DOCKETED

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Project Title:	Fuels and Transportation Merit Review
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Document Title:	Merit Review and Peer Evaluation Workshop 2015 Draft Presentation
Description:	CEC PON-14-605 (ARV-15-001 and ARV-15-002) Medium- and Heavy-Duty Advanced Vehicle Technology Demonstration, New Flyer Advanced Fuel Cell Vehicle Technology Demonstration for Transit Bus, Hydrogenics Advanced Fuel Cell Vehicle Technology Demonstration for Drayage Truck
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California Energy Commission PON14-605 (ARV-15-001 and ARV-15-002)
Medium-and Heavy-Duty Advanced Vehicle Technology Demonstration
New Flyer Advanced Fuel Cell Vehicle Technology Demonstration for Transit Bus
Hydrogenics Advanced Fuel Cell Vehicle Technology Demonstration for Drayage Truck

Merit Review and Peer Evaluation Workshop 2015 (DRAFT)

Rob Del Core
Director, Fuel Cell Power Systems
Hydrogenics USA
Dec 2, 2015

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Projects Overview

- One Daimler Fuel Cell Truck integrated with Celerity Plus – latest medium and heavy duty fuel cell power system technology by Hydrogenics together with Siemens' ELFA electric drive
- To be demonstrated with data collection by TTSI in ports of Long Beach, Port of LA and Alameda Corridor for 1 year
- CEC approved the following for this project:

CEC Funds :	$2,679,417
Match :	$1,525,915
Total Project Value:	$4,205,332

- Hydrogenics: Lead integrator, project manager and fuel cell supplier
- Daimler/VVG : Truck OEM and truck dealer
- Siemens: Electric drive supplier
- ACTIA: Battery supplier
- TTSI: Truck operator for demonstration

- One New Flyer Fuel Cell Bus integrated with Celerity Plus – latest medium and heavy duty fuel cell power system technology by Hydrogenics together with Siemens' ELFA electric drive
- To be demonstrated with data collection by SunLine in Coachella Valley in Palm Spring for 1 year
- CEC approved the following for this project:

CEC Funds :	$2,148,177
Match :	$1,158,425
Total Project Value:	$3,306,602

- Hydrogenics: Project manager and fuel cell supplier
- New Flyer: Lead integrator and bus OEM
- Siemens: Electric drive supplier
- SunLine Transit: Transit operator for demonstration

Key Elements Contributed to Projects Success

- **Celerity Plus** is a pre-integrated bundled fuel cell drive system combining state-of-the-art fuel cell technology from Hydrogenics and proven electric drive technology from Siemens
  - Customized for medium and heavy duty commercial vehicles
  - Easy to integrate, service and maintenance
  - Accelerate commercialization and mass adoption by reducing development cost, servicing cost and maintenance cost and thus reducing TCO
- **Reputable OEMs** involvement like Daimler Trucks and New Flyer Bus enhances the success of technology development, vehicle delivery and commercialization
- **Focused and small capable team** facilitates project execution and cost control
- **Dedicated Long Term Commitment of Hydrogenics in California** in deploying hydrogen fuel cell fleet and hydrogen onsite generation technology to support mass deployment of hydrogen fuel medium and heavy duty vehicles – combining innovative ideas and hydrogen technology

Daimler Fuel Cell Drayage Truck with Hydrogenics Celerity Plus

Project Objectives:

- ✓ Develop and demonstrate a Fuel Cell Drayage Truck with Hydrogenics Celerity Plus and Daimler truck chassis capable of a maximum of 200 zero emission miles daily
- ✓ 12 months of demonstration with data collection and lesson learned
- ✓ Accelerate commercialization of fuel cell drayage truck
- ✓ Achieve significant greenhouse gas reduction

Overall Project Progress – **Truck**

Project Admin progress:

- **Contracts signed on Oct 1, 2015 and kick off meeting completed on Oct 15, 2015**
- **Subcontract drafting in progress – expect to sign with all partners by 1Q/2016**
- **First monthly report on Nov 10, 2015: no major concerns.**
- **Secure technology integration facility in progress:**
  - **Discussion with Go Business and City of Poway for permits and site requirements**
  - **Visited several potential sites with commercial realty agent**
  - **In progress to present options to management for review**

Technical progress:

- **Current stage: Task 2: Design and Procure**
- **Collection of duty cycle data for truck design commences**
  - **Port of Long Beach – general route data for reference**
  - **Collect real time duty cycle data from TTSI**
- **Finalizing truck chassis specification in progress with TTSI and VVG (Daimler Truck Dealer)**
- **Next step: define detailed functional requirement and develop the system architecture with CAD and engineering information from partners**
- **No major concerns**

Project Budget and Schedule - **Truck**

Budget:

- **Yet to submit the first invoice**
- **No budget concern**

Schedule:

- **Given current technical progress, project is currently on time**
- **Current Schedule:**

Task	Target Completion Date
Secure Technology Integration Site	April 30, 2016
Design and Procure	Feb 20, 2017
Build, Integrate, and Ship the Truck	Sept 4, 2017
12 Months Demonstration with Data Collection	Nov 2018
Project Completes	Dec 10, 2018

Significance of this CEC **Truck** Project

- Port truck is operated in the most polluted part of a city; success of this zero emission truck can significantly reduce greenhouse gas reduction

- This project will provide insight and data into developing longer distance zero emission port truck with more highway miles by using fuel cell power system as range extender
  - This is made possible as Celerity Plus is a transferable fuel cell power and drive system technology that can be adapted in different medium and heavy duty vehicle platform with minimal effort due to the pre-integrated feature between the fuel cell power system and electric drive

- Successful demonstration of ease of integration, development and deployment of Celerity Plus and the zero emission truck will encourage adoption of fuel cell port trucks and accelerate commercialization

New Flyer Fuel Cell Transit Bus with Hydrogenics Celerity Plus

Project Objectives:

- ✓ Develop and demonstrate a Fuel Cell Transit Bus with Hydrogenics Celerity Plus and New Flyer electric bus
- ✓ 12 months of demonstration with data collection and lesson learned
- ✓ Accelerate commercialization of fuel cell bus by increasing the selection of fuel cell buses in market
- ✓ Achieve significant greenhouse gas reduction

Overall Project Progress - **Bus**

Project Admin progress:

- **Contracts signed on Aug 21, 2015 and kick off meeting completed on Sept 28, 2015**
- **First monthly report on Nov 10, 2015: no major concerns.**
- **Subcontract drafting in progress – expect to sign with all partners by 1Q/2016**

Technical progress:

- **Current stage: Task 2: Design, Procure and Build Phase**
- **New Flyer has started reviewing Celerity Plus integration manual. Only minor integration clarification questions raised by New Flyer and have been addressed by Hydrogenics. No major technical concerns at this point**
- **Finalizing bus specification in progress**
- **New Flyer completed first preliminary bus packaging concepts for team review**
- **First bus design review within project team on Nov 30, 2015 (on schedule)**

Project Budget and Schedule - **Bus**

Budget:

- **Yet to submit the first invoice**
- **No budget concern**

Schedule:

- **Given current technical progress, project is currently on time**
- **Current Schedule:**

Task	Target Completion Date
Design, Procure, and Build the Bus	Jan 30, 2017
Test, Validate, and Ship	Mar 13, 2017
12 months Demonstration with Data Collection and Altoona Testing	Mar 27, 2017 – Feb 15, 2019
Project Completes	Feb 15, 2019

Significance of this CEC **Bus** Project

- Increase the selection of fuel cell transit bus in the market to encourage technology competition and to mass adoption, which will lead to commercialization of fuel cell transit bus

- This CEC fuel cell bus with New Flyer will become New Flyer's standard product offering once it passes Altoona Test and will be eligible for DOE funding and FTA subsidy for commercialization and mass deployment

- Mass deployment of fuel cell buses together with fuel cell trucks enables economies of scale in deploying heavy duty central hydrogen refueling stations that shared by both buses and trucks
  - ✓Volume deployment between fuel cell trucks and buses
  - ✓Economies of scale in hydrogen fuel
  - ✓Fuel cost reduction
  - ✓Improved TCO for fuel cell commercial vehicles
  - ✓Enables and accelerate commercialization


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