia's renowned photovoltaics center at the University of New South Wales. Barnett went into business, spending 14 years running solar power company AstroPower. The company fell into financial turmoil. Barnett resigned and returned to the Newark, Del. campus in 2003. A year later GE bought the assets. When Barnett went looking to staff up a solar research program, Honsberg topped the list of recruits.



Honsberg and Barnett knew that one of the most efficient solar cell designs was a sandwich of three different photovoltaic materials, each of which is triggered by a different wavelength (or color) of light. But to make those photovoltaic stacks researchers must force the crystal structure of one material to match another—a difficult and costly task.

Why struggle with single structure, asked Honsberg, when you could let the constituent parts operate independently?

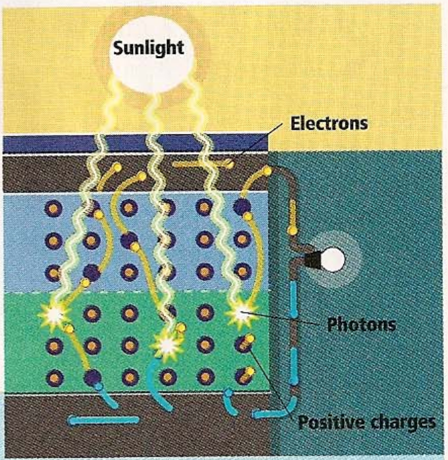
Honsberg and Barnett proposed a device that uses a concentrator lens to focus light. Another device splits it into colors that are aimed at the various photovoltaic materials. High-energy (short-wavelength) photons are absorbed by one compound semiconductor; mid- and low-energy photons are bounced to other solar materials, such as gallium arsenide and silicon. They figure their device can use as many as six materials, and they can mix and match from among the best or cheapest. No other solar cell design lets engineers swap different materials in and out to balance costs and efficiency, points out Douglas Kirkpatrick, the Darpa manager overseeing the project.

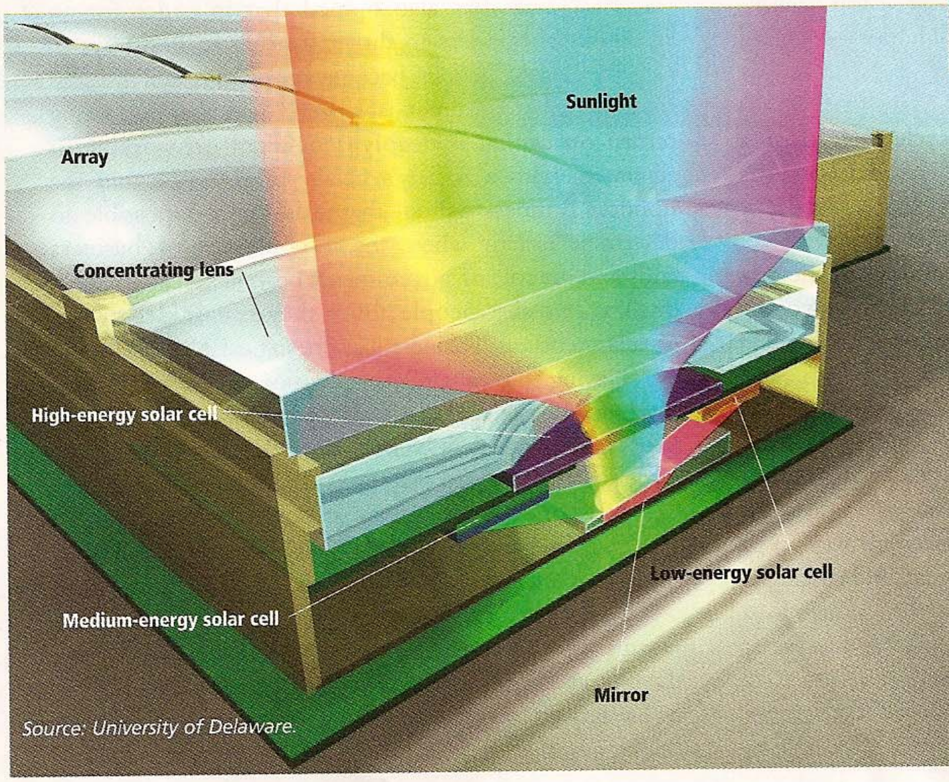
The Delaware lab has built a few dozen experimental solar cells; they can be from 1 to 10 square centimeters. Wiring about three dozen together into a module would be enough to recharge a laptop. Building modules is the agenda for the next six months. Barnett predicts they will be 10 to 20 percentage points more efficient than what's on the market.

Darpa is doubling its funding for the program. With corporate dollars, too, the three-year program will have a $100 million budget. "There's no technological reason why this technology couldn't scale to rooftops," says Kirkpatrick. But first things first: The Pentagon wants solar-powered flashlights and battle gear.

*—Elizabeth Corcoran*

## Splitting Rainbows




Source: University of Delaware.

In a traditional photovoltaic cell (above) the sun's energy knocks electrons away from positive charges called holes. The nature of the semiconductor prevents the two from recombining on the spot—the electrons have to go the long way around, through a circuit that powers a load. University of Delaware's experimental solar cells (left) are far more efficient because they use as many as six photovoltaic materials to generate power. Incoming light is concentrated 20 times and passes through a high-energy-absorbing material (purple) to a mirror that splits and redirects medium (green) and low (red) energy light to other materials.