

# *Incorporation of Two Ford H<sub>2</sub> ICE Buses into the Shuttle Bus Fleet*

*Serving LLNL and SNL*

Project ID# MT005

This presentation does not contain any proprietary, confidential, or otherwise restricted information.

**Bob Glass**  
Lawrence Livermore  
National Laboratory

**Lennie Klebanoff**  
Sandia National Laboratory

May 10, 2011



LLNL-PRES-472684

This work was performed under the auspices of the U.S.  
Department of Energy by Lawrence Livermore National  
Laboratory under contract DE-AC52-07NA27344.  
Lawrence Livermore National Security, LLC



# Overview

## Timeline

- Project start date: 7/1/10
- Project end date: 9/30/11
- Percent complete: 60%

## Budget

- Total project funding
  - DOE share: \$691K
  - Contractor share: \$0K
- Funding received in FY10: \$634K
- Funding for FY11: \$57K

## Barriers

- A. Non-technical issues preventing full commercialization of hydrogen and fuel cell systems
- B. Hydrogen storage
- C. Lack of hydrogen refueling infrastructure performance and availability data
- D. Maintenance and training facilities

## Partners

- Ford Motor Company
- Air Products and Chemicals



# Relevance and approach

**Relevance:** The U.S. DOE requested that the national laboratories host H<sub>2</sub> ICE buses

- To promote the early market adoption of hydrogen technology
- To displace diesel fueled vehicles at the labs
- To help promote public education on the benefits of hydrogen and fuel cell technology

**Approach:**

- Receive two H<sub>2</sub> ICE buses from Ford
- Integrate them into the existing LLNL/SNL shuttle bus fleet
- Establish a reliable source of H<sub>2</sub> refueling for the shuttle buses
- Use the shuttle buses as a vehicle for educating the local public on the benefits of hydrogen and fuel cell technology

The LLNL/SNL shuttle buses are now in routine use

# Technical accomplishments and progress

1. Worked with LLNL Operations and Business Offices/Facilities and Infrastructure Directorate to permit mobile H<sub>2</sub> refueling station at LLNL
2. Collaborated with Air Products and Chemicals to bring mobile H<sub>2</sub> refueler to LLNL
3. Instituted refueling training and shuttle bus operation for drivers
4. Worked through insurance issues associated with on-site refueling and public ridership
5. Instituted shuttle bus service and have done several community outreach activities
6. Established means to monitor ridership, refueling, and vehicle operations



# Maintenance issues resolved

- Worked with Ford to resolve H<sub>2</sub> shuttle bus maintenance issues
- Shuttle buses arrived with fuel system leaks, which were resolved by Ford
- Operating Issues:
  - Fuel system O-rings
  - Electrical control panel
  - Rattling in the tank area
  - CCV canister (oil separator)
  - Engine codes
  - Gasket leaks
  - Cabin heating system
- Frequency of shuttle bus maintenance is approximately every other week—*still a demonstration project (shuttle buses sat unused for almost one year)*



# Using the shuttle buses

- Both shuttle buses are integrated into the LLNL/SNL fleet
- Shuttle buses also go to the local ACE train station, picking up LLNL and SNL employees and transporting them to our campuses

Ridership per shuttle bus: ~80 passengers/day  
Mileage per shuttle bus : ~80 miles/day  
Daily refueling: Usually top-off, ~ 13 kg/shuttle bus

# Community education/outreach

February 22, 2011:  
Hydrogen Technology Celebration in  
downtown Livermore

- Speakers:
  - LLNL and SNL Executives
  - John Garbak, DOE Technology Development Manager
  - Vice Mayor, City of Livermore, John Marchand
  - NNSA Site Manager, Alice Williams
- Local and San Francisco Media (KPIX television)
- Two local newspapers
- Representation from Congressmen's Garamendi and McNerney's offices and State Assembly member Joan Buchanan



Both shuttle buses present at event, rides given to public, in addition to posters and hardware from other H<sub>2</sub> technology projects

# Local dignitaries have utilized shuttle bus services



County Supervisor Scott Haggerty

# Expanding Your Horizons

Saturday, February 26, 2011

Diablo Valley College, San Ramon Campus



The EYH conference serves to:

- Increase the interest of young women in math and science through positive hands-on experience (over 300 present)
- Foster awareness in math- and science-related careers
- Provide young women with opportunities to meet and interact with positive role models who are active in math- and science-related careers



# Collaborations

- LLNL and SNL co-lead this project
- Ford Motor Company (partner in shuttle bus demonstration projects)
- Air Products and Chemicals (mobile refueler)
- LLNL Taxi Service (drivers and management)
- LLNL and SNL public relations and government relations
- LLNL and SNL protocol offices (community events)
- LLNL Safety
- City of Livermore (community events)
- Las Positas College (curriculum development on H<sub>2</sub> technology)



# Some Proposed Future Work

- Monitor shuttle bus mileage, ridership, vehicle operation
- Maintain the vehicles in collaboration with Ford
- Conduct community outreach events
  - Curriculum development with Las Positas College
  - American Chemical Society Earth Day Event
  - LLNL/San Francisco Bay Area Earth Day Events
  - Annual Community Festivals/Antique Automobile Shows
  - High school demonstrations

# Summary

- The shuttle buses have been received
- H<sub>2</sub> refueling station has been established
- The shuttle buses are being used daily and maintained
- A celebration of the shuttle buses and other H<sub>2</sub> technology was held February 22, 2011 in downtown Livermore, CA
- Engagement in several community events has occurred and many future events are being planned
- Engagement with Las Positas College in curriculum development