An Energy-Efficiency Workshop and Exposition

Orlando, Florida

Past, Present and Future of DoD Stationary Fuel Cell Programs

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ERDC / CERL

Real-World Solutions for a Secure Future

Wednesday, August 20

DoD Stationary Programs

- Phosphoric Acid Fuel Cell (PAFC) Demonstration Program
- Residential Proton Exchange Membrane (PEM) Fuel Cell Demonstration Program
- Microturbine Demonstration Program

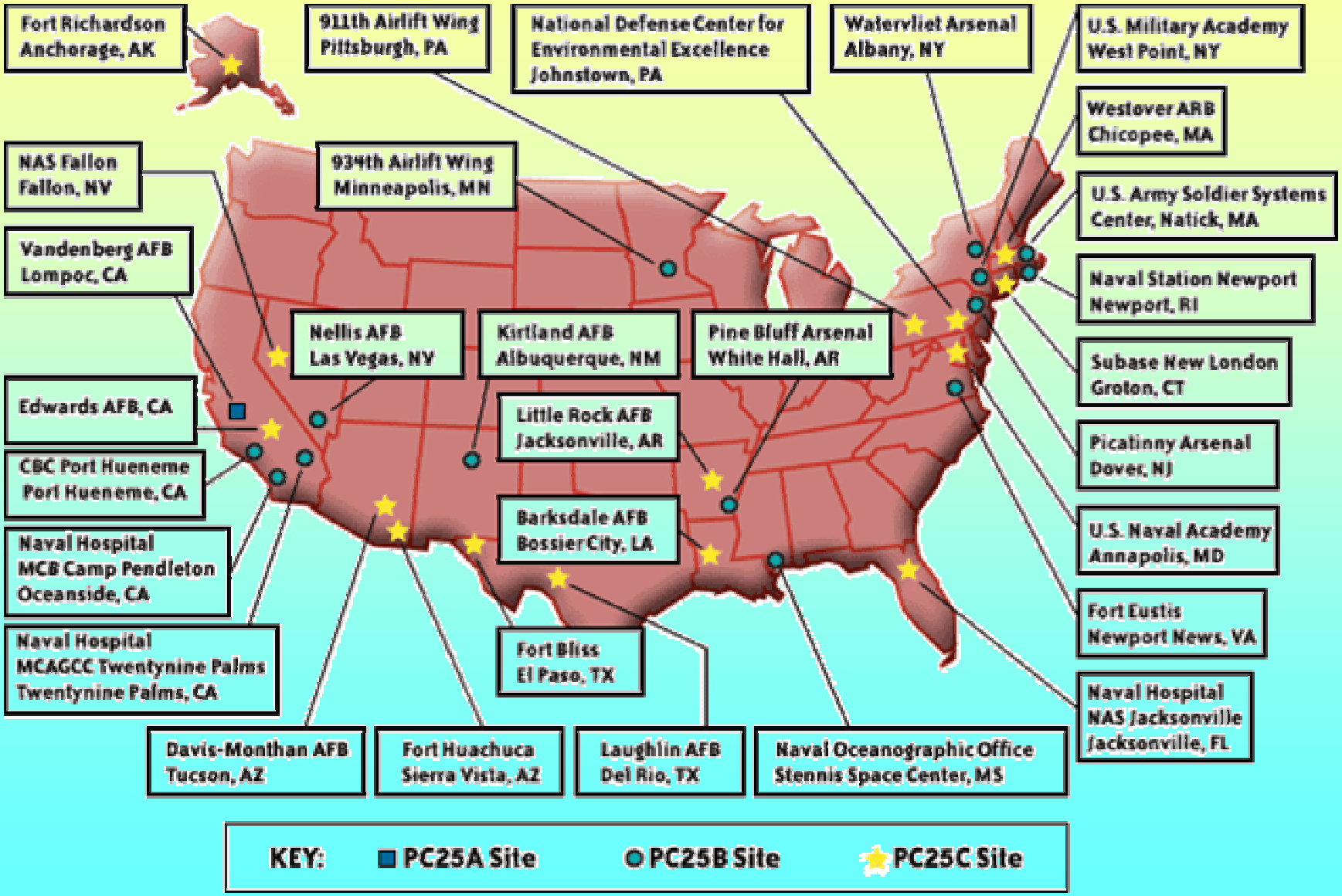
Energy Security

- **The DoD Energy Infrastructure Is Both Large and Centralized, Making It Very Difficult to Protect From Attacks, Accidents, or Natural Disasters.**
- **Distributed Generation (DG), Such As Fuel Cells and Microturbines, Can Improve Both Security and Reliability of Power Delivery.**
- **DG Technology Also Can Employ Newer, Cleaner Fuels That Can Be Produced Domestically.**
- **These Technologies Can Be Applied for Uses From Back up Power to Combined Heat and Power (CHP), to a Variety of Niche Applications.**

PAFC Demonstration Program Objectives

- Demonstrate Fuel Cell Capabilities in Real World Situations
- Stimulate Growth and Economies of Scale in the Fuel Cell Industry
- Determine the Role of Fuel Cells in DoD's Long Term Energy Strategy

DoD PAFC Sites



PAFC Facility Applications

- **Central Heat Plants**
  11 Sites

- **Hospital Utility Plants**
  7 Sites

- **Pool / Gymnasiums**
  3 Sites

- **Others**
  Barracks, Dining Facility, Laundry, NG Armory, Launch Control Bldg., Office, Evaporator process

PC25B Installed at Picatinny Arsenal, NJ

PAFC Fleet Performance Summary

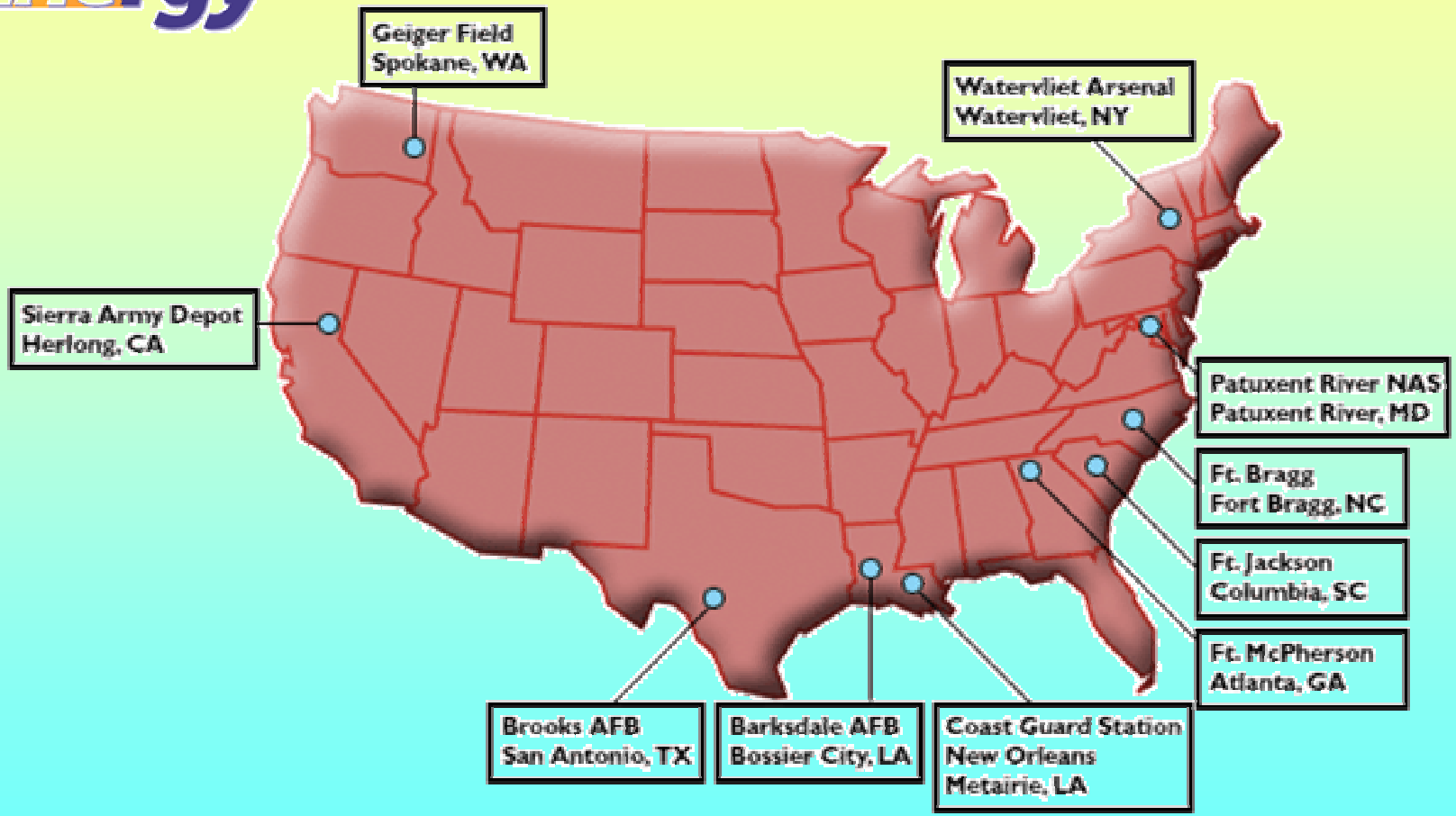
(29 Power Plants)
As of 30 June 2003

• **Total Run Time**		**869,334 hrs**
• **Availability**		
• **Model B Fleet**	**57%**	
• **Model C Fleet**	**77%**	
• **Energy $ Saved**		**$5,917,008**
• **NOx Abated**		**278.0 tons**
• **SOx Abated**		**589 tons**
• **CO Abated**		**24.0 tons**

"PEM" Program Requirements / Broad Agency Announcement (BAA)

- **"Domestically Produced" PEM Units, 1 kW to 20 kW**
- **US Military Facilities/Embassies, etc.**
- **Turn-key Packages Requested**
- **Maximum Diversity Desired**
- **1 Year of "Fuel Cell Power" Required**
  - **(Minimum 90% Availability)**

FY01 Residential PEMFC Program Sites



FY01 Residential PEMFC Demonstration Program

Site Name	Building Application	Fuel Cell Manufacturer	Input Fuel	Size (kW)	No. Units	Cogen. Y/N
Sierra Army Depot	Barracks	H Power	Propane	4.5	1	Yes
Brooks AFB	Base Housing	Plug Power	Natural Gas	5	3	No
Ft. Bragg	Office Building	Plug Power	Natural Gas	5	1	No
Ft. Jackson	Officer's Quarters	Plug Power	Natural Gas	5	1	Yes
Barksdale AFB	Base Housing	Plug Power	Natural Gas	5	1	No
Ft. McPherson	Base Housing	Plug Power	Natural Gas	5	1	Yes
Coast Guard Station, New Orleans	Administration & Operation Building	Plug Power	Natural Gas	5	1	Yes
Patuxent River NAS	Office Building	H Power	Propane	4.5	1	Yes
Patuxent River NAS	Officer's Quarters	H Power	Natural Gas	4.5	1	Yes
Geiger Field	Maintenance Fac.	Avista Labs	Hydrogen	3	1	No
Watervliet Arsenal	Research Facility	Plug Power	Natural Gas	5	3	No
Watervliet Arsenal	Manufacturing Fac.	Plug Power	Natural Gas	5	3	No
Watervliet Arsenal	Officer's Quarters	Plug Power	Natural Gas	5	4	No

FY02 Residential PEMFC Demonstration Program

Site Name	Building Application	Fuel Cell Manufacturer	Input Fuel	Size (kW)	No. Units	Cogen. Y/N
Saratoga Springs NSU	Base Housing	Plug Power	Natural Gas	5	8	Yes
West Point Military Academy	Officer's Quarters	Plug Power	Natural Gas	5	3	Yes
USCG Aids to Navigation Team	Maintenance Facility	Nuvera	Natural Gas	5	2	No
Selfridge Air National Guard Base	Fire Station	Plug Power	Natural Gas	5	2	Yes
Robins AFB	Fire Station	Plug Power	Natural Gas	5	1	Yes
North Carolina Agricultural & Tech (NCA&T)	Reserve Officer Training Corps (ROTC) Facility	Plug Power	Natural Gas	5	1	Yes
Shaw AFB	Base Housing	Plug Power	Natural Gas	5	1	Yes
McChord AFB	FAA Radio Transmitter	Avista Labs	Hydrogen	0.5	6	No

PEMFCs Installed at Brooks AFB

Brooks AFB PEMFC Performance Summary

Base Housing (3 units)
February 3, 2003 – June 30, 2003

System No.	Total Run Hours	Total Hours	Availability (%)	Capacity Factor (%)	Total Energy Produced (kWe-hrs AC)	Average Output (kW)	Electrical Efficiency (%)
Tess	3231	3469	93.1%	49.0%	7912	2.45	22.8%
Joe	2694	3469	77.7%	49.7%	6692	2.48	16.8%
Mariah	2943	3469	84.8%	47.2%	6950	2.36	17.0%

PEMFCs Installed at Watervliet Arsenal

2003 Winner DOE Federal Energy Saver Showcase Award

Watervliet Arsenal PEMFC Program Highlights

- 10 Plug Power Units - 5kW PEMFC
  - 93.7% Total Availability
  - > 83,000 Run Hours
  - > 214,500kW-hrs
- System B103
  - 100% Availability Final 4.5 Months
  - 98.8% Availability Final 11.5 Months
- System B98
  - 6742 Cell Stack Run Hours
- System B104
  - 7056 Cell Stack Run Hours

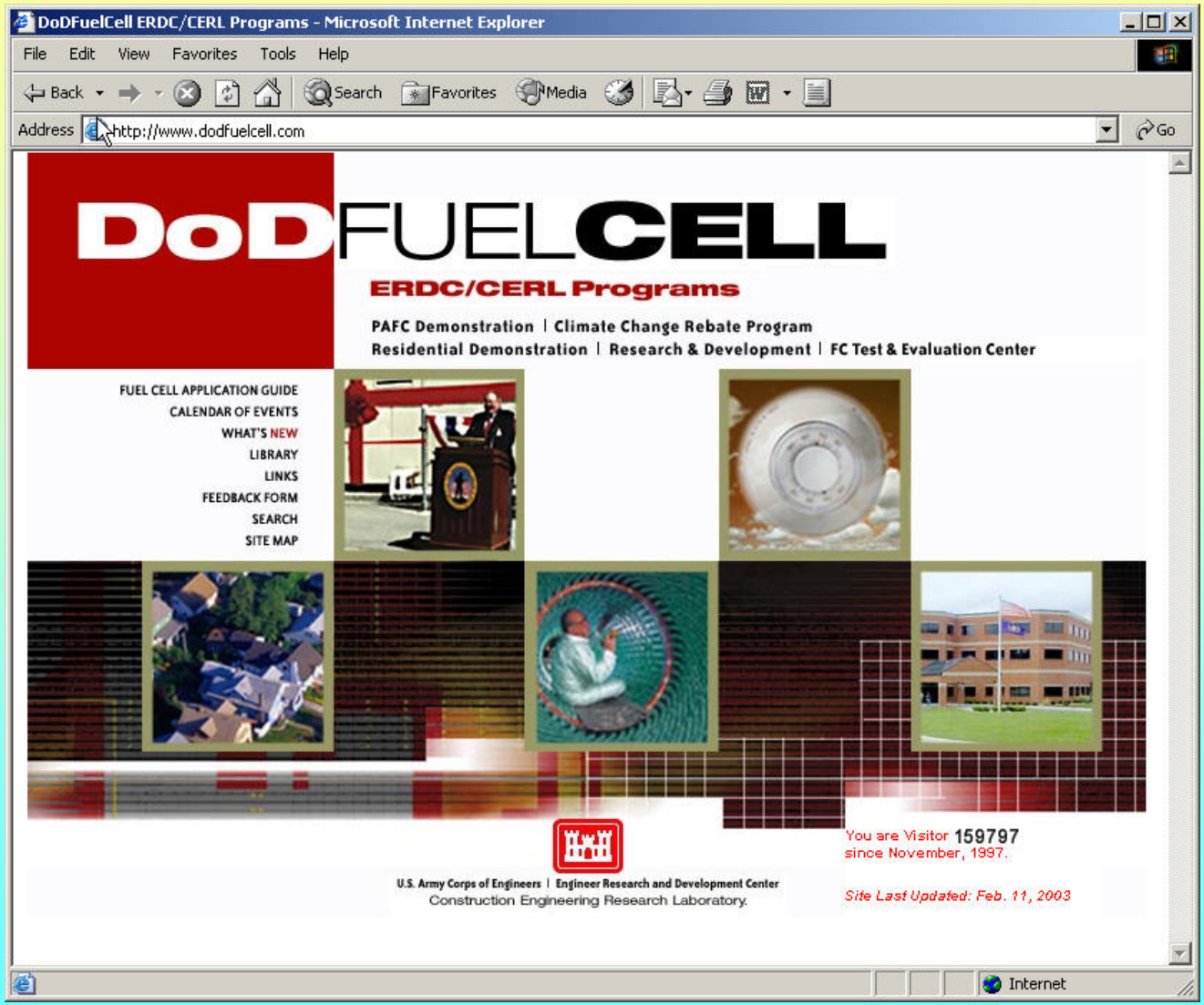
ERDC/CERL Microturbine Demonstrations -- Field Demo Plans

- All Field units to be installed 2002-2003
- Bench testing at UC-Irvine prior to installation
- Monitoring
  - Fort Drum unit monitored by DOE PNNL
  - One year of field monitoring
- Report / Document

ERDC/CERL Microturbine Demonstrations -- Application Matrix

Site	kW	Dual Mode	CHP	Comments
CERL Champaign,IL	30	√	-	Installed, commissioning complete, interconnect pending
Barracks Bldg Fort Drum, NY	30	√	√	PNNL/FEMP project. Installed & Operating
Office Bldg, Presidio of Monterey, CA	30	√	√	Backup power bldg & computer server
Swimming Pool, Port Hueneme, CA	60	-	√	
Hospital Heidelberg, Germany	60	-	√	Expected hardware delivery in Dec 2002
Maintenance Bldg, Fort Bragg, NC	30	√	-	Same bldg site as PEM fuel cell. Possible connect to remote dispatch

www.dodfuelcell.com



- **Updated data on each demonstration program.**
- **Links and Photos pertaining to individual projects**