

DEFENSE LOGISTICS AGENCY

DLA's H₂ and Fuel Cell MHE Demonstration Program - *Lessons Learned* -

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★
Warfighter
Support Enhancements

★
Stewardship
Excellence

★
Workforce
Development



DLA's Hydrogen and Fuel Cell Program: MHE Pilots

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: \$18M

FY09: \$8M

FY10: ??

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)

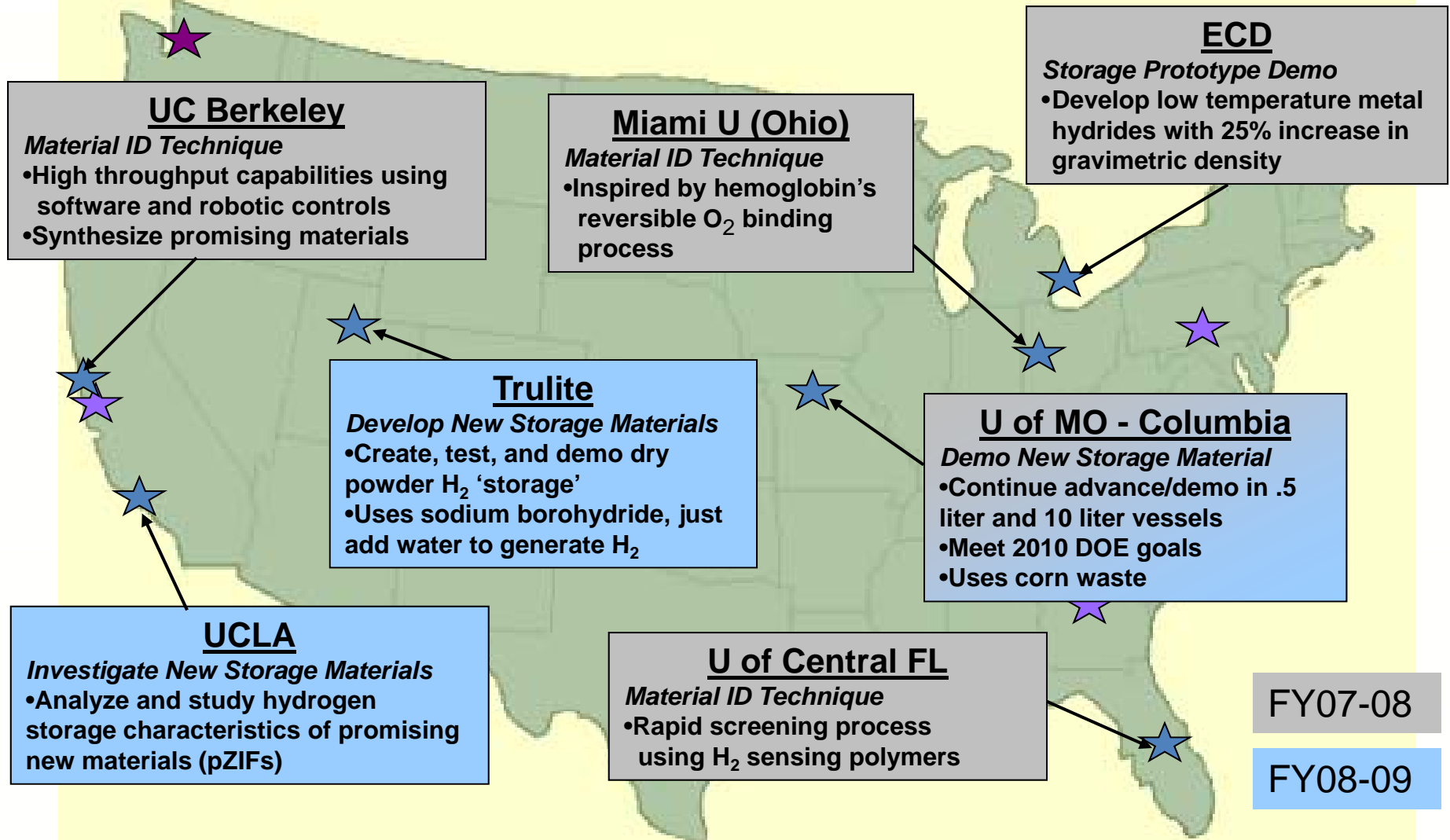
Ft. Lewis: 19 forklifts, 1 bus, wastewater digester gas H₂, mobile refueling

Duration: 2 years each

Business case analysis: Performance/cost data collected by NREL & LMI



Other DLA Initiatives: Solid H₂ Storage R&D





Hydrogen and Fuel Cell Program: Future Considerations

Spiral Development

- H₂ fuel cell stock selectors/'yard dogs' 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 /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



- Some Lessons Learned -





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/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





Lessons Learned: Site Prep

- Permitting
 - Introduce contractor and safety/environmental staff early
 - Environmental impact reviews were easy because contractor was experienced
- Expect the unexpected in the schedule
- 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: 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: Develop Buy-In

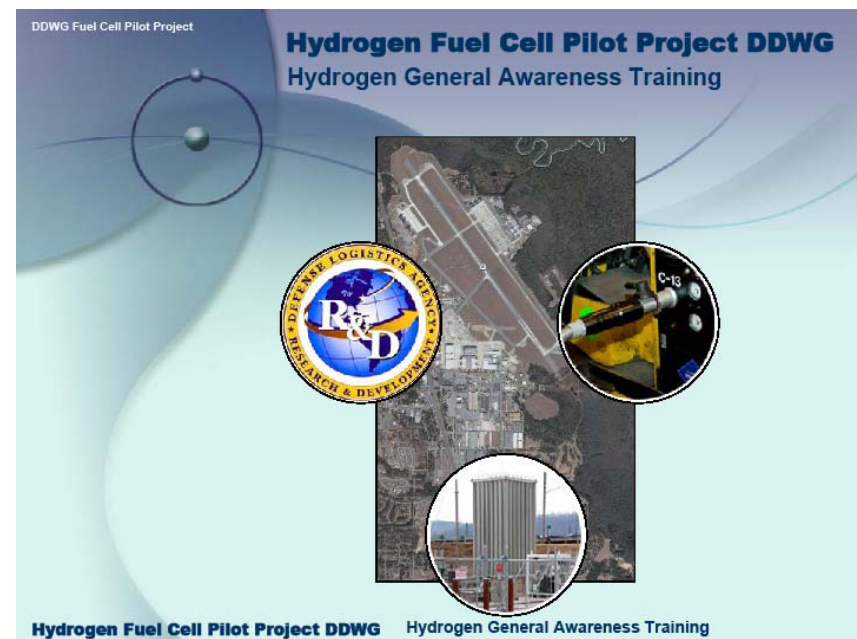
- Socialize early
 - Bring the right people to listen and talk
 - Share experiences with follow-on sites
 - Involve all the right parties early
 - Command
 - Union representation
 - Users
 - Fire Department – work closely, get them involved, educate them especially when H₂ is new
 - Physical security
 - Public affairs/legal





Lessons Learned: Training

- Content specific to those being trained – we have employed:
 - General Awareness Training (@2500 trained)
 - First responders
 - Refueling personnel
 - Forklift personnel
- Training fits group size
 - Break into small groups as needed
- Complicated with more than 1 FC type
 - Physical aspects of fuel cells
 - Getting used to refueling
 - Running out of fuel





Lessons Learned: Surveying the Workforce

- LMI created and administered survey
 - For DDWG personnel – July 2009
 - 77% response rate – (234/305 participants)
 - Preceded General Awareness Training
- Survey results indicate
 - No significant safety concerns
 - Optimism about H2 potential
- Repeating the survey
 - Post training
 - Post Ops





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)





Lessons Learned: Operations Support

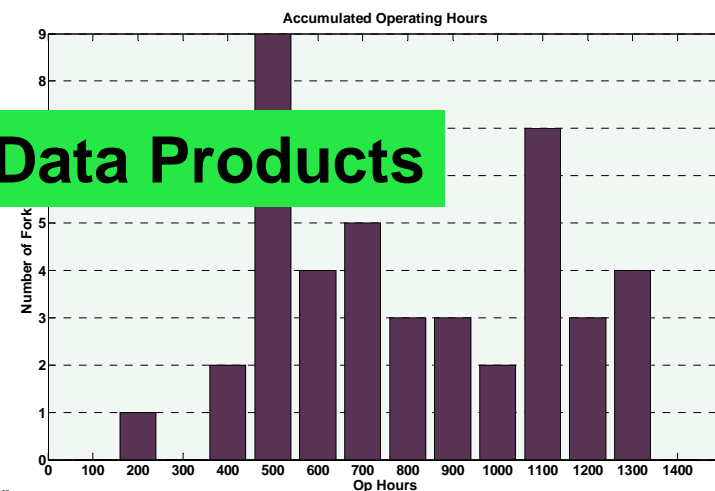
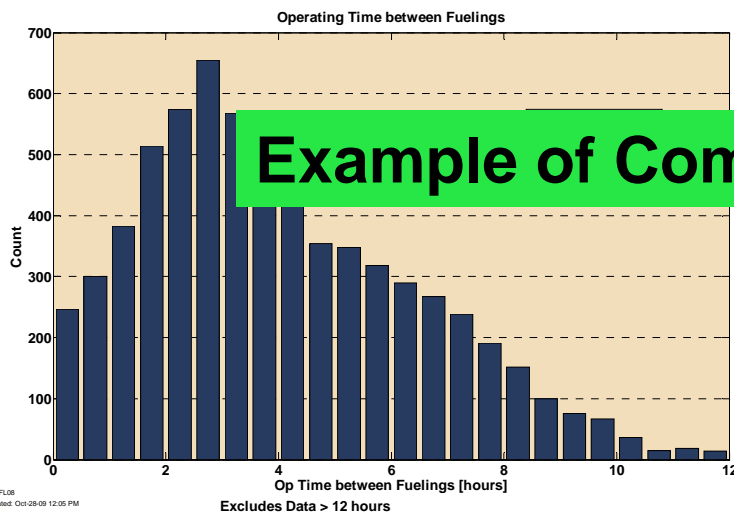
- Working with contractors
 - Response time on repairs has to be fast
 - One single point of contact to maintain control (particularly important working with gov't and multiple contractors)
 - Use local contractors when possible
 - No accidents is key to maintaining confidence





Lessons Learned: Defining the Business Case

- Analyzing and combining the business case at 4 separate locations
 - DDSP, DDWG, DDJC, and Ft. Lewis, WA
 - Will take 2-3 years to compile
- DLA asked for a preliminary business case analysis at DDSP
 - To support transition planning
 - Still developing composite data products (NREL)
 - Unique situation – infrastructure, costs, operations, leadership role



Example of Composite Data Products



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