



**TECHNOLOGY DRIVEN. WARFIGHTER FOCUSED.**

**NSRDEC Project Officer:**

*Flexible Photovoltaics:*

*Mission Power from the Sun*

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## *Travel Lighter, Stay Longer!*

***Problem:*** *Current power sources are heavy, expendable and detectable, not directly integratable into Warrior Systems, and do not have sufficient density for extended missions.*

***Known*** – Photovoltaics (PV) convert “free” light energy into electricity with no noise, moving parts, fuel consumption or pollutant emissions.

***Less known*** – PV technology has changed significantly over recent years... that technology now allows PV's to be flexible and lightweight!



Photo courtesy DOE/NREL



**Today's PV's can provide many benefits to the military.....**

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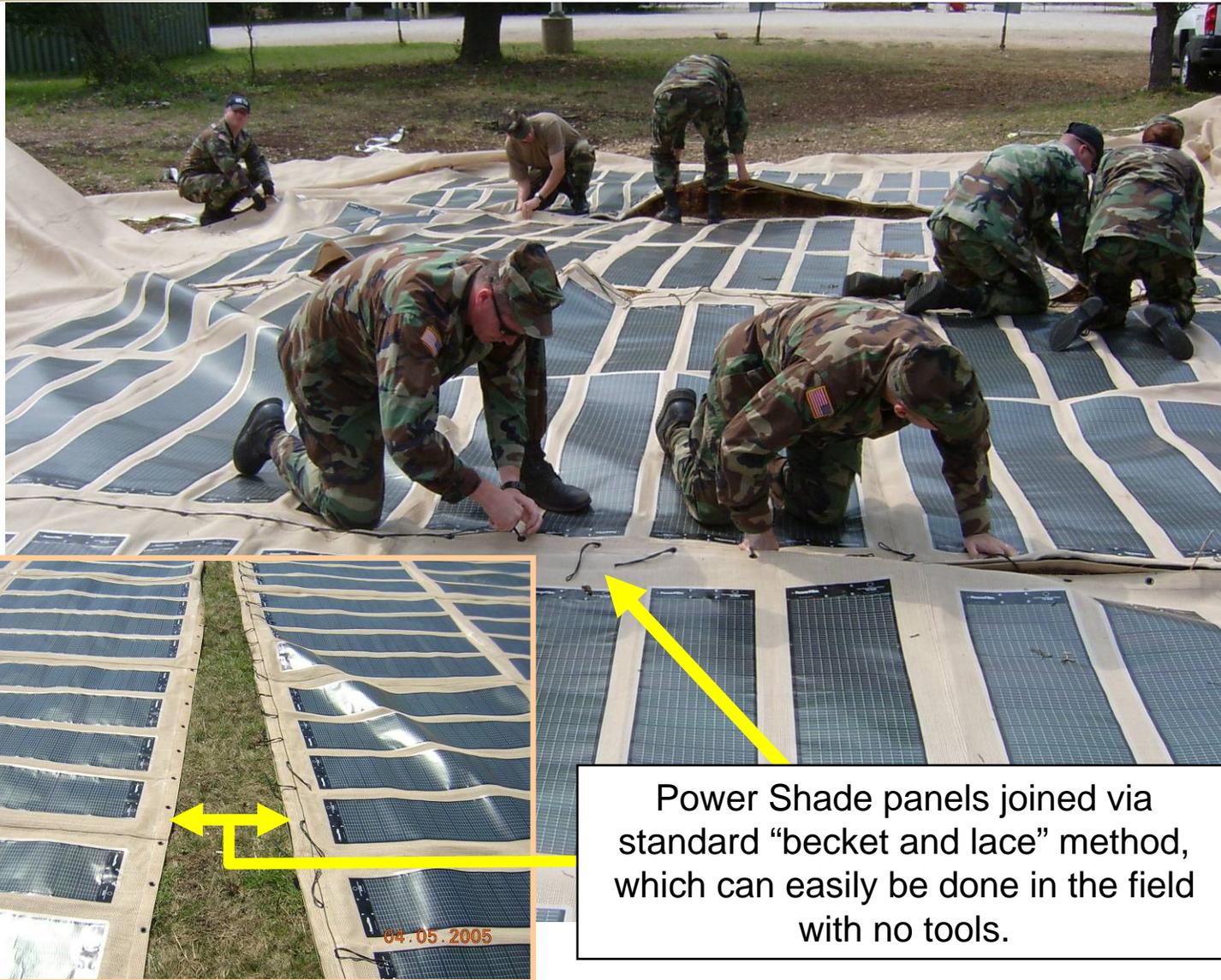
## Application:

- Solar shade w/ integral PV power, reduces solar load 80% – 90%
- Small version provides 1 KW of PV power
  - Designed to fit over: MGPTS small, 16' TEMPER
- Medium version provides 2 KW of PV power
  - Designed to fit over MGPTS medium, 24' TEMPER
- Modular expandability





# Power Shade – Easy field assembly



Power Shade panels joined via standard “becket and lace” method, which can easily be done in the field with no tools.

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*Give them one prior supervised set-up, and 20 minutes later...*



*...these Soldiers are enjoying the reality of shade AND silent electrical power with no logistical fuel tail!*

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**Application:**

- TEMPER PV fly is a “drop-in” replacement for existing tent fly
  - Provides ~750W of power
- QUADrant is ¼ of a TEMPER fly
  - Provides ~ 200W of power
  - Modular expandability, flexible ground or frame mounted use.

TEMPER Fly



QUADrant



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# *TEMPER fly and QUADrant* - Large impact applications



TEMPER tent complexes with large surface areas offer the military an opportunity for real fuel savings and less generator maintenance by replacing the standard TEMPER fly with a PV integrated TEMPER fly, or QUADrant units!

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## Energy collection and storage w/ DC to AC conversion in one unit



**4-man portable unit  
(capacity ~1 KW)**

- Reduction of weight and cube with preference to COTS components
- Modular unit to match PV capability – 2KW PowerShade uses 3 BOS units.
- Simplified hook-up for ease of use with integrated DC Buss for power sharing
- Rugged. Passed testing at Aberdeen Proving Ground (APG) – FY09.

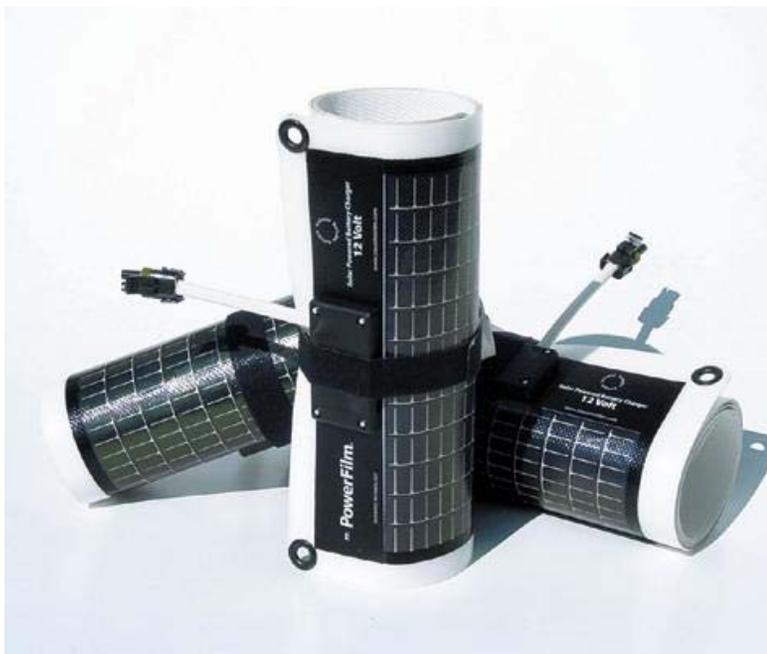


## Portable power in the field

- 5, 10, 20, 30 and 60 watt units
- 12VDC output (24VDC available)
- Easily deployed, just unfold and use!
- Compact and lightweight (6oz for 5w unit)
- Daisy chain units together for higher power

## Application:

- Versatile PV power supply.... Just roll out anywhere for instant power
- Multiple sizes to match the need - .3, .6, and 1.2 Amp units
- Stores in it's own pouch
- Rolls tight.. Rolls to under 5" diameter for even the largest unit
- Roll-able units with Desert tan and Olive drab substrate available



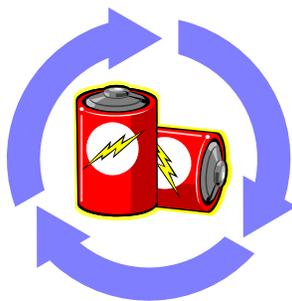
## Technical Specifications:

	Operating Voltage (V)	Operating Current (Amps)	Weight (lbs./kg)	Rolled Dimensions (in./mm)	Unrolled Dimensions (in./mm)
<b>PowerFilm® R15-300</b>	15.4	<b>.3</b>	.6 .29	11.5x4x3.75 292x101x92	11.5 x 21 292 x 531
<b>PowerFilm® R15-600</b>	15.4	<b>.6</b>	1 .46	11.5x4.25x4.25 292x108x108	11.5 x 38 292 x 972
<b>PowerFilm® R15-1200</b>	15.4	<b>1.2</b>	1.9 .88	12x4.25x4.5 305x108x114	12 x 73 305 x 1858

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## Specifications:

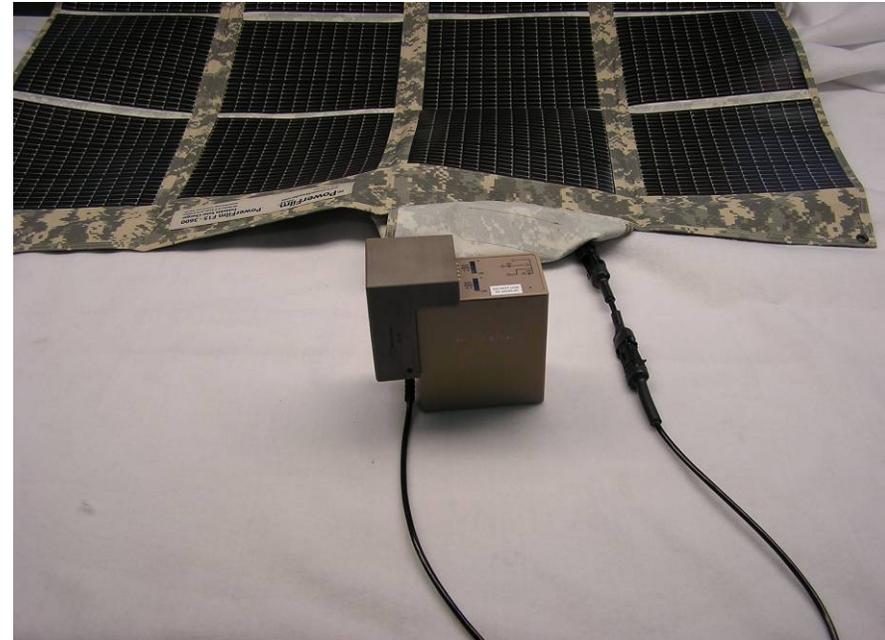
- Capacity:
  - Two (2) or Four (4) AA batteries
  - Charges both NiMH and NiCAD chemistries
- Weight (w/o batteries): ~ 3.4 oz
  - Less than the weight of four (4) AA batteries!
- Approx time to charge
  - Full Sun: ~ 4 hours
  - Partly cloudy: ~ 6 - 8 hours
  - Overcast: ~ 16 hours



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# Flexible PV Charging Solution: BB2590 / BB390 battery charger



- 3rd iteration design shown
  - New smaller package & electronics have >90% charging efficiency!
  - Intuitive design with LED indicator for optimal solar panel orientation
- OFIG field evaluation completed in FY09.

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- Questions?
- Comments?
- Suggestions?

Soldier input always welcome!