



**ADVANCED ENERGY TECHNOLOGIES**

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**PALM POWER TEAMING WORKSHOP  
Ft. Lauderdale, FL  
14, 15 November 2000**

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**The purpose of this workshop is to:**

- **Acquaint the R&D community with DoD power source deficiencies and future needs**
- **Provide a forum for discussion of emerging technologies to meet those needs**
- **Provide an opportunity for the diverse R&D community to form teams to respond to DARPA Palm Power program initiatives**

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## **Brief Overviews**

- **Military Customers**
- **Novel New Platforms**
- **DARPA Synergistic R&D**

## **Poster Summaries (Three, That's "3," Minutes!)**

## **Poster Sessions**

## **SOA Technology Demonstrations**

## **Informal Discussions During Breaks & Meals**



## Workshop Logistics



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Errata Book at Registration Table

Teaming Website  
(See DARPA/DSO Solicitation Link)

DARPA Contract Representative  
Tom Lyon

Conference Dinner Tonight

Poster Presenters Should Be at Their Posters  
During the Assigned Session

Poster Security

Restrooms, Phones, Meal Locations



**ADVANCED ENERGY TECHNOLOGIES**

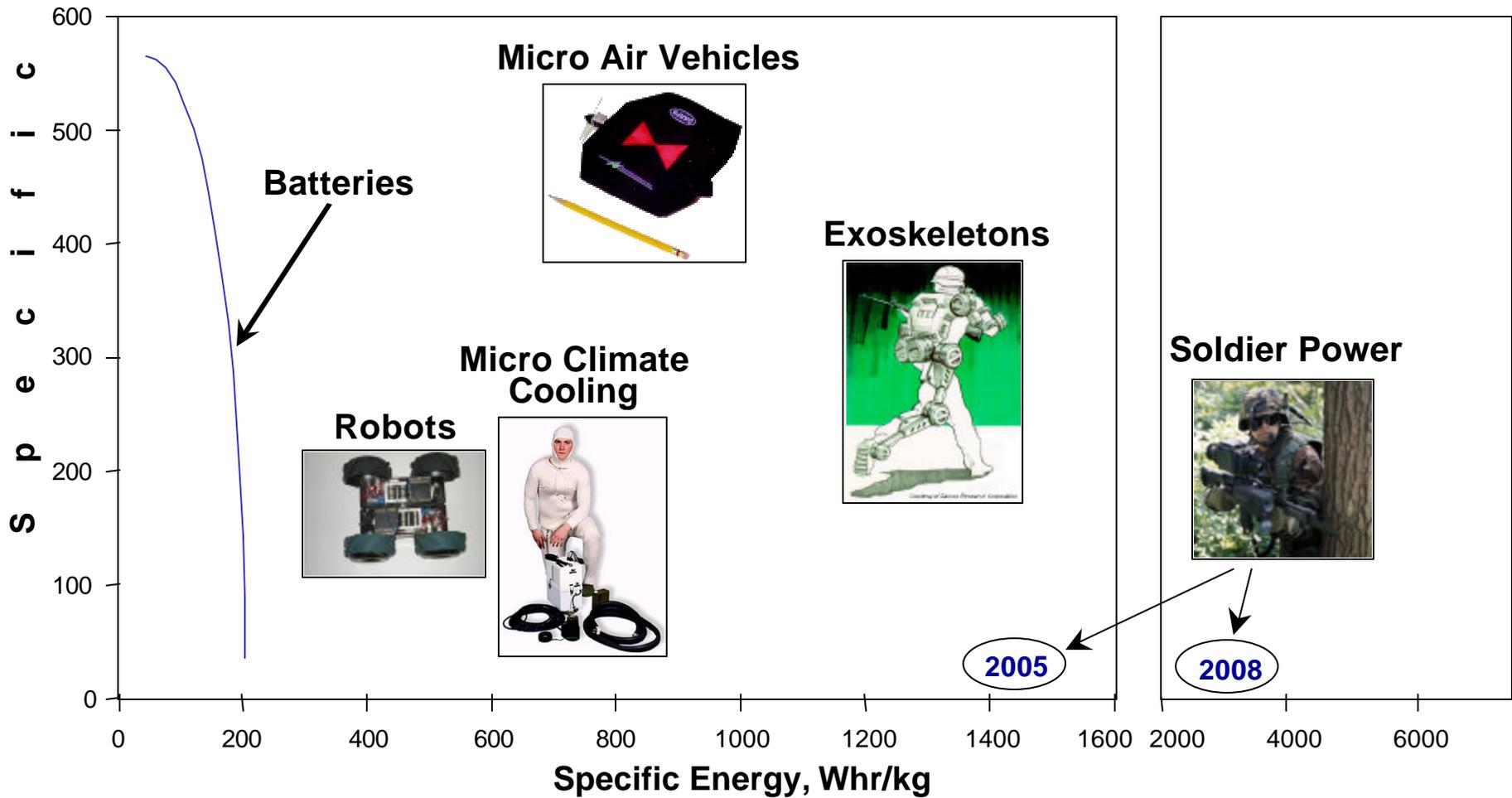
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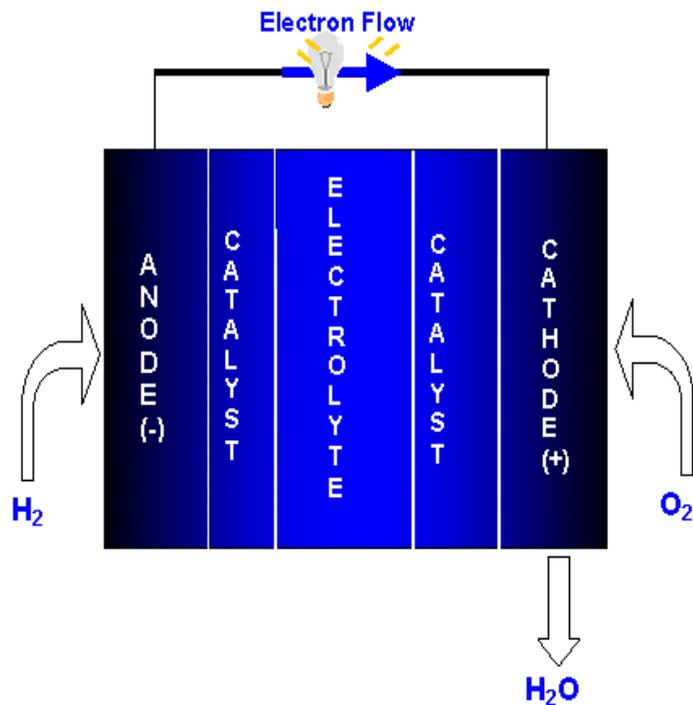
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# Performance Shortfall For Today's Power Sources



## Electrochemical $\epsilon \sim 100\%$ (Theoretical)

- Fuel Cells (PEM, Alkaline, PAFC, MCFC, SOFC; 20-1000°C)



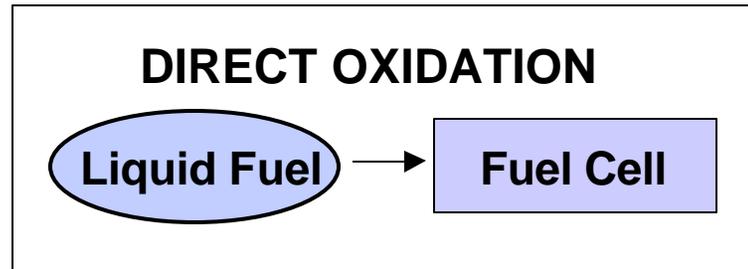
## Heat Engines $\epsilon = [(1 - T_L/T_H) * 100]\%$

### *Dynamic Systems*

- Pistons, etc.
- Turbines
- Stirling

### *Static Systems*

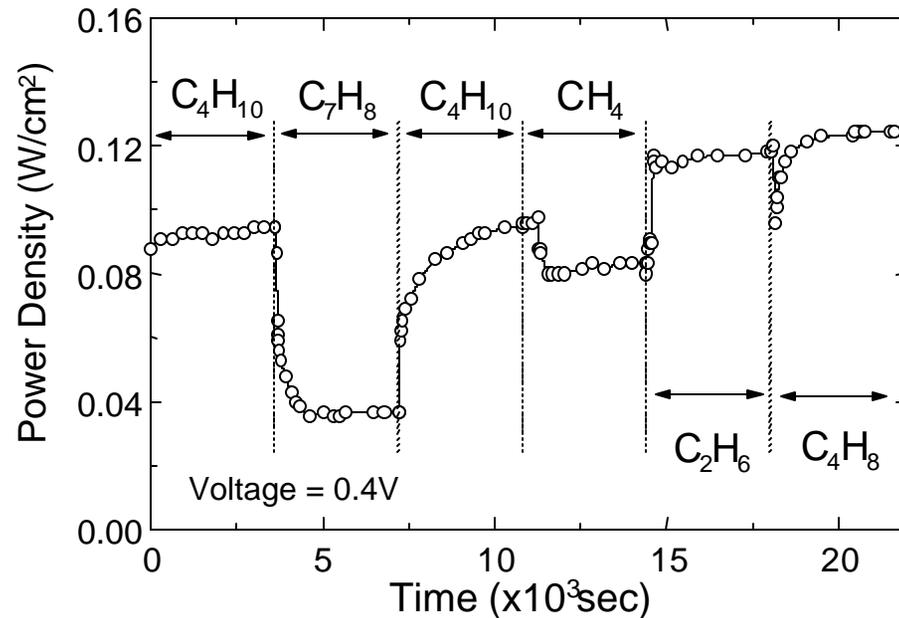
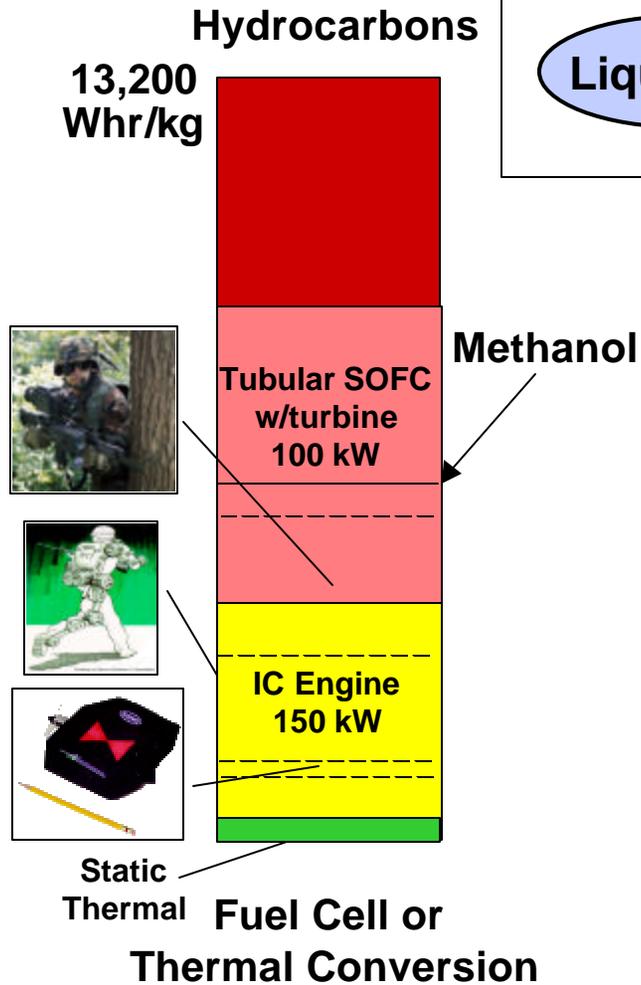
- Thermoelectrics
- Thermionics
- Alkali Metal Thermal to Electric Conversion
- Thermophotovoltaics



**CHALLENGES**

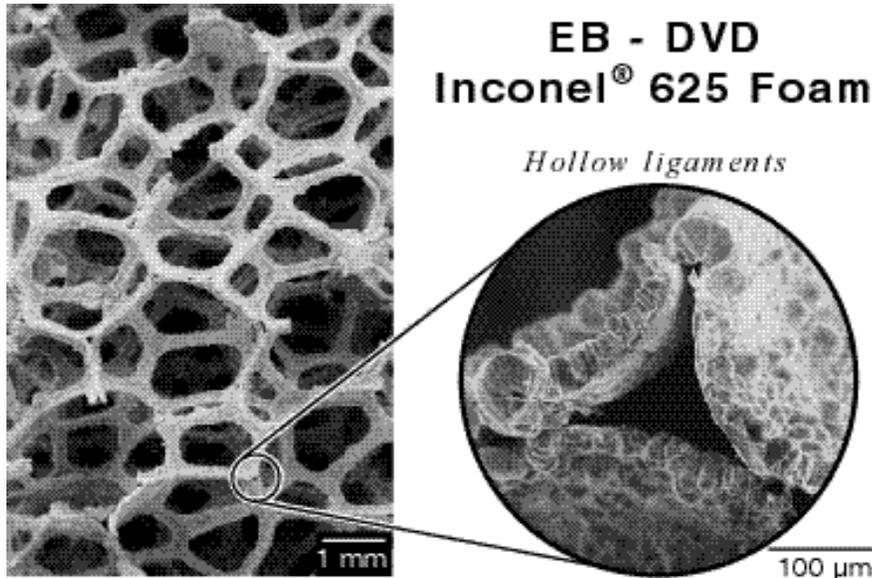
- Increase Performance  
    → Catalysts
- Thermal Management
- Liquid Fuels, JP- 8

Recent work:



S. Park, J. M. Vohs, and R. J. Gorte, Nature, 404 (2000) 265.

## Superthermal Conductors and Heat Exchangers



## Aerogel Insulators



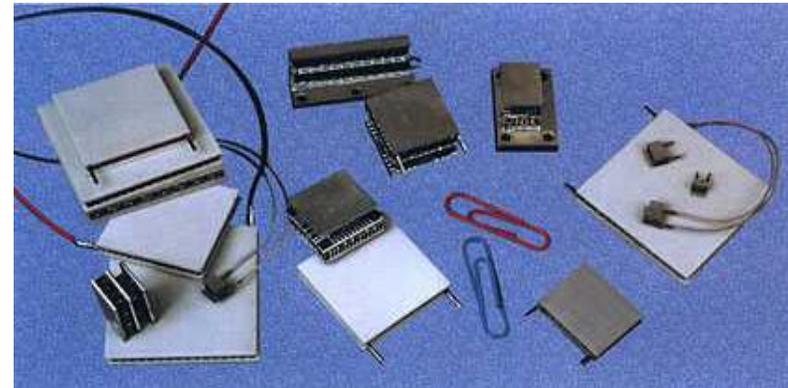
$K_{\text{solid}}$  **Aerogel = 0.002 W/mK @ 300K**  
 $K_{\text{solid}}$  **Silica = 1.4 W/mK @ 300K**

## Cascading Systems

- ▼ Thermally integrate multiple technologies
  - ◆ Design
  - ◆ Fabrication



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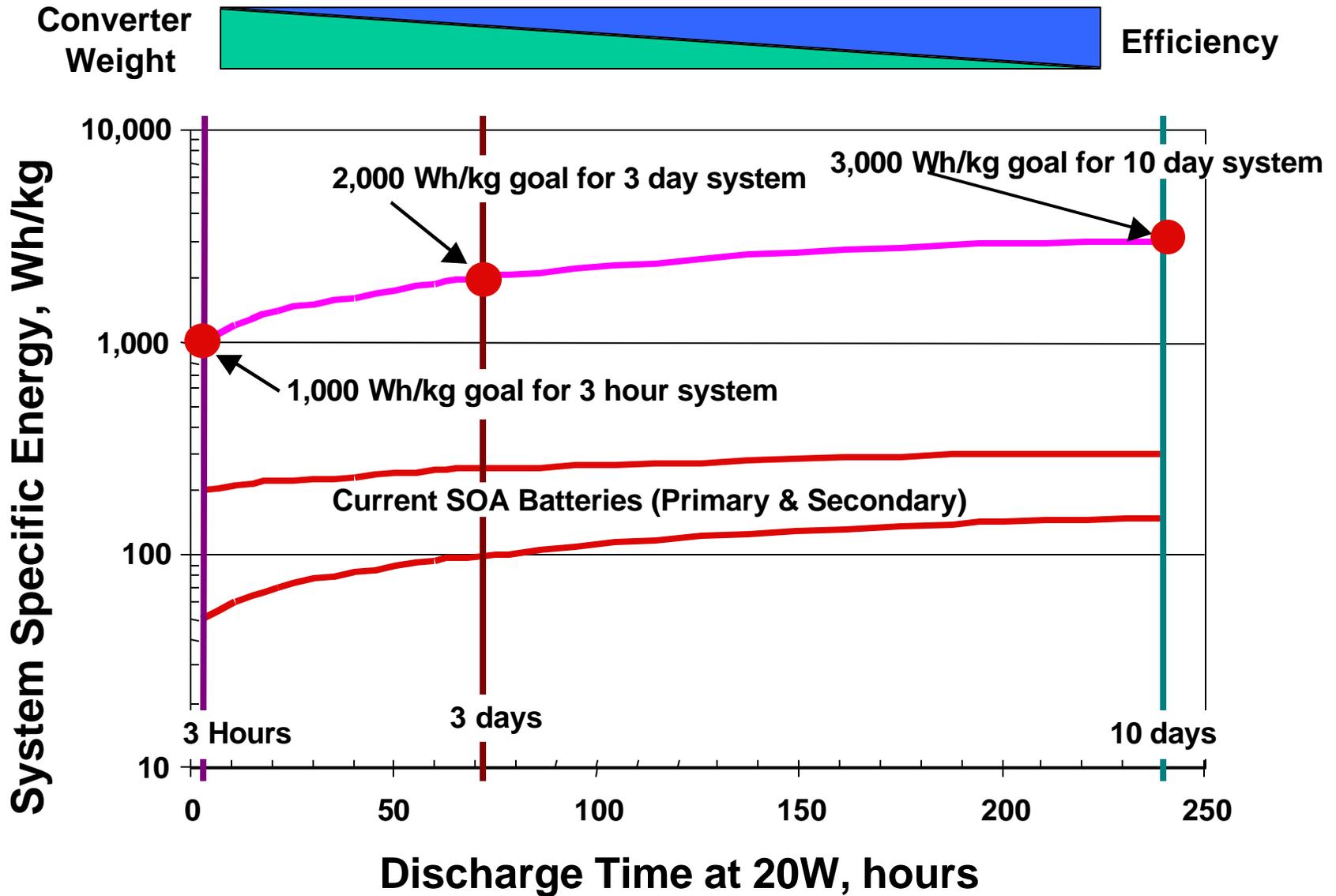
**SOLID OXIDE FUEL CELL**  
1000 - 650 C

**THERMOELECTRICS**  
1000 - 100 C

*Integrated Efficiency >> S Individual Efficiencies*

**PALM  
POWER**

The logo consists of the words "PALM" and "POWER" stacked vertically in a bold, yellow, sans-serif font with a blue glow. The letter "A" in "PALM" is stylized as a lightning bolt that extends downwards and to the left, passing through a blue globe with a white lightning bolt on its surface. The globe is positioned between the "A" of "PALM" and the "O" of "POWER".





# Palm Power Program Attributes



- **1 – 3 Year Proposals Accepted in Initial Phase**
- **5 Year Overall Program**
- **Technology Development Program Leading to Integrated Systems for Field Testing**

***“Build It and They Will Come”***

- **Nominal 20 Watts Average Power**  
**Many Military and Commercial Applications**  
**Easier to Scale Up than Down – “DARPA Hard”**



# Palm Power Program Attributes



- **No Technology Preferences...but Materials, Components, And Systems Must Address Program Goals and Be Compatible With Military Environment**
- **Different Technologies for Different Missions?**
- **Fuel Preferences – Easily Handled, Safe, JP8 Ideal but Other High Energy Content Fuels Will Be Considered**
- **Teaming Encouraged but Not Required**
- **Bottom Line – IMPACT on the Military**



# Notional Program & BAA Schedule



**5 YEARS/~\$70M**

**NOVEMBER 30, 2000**

**CBD Announcement**

~~**DECEMBER 21, 2000**~~

~~**Optional Abstracts Due**~~

~~**JANUARY 5, 2001**~~

~~**Abstract Feedback**~~

**FEBRUARY 1, 2001**

**Full Proposals Due,  
BAA Closed**



# Palm Power Program

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*“The Rules of Engagement”*

Tom Lyon, DARPA/CMO



# THANKS!



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**Strategic Analysis Staff –  
Leanne Wiegand  
Barb Smith  
Alice Burgess**

**DARPA PMs**

**Tom Lyon, DARPA Contracts**

**ONR, ARO, Sandia, Natick**

**Military Organizations**

**Jay Stedman, Dick Paur**



**THANKS!**



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**...and YOU!**