Innovative Advanced Hydrogen Mobile Fueler

Project ID: TV039

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PI: Sara Odom

Presenter: Spencer Quong

Electricore, Inc.

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Overview

Timeline

- Start Date: 07/01/16
- End Date: 12/31/19*
- *Schedule dependent on go/no-go approval of each phase

Barriers Addressed

- Lack of hydrogen refueling infrastructure performance and availability data
- Hydrogen storage
- Codes and standards

Budget

Total Project Budget: $2,582,552

- Total Recipient Share: $1,293,769
- Total Federal Share: $1,288,783
- Total DOE Funds Spent*: $189,840

* As of 3/31/17

Partners

- Electricore – Federal Project Manager / PI
- Air Liquide – Design / Demonstration
- HTEC – Design & Fabrication
- QAI – Technical Lead
- Manta Consulting – Economic Analysis

Relevance

Objectives

Design, develop, deploy, and analyze an advanced hydrogen mobile fueler

Results

- Increased use of hydrogen
- Expansion of fuel cell vehicles
- Reduced petroleum use
- Reduced emissions
- Permitting of hydrogen mobile fueler
- Collect hydrogen mobile fueling data

FCT Office Goals

- Reduced petroleum use
- Improved greenhouse gas emissions and air pollution
- Enabled widespread commercialization of H2 and fuel cell technologies

FCT Office Barriers

- Mobile fueler performance and efficiency data
- Transportable hydrogen storage
- Codes and standards for mobile fueling

Approach and Strategy

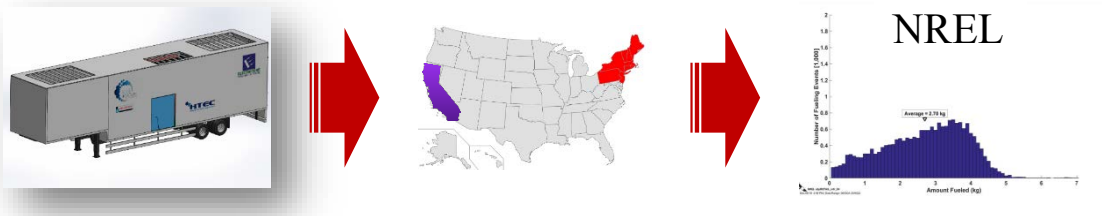
		2016		2017				2018				2019			
#	Task	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1	Specifications														
2	Component Selection														
3	Design														
	Go/No Go: Final Design														
4	Construction														
5	Testing														
6	Site Selection														
	Go/No Go: Assembled AHMF, Site selection														
7	Demonstration														
8	Economic Analysis														
9	Program Management														

Complete

* Schedule assumes approval of First Go/No-Go in Q2 2017

Key Objectives

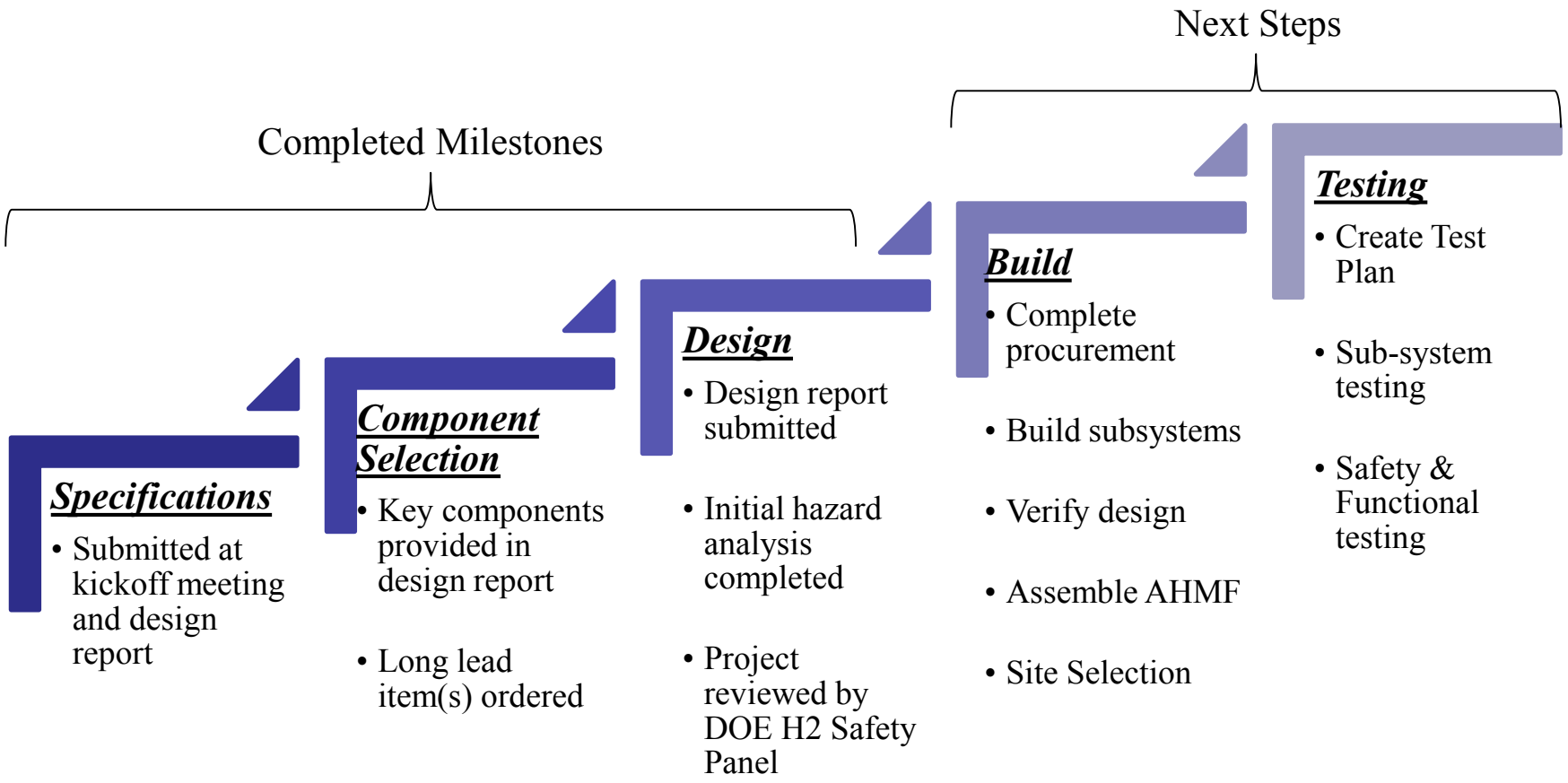
- Design and build an Advanced Hydrogen Mobile Fueler (AHMF)
- Deploy AHMF to support a network of H2 stations and vehicles in the United States.
- Gather and analyze fueling data for NREL Technology Validation Team



Unique Approach

- Based upon existing conventional station (reduced risk)
- Coordination with station provider and automotive OEMs

Approach: Phase 1 Milestones



Accomplishments and Progress: Specifications

- AHMF Specifications Finalized

Specification	Description
Pressure Class	H70 (70 MPa) after compressing high bank storage
Pre-cooling	T30 (-30° C) or T40 (-40° C)
Performance	Up to 15 kg per hour, 100-120 kg in 8-10 hours
Fueling Protocol	SAE J2601-2014 table based for 2-7 kg tanks. SAE J2799-2014
Setup	One hour for limited performance, 8 hours for full performance
Storage	Up to 170 kg H2 at 45 MPa with ability to connect to external storage
Power	On-board 480VAC, low noise, low emissions diesel generator with option of using external power
Usage	Dispenser human machine interface allows fueling by minimally trained users.

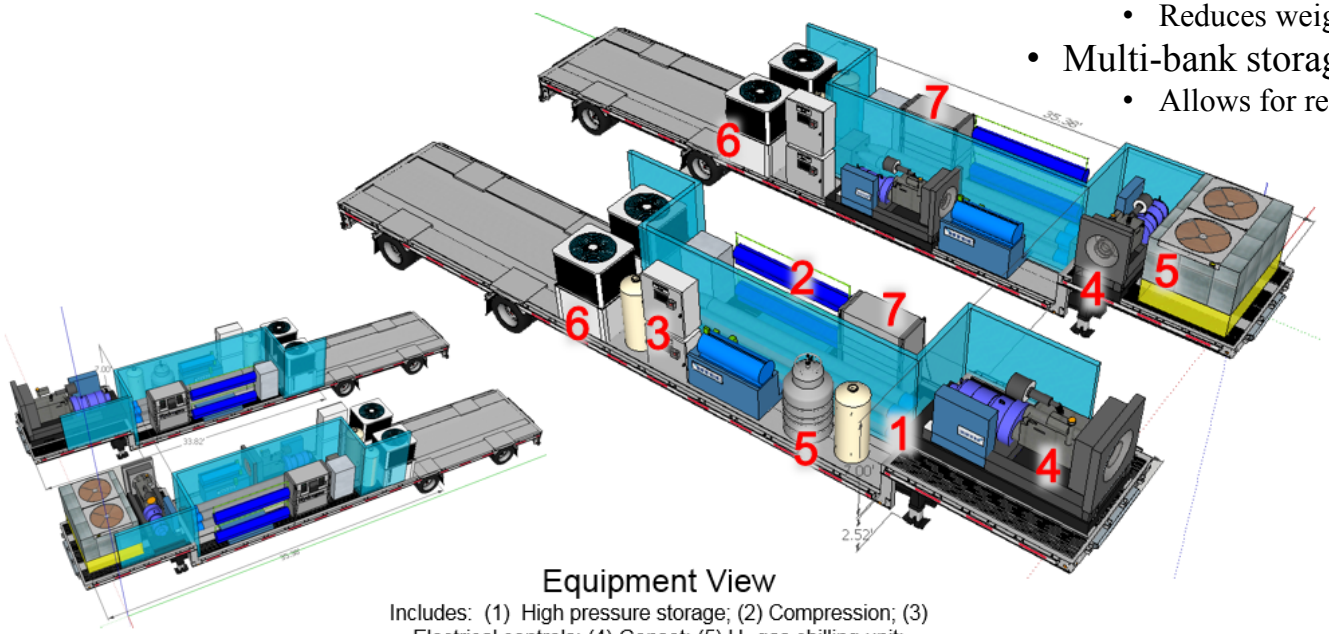
Accomplishments and Progress: Design

Design Complete

- Final design report submitted to DOE
- Initial hazard analysis completed
- Project reviewed by DOE H2 Safety Panel
- Long lead items ordered

Key Design Features

- Based upon Air Liquide C100 H2 station design
  - Station being used around the world
  - Same user interface
  - Reduced risk to project
- Fully self contained
  - On-board compression, storage, dispensing and power
- Full performance station
  - Same fueling times (3-5 minutes on 25°C day)
  - Can fuel ~ 3 Vehicles in first hour, ~24 vehicles per day
- Compact heat exchanger
  - Reduces weight and size
- Multi-bank storage
  - Allows for reduced setup/teardown time



Equipment View

Includes: (1) High pressure storage; (2) Compression; (3) Electrical controls; (4) Genset; (5) H_2 gas chilling unit; (6) Equipment cooling; (7) Dispenser

Previous Year Reviewers' Comments

- This project was not reviewed last year.

Collaborations

Partner		Role
	Air Liquide	Design Operations Project Co-Funding
	HTEC Hydrogen Technology & Energy Corporation	Design and Fabrication
	Quong & Associates, Inc.	Technical Lead
	Manta Consulting	Economic Analysis
	National Renewable Energy Lab	Data Analysis
	Multiple automotive companies	Advisor on Site Selection/Usage
	DOE Hydrogen and Safety Panel	Safety Analysis

Remaining Challenges and Barriers

High Pressure Storage

- **Barrier**: Can not transport AHMF with hydrogen fully pressurized. Will lead to long setup/teardown times.
- **Solution**: Attempt to obtain US DOT special permit to allow for transport of H2 at full pressure

Retail Sale of Hydrogen

- **Barrier**: Regulations regarding retail sale (metering) not established by state regulators outside of California
- **Solution**: Locate AHMF in one site that allows retail sale of H2. Work with other states to develop framework for sale of H2

Unattended Fueling

- **Barrier**: Unattended fueling requires significant design changes that would impact "mobile" aspect of AHMF
- **Solution**: User interface requires minimal training. Select sites which have some supervision, but still public

Long Lead Items

- **Barrier**: Long lead time components may result in delays
- **Solution**: Simplify the system architecture by using existing station design. Perform additional CAD efforts to avoid interferences in construction

Proposed Future Work

Buy, Build, Test and Deploy

2017

- Purchase components
- Assemble AHMF
- Test Sub-systems and full system
- Site Selection

2018/ 2019

- Deploy AHMF
- Gather and analyze fueling data

Future Decisions

Design Issues: Current design is conservative and any design changes will improve performance

Site Selection: Team will select multiple sites with public access; at least one site will allow retail sale of hydrogen.

Purchasing: Team has set up a purchasing committee to expedite process

Technology Transfer Activities

- Permitting of high pressure composite cylinder for transport
  - Facilitates industry-wide use of high pressure transportation systems for applications beyond the AHMF
- The market is already indicating interest for fast, full-performance mobile fueling
  - Public agencies
  - Private companies
- AHMF facilitates establishment of new market areas and expansion of existing markets

Summary

- The AHMF is a self contained, full performance mobile hydrogen station
- The AHMF project has completed the design stage and is ready to begin construction
- The project has some barriers associated with operation and site selection
- Team has developed a plan with DOE and other stakeholders to reduce risk