



# The Defense Logistics Agency



## DLA's H<sub>2</sub> Demonstration Project at Defense Depot Susquehanna, PA - *Lessons Learned* -

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# DLA's Hydrogen and Fuel Cell Program: MHE Pilots



## DLA Goals:

- Be an early adopter and principal demonstrator
- Foster competition in the marketplace and provide a market demand
- Support improved Technology and Manufacturing Readiness Levels
  - Exercise the supply chain
  - Test under real world conditions
  - Provide feedback to manufacturers
- Highlight the business case for fuel cells

Improve fuel cell readiness by funding R&D efforts in areas that are near commercialization



# DLA's Hydrogen and Fuel Cell Program



## *4 Fuel cell forklift demonstration projects*

### Approach:

- Pilot multiple H<sub>2</sub> generation, dispensing and fuel cell technologies to power Material Handling Equipment (MHE) in warehouse operations
- Analyze operational data to establish an operational business case

### Collaborators:

3 Leading Fuel Cell Mfg, 2 Leading Hydrogen Mfg, DLA/DOE/NSWC Crane/NREL with multiple Prime Contractors

### Funding (Congressional):

FY07: \$10M

FY08: \$13M

FY09: \$8M (Projected)

### Locations:

**DDSP:** 40 forklifts, delivered (cryogenic) H<sub>2</sub>, indoor dispensing

**DDWG:** 20 forklifts, onsite natural gas reformation for H<sub>2</sub>, mobile refueling

**DDJC:** 20 forklifts, electrolysis for H<sub>2</sub>, Power Purchase Agreement (Solar)

**Ft. Lewis:** 19 forklifts, 1 bus, wastewater digester gas H<sub>2</sub>, mobile refueling

Duration: 2 years each

Business case analysis based on performance and cost data collect by NREL



# Lessons Learned: Project Development



- **Work closely with host activities to identify, define & understand project goals/objectives**
  - Identify realistic technology/manufacturing goals/targets/expectations
  - Define program deliverable requirements
  - Generate MOA with participants to establish and document responsibilities
- **Allow program objectives to drive procurement strategy**
  - BAA/PCA/RFI/RFP
- **Track and implement improvements made along the way in future development**
- **Identify technical team as early as possible for the selection process**





# Lessons Learned: Contracting Phase



- Clearly identify all requirements/objectives/selection criteria within solicitation material
- Allow ample time for proposal submittal
  - 45-60 days minimum recommended
- Provide site visits and open Q&A opportunities
  - One or more site visits
- Review and award contracts to solicitation requirements
  - Provide step by step review instructions



**Be patient: the contract award process takes time!**



# Lessons Learned: Permitting & Site Approval Process



- Again, Be Patient
  - Lack of detailed codes/regulations slows approval process for state/Federal/site permitting
- Share Lessons Learned
  - Share permitting process with DOD activities considering hydrogen pilot programs
  - Share permitting process with commercial sector generating codes and standards







# Hydrogen Power at DDSP



- DDSP's Operations:
  - New Cumberland, PA
  - Move 770,542 NSNs worth \$9.0B
  - H<sub>2</sub> operations in 1.7 mil sq ft. warehouse
  - 1200 various types of MHE



- Anticipated advantages of fuel cell powered operations:
  - Longer operations at full power (constant voltage)
  - Time savings on battery management vs. fueling
  - Reduced hazmat handling concerns



# Hydrogen Power at DDSP



- **Ribbon Cutting – February 10<sup>th</sup>, 2009**

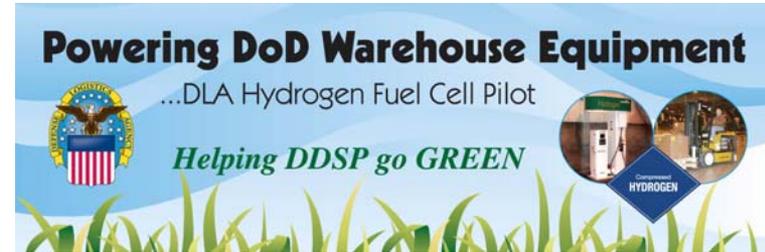
- Features:

- 40 fuel cell MHE integrated in fleet
- Dual indoor dispensing system
- Outdoor storage and compression for delivered liquid H<sub>2</sub>

- Funding: \$5.3M

- Performers:

- Air Products - infrastructure and integration
- Plug Power (20 new units)
- East Penn/Nuvera (20 retrofit units)



First two months:  
1474 kg

2205 Transactions

One of the largest  
uses of H<sub>2</sub> for fuel  
cells in the US!



# Lessons Learned: Develop Buy-In



- Socialize early
  - Bring the right people to listen and talk
    - Share experiences with follow-on sites
  - Involve all the right parties early
    - Command
    - Union representation
    - Users
    - Fire Department – work closely, get them involved, educate them especially when H<sub>2</sub> is new
    - Physical security
    - Public affairs/legal



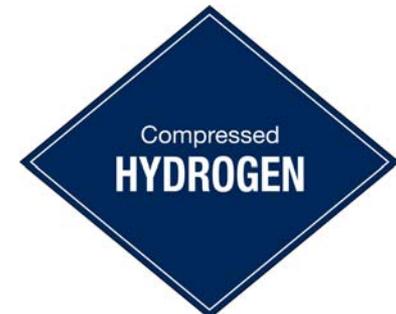


# Lessons Learned: Develop Buy-In



## Socialize safety – Instill confidence!

- Dispel “Hindenburg” misperceptions
- Hand out brochures
  - Highlight benefits but recognize safety concerns
- Hold regular meetings to keep people in the loop as implementation progresses
- Focus on system safety features
- Provide awareness training for all employees
- Heavily promote response procedures





# Lessons Learned: Site Prep



- Permitting
  - Introduce contractor and safety/environmental staff early
  - Environmental impact reviews were easy because contractor was experienced
- Coordinate and test alarm system operations (early!)
- Set fuel cell factory settings (voltage limits) to match user requirements
- For retrofits, carefully select equipment and uses
  - Some vehicles are harder than others to retrofit





# Lessons Learned: Operations Support



- Working with contractors
  - Response time on repairs has to be fast
  - One single point of contact to maintain control (particularly important working with gov't and multiple contractors)
  - Use local contractors when possible
  - No accidents is key to maintaining confidence





# Lessons Learned: Training



- Training
  - Content specific to those being trained
  - Training needs to fit group size
    - Break into small groups when hands on is needed
  - Complicated by having more than 1 fuel cell type
- Physical aspects of fuel cells
  - Getting used to refueling
  - Running out of fuel because users are used to battery slowing down





# Lessons Learned: Operations



## • Infrastructure

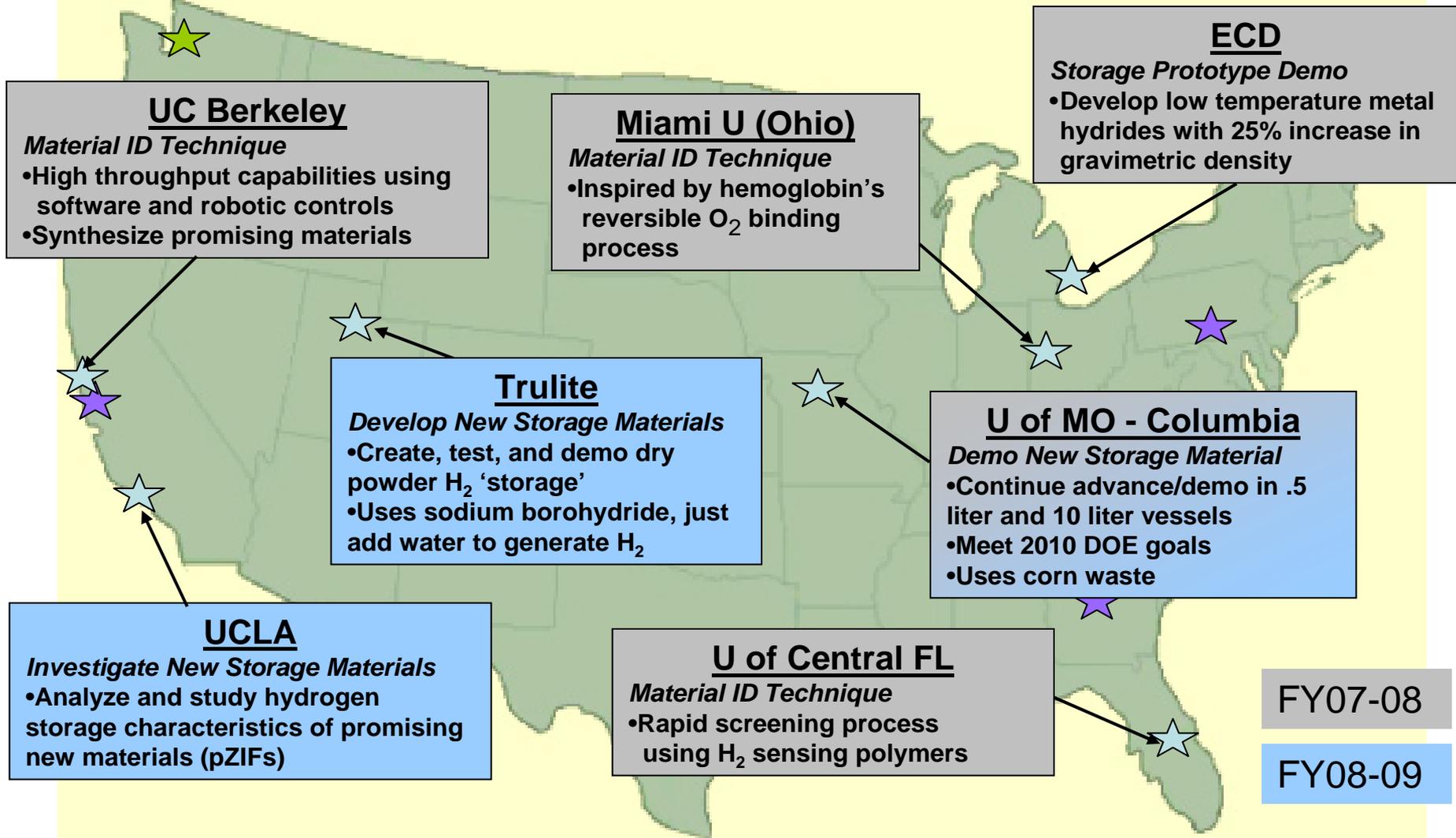
- Limited early startup
  - Break in equipment and the people
- Two dispensers; mobile refueler as backup
  - Indispensable! Critical for startup because break-in ran in to more issues than anticipated; must maintain productivity and buy-in
- Recommend getting infrastructure up as soon as possible – lots of unanticipated bugs
- Indoor dispensing is key (buy-in, utilization)







# Other DLA Initiatives: Solid H<sub>2</sub> Storage R&D





# Hydrogen and Fuel Cell Program: Future Planning



## Spiral Development

- H<sub>2</sub> fuel cell stock selectors at DDWG
- Expand the technical requirements and/or capacity of ongoing DLA demonstration projects
- Focus on improving value proposition and 'green' hydrogen production

## Solid Hydrogen Storage

- Continue teaming with DOE and other military Services for early stage R&D

## Extended Range Utility Vehicle

- Phase I: Design novel H<sub>2</sub> storage to extend range of fuel cell utility
- Phase II: Construct and integrate the technology at DDWG

## Low cost/green H<sub>2</sub> production, storage, and delivery



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