



The Defense Logistics Agency



DLA's H₂ 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 H₂ 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) H₂, indoor dispensing

DDWG: 20 forklifts, onsite natural gas reformation for H₂, mobile refueling

DDJC: 20 forklifts, electrolysis for H₂, Power Purchase Agreement (Solar)

Ft. Lewis: 19 forklifts, 1 bus, wastewater digester gas H₂, 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
 - H₂ 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 10th, 2009**

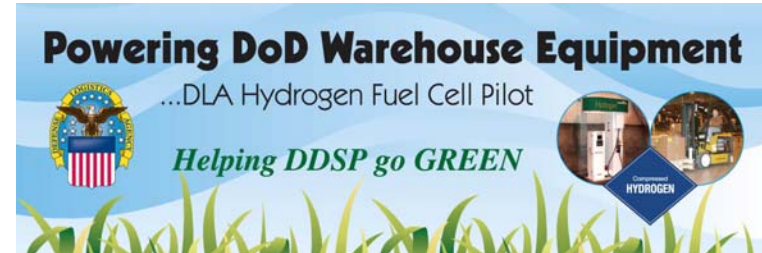
- **Features:**

- 40 fuel cell MHE integrated in fleet
- Dual indoor dispensing system
- Outdoor storage and compression for delivered liquid H₂

- **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 H₂ 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 H₂ 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



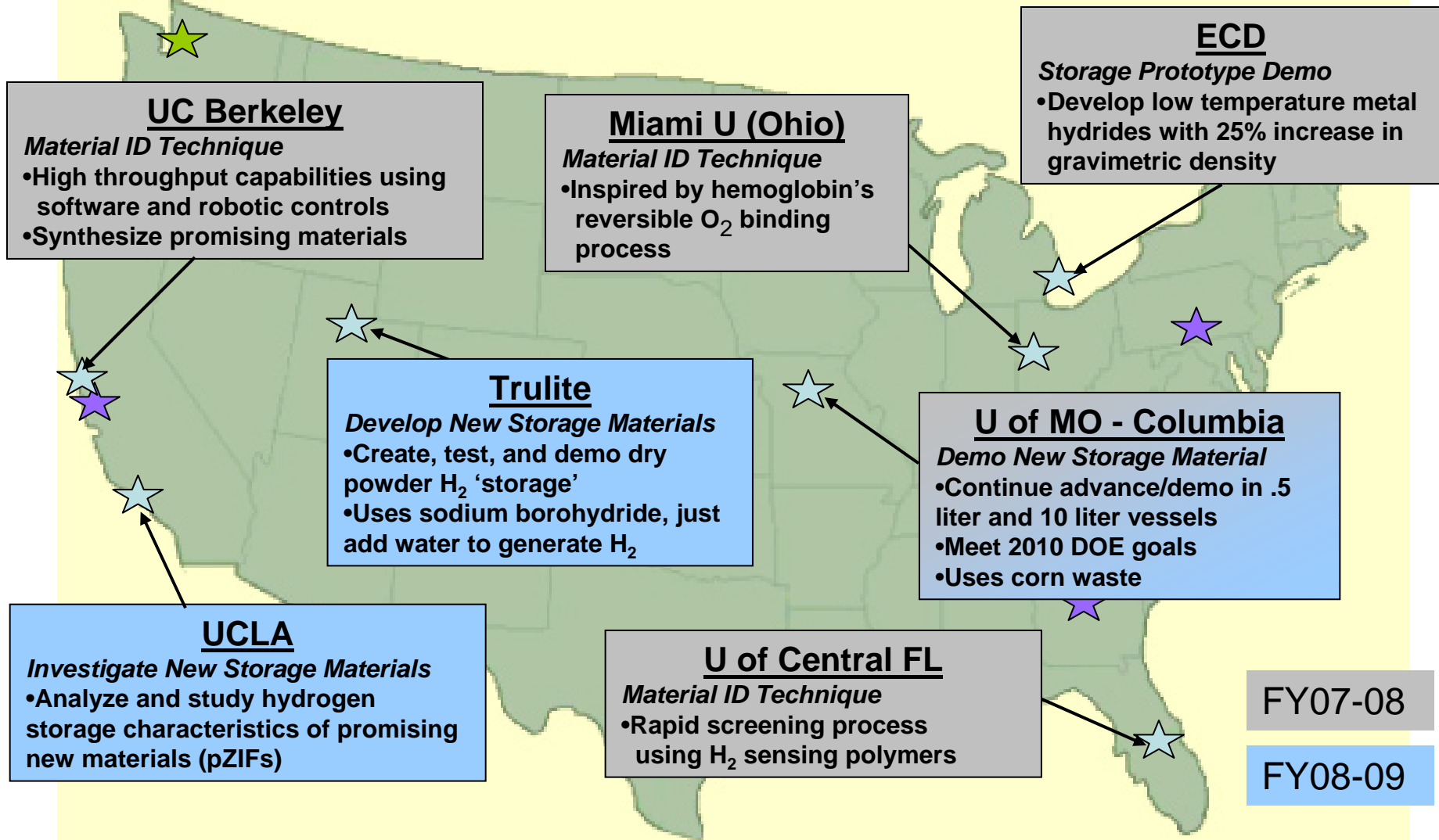
- Infrastructure
 - Limited early startup
 - Break in equipment and the people
 - Two dispensers; mobile refueler as backup
 - Indispensable! Critical for startup because break-in ran in to more issues than anticipated; must maintain productivity and buy-in
 - Recommend getting infrastructure up as soon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







Other DLA Initiatives: Solid H₂ Storage R&D





Hydrogen and Fuel Cell Program: Future Planning



Spiral Development

- H₂ 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 H₂ storage to extend range of fuel cell utility
- Phase II: Construct and integrate the technology at DDWG

Low cost/green H₂ production, storage, and delivery



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