



U.S. Department of Transportation Fuel Cell Bus Program



Christina Gikakis

U.S. Department of Transportation
Federal Transit Administration

International Fuel Cell Bus Working
Group Meeting

June 2009

Overview

- ◆ U.S. DOT/ Federal Transit Administration
- ◆ FTA Research in Fuel Cell Technologies for Transit
- ◆ Highlights and Accomplishments of the National Fuel Cell Bus Program
- ◆ FTA's Electric Drive Strategic Planning Efforts
- ◆ New Programs under the Recovery Act

U.S. Department of Transportation Federal Transit Administration (FTA)

- ◆ Provides financial and technical assistance to the local public transit systems to plan, construct, and operate public transportation in the U.S.
 - Systems includes buses, subways, light rail, commuter rail, streetcars, and passenger ferry boats
- ◆ Current programs authorized in SAFETEA-LU from 2006 to 2009
- ◆ Over \$10 Billion in annual funding
- ◆ \$8.4 Billion in additional funding for transit capital improvements in Recovery Act legislation, Feb 2009

Transit Research under FTA

◆ Pursue multiple technologies including electric drive pathway

- Reduce transit bus emissions
- Lower greenhouse gas emissions
- Improve fuel efficiency
- Improve vehicle performance

◆ Fuel cell efforts

- Successful demo programs funded under prior FTA programs, such as Georgetown University and SunLine program in Palm Springs, CA
- Efforts continue under NFCBP



*Alamodome Transit Entrance.
VIA Metropolitan Transit; San
Antonio, TX*



*New Flyer Hybrid Bus.
Intended for Seattle, WA*

National Fuel Cell Bus Program

- ◆ Program to facilitate the development of commercially-viable fuel cell buses
- ◆ Authorized under SAFETEA-LU
- ◆ **\$49 Million** over fiscal years 2006 to 2009
- ◆ Teams and projects **competitively selected**
- ◆ **50-percent** non-Federal cost share required



Van Hool Fuel Cell Bus
Sunline Transit; Thousand Palms, CA

National Fuel Cell Bus Program Projects



Balanced portfolio of projects selected to best advance fuel cell bus commercialization

◆ Development and Demo projects

- Both evolutionary and “clean sheet” approaches
- Spectrum of cost and risk
- Multiple drive technologies/configurations
- Fuel cell stack size/utilization
- Multiple energy storage technologies - NiMH, Li ion, ultracaps
- Supporting infrastructure



New Flyer Fuel Cell Bus. Sunline Transit; Thousand Palms, CA

◆ Component Technology projects

◆ Analysis, Outreach, Coordination projects

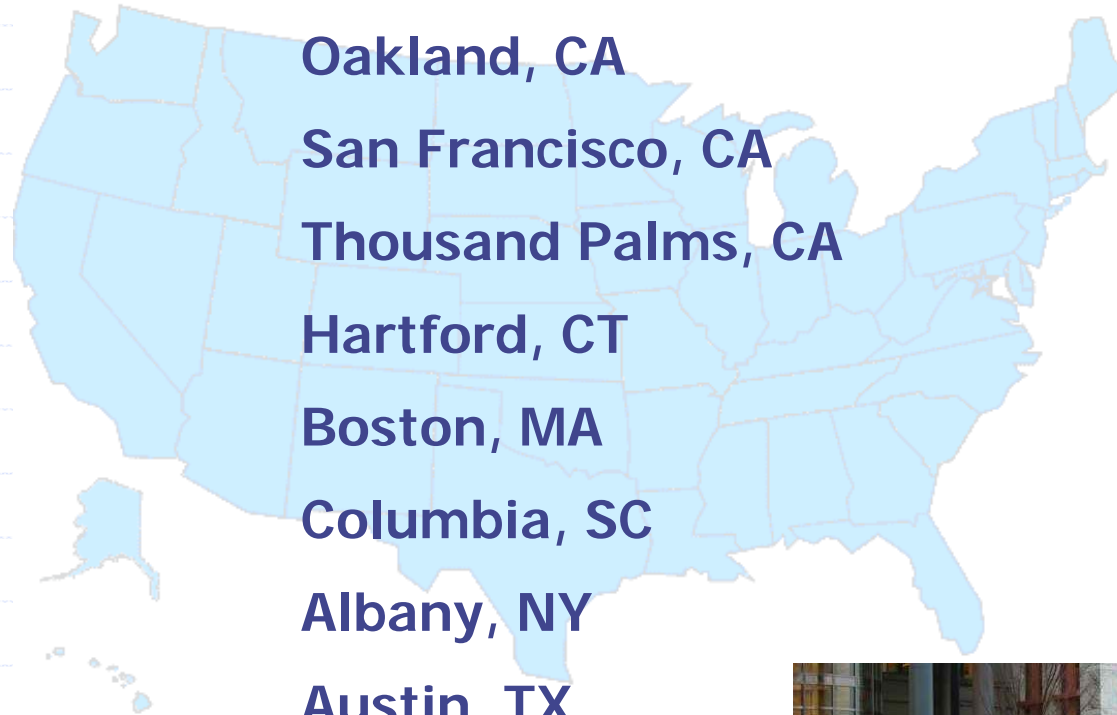
National Fuel Cell Bus Program

- ◆ **Each project managed by one of three non-profit consortium:**
 - Center for Transportation and the Environment in Atlanta, GA
 - Northeast Advanced Vehicle Consortium in Boston, MA
 - WestStart /CALSTART in Pasadena, CA

- ◆ **Projects include partners from industry, government, transit:**
 - Multiple fuel cell manufacturers - UTC, Ballard, Hydrogenics, Nuvera
 - Multiple drive system integrators - ISE Corp, BAE Systems, GE Global Research
 - Multiple bus manufacturers
 - Multiple fuel suppliers

National Fuel Cell Bus Program

Demonstration sites across U.S. in diverse locations, climates



Van Hool Fuel Cell Bus.
AC Transit; Oakland, CA



Supporting Program Efforts

- ◆ Data collection in partnership with the Department of Energy (DOE) National Renewable Energy Lab (NREL)
- ◆ Outreach efforts to share findings and results, nationally and internationally
- ◆ Coordination with existing FTA, DOT, DOE and State research efforts in electric drive and fuel cell research
- ◆ Comprehensive safety plan assessment for each test site conducted by DOT Volpe Center



Program Highlights and Accomplishments



◆ Hydrogen hybrid bus complete development complete evaluation and demo to begin this summer

- ◆ 35-foot Battery-dominant hydrogen fuel cell bus by **CTE/Proterra** team
- ◆ Dual 16 Kw Hydrogenics fuel cell stacks managed through algorithms to optimize output and minimize wear
- ◆ New design, lightweight composite structure
- ◆ Advanced Lithium Titanate batteries
- ◆ H2 fueling station in Columbia, SC open
- ◆ Delivery to Columbia, SC for 10-month demonstration in transit environment



Program Highlights and Accomplishments



AC Transit Fuel Cell Bus Demonstration HyRoad Program

- ◆ Accelerated testing of current fleet of fuel cell buses at AC Transit and system upgrades
 - Identify weak areas of fuel cell or hybrid system and conduct root cause analysis, fuel cell technology development and component upgrades
- ◆ Project Team CALSTART/ UTC Power, ISE and AC Transit
- ◆ Three buses continuing accelerated testing following upgrades
 - Fuel cell upgrades to PureMotion 120KW FC
 - Battery system upgrades, ongoing effort
 - 152,000+ miles on the buses undergoing accelerated testing
- ◆ Results of accelerated testing will further validate system and provide valuable information for next generation systems planned for AC Transit

Program Highlights and Accomplishments



AC Transit Fuel Cell Bus Demonstration

- ◆ Accelerated testing of current fleet of fuel cell buses at AC Transit – initial evaluation complete, testing continues
- ◆ *Accelerated Testing Evaluation Report*, authored by NREL, published Jan 2009

Program Highlights and Accomplishments



BAE Systems BUS 2010 project on track for transit demonstration in 2010

- ◆ Enhancing a successful HEV with fuel cell Auxiliary Power System (APU)
- ◆ Hydrogenics Fuel cell system, Orion bus platform
- ◆ Lithium ion energy storage
- ◆ Electrified accessories to increase efficiency reduce power requirements
- ◆ Evolutionary commercialization pathway
- ◆ Testing with MUNI in San Francisco

Program Highlights and Accomplishments



Component Projects Completed Successfully

CALSTART/ US Hybrid team

◆ **Hybrid Fuel Cell Power Converter**

- Scaled design of an existing automotive fuel cell DC-DC converter to fuel cell transit bus requirements.
- Can replace functions now accomplished with expensive custom one-off designs
- Will work with multiple fuel cell power system manufacturer products and multiple energy storage devices

◆ **Integrated Auxiliary Module (IAM) for Fuel Cell Bus**

- Fabrication and demonstration of a low-cost, compact, integrated module.
- Design intended to increase efficiency and reduce cost from current auxiliary systems.

◆ ***Exploring integration and testing of components in full scale fuel cell bus demo***

Program Outreach and Coordination



◆ Hydrogen Bus Survey Report

- Released March 2009
- Based on interviews with Hydrogen Bus operators from around the world *Survey of International Fuel Cell Bus Demonstrations*

◆ International Fuel Cell Working Group

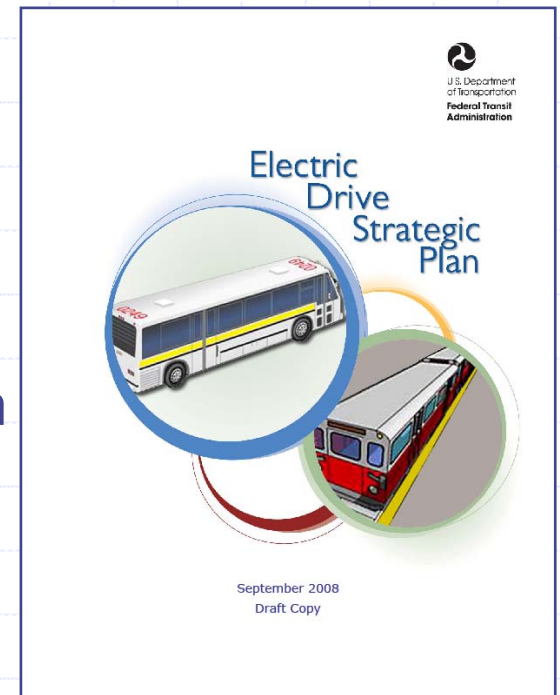
- Meeting held in Reykjavik, Iceland, May 2008
- 6th Working Group Meeting in Vancouver

◆ International fuel cell bus website initial development complete, in beta format



Moving Forward: Electric Drive Strategic Plan

- ◆ Plan to help guide FTA research in electric drive technologies
- ◆
 - Plan defines a 5-year electric drive research plan in the context of a 20-year strategic outlook
- ◆ Continued development and demonstration of fuel cell technology integral part of Plan



Electric Drive Strategic Plan

- ◆ Plan developed in consultation with industry
 - Broad cross section of industry input:
 - ◆ Transit agencies
 - ◆ Bus manufacturers
 - ◆ System/component suppliers
 - ◆ Academia
 - Several industry / government meetings held to get individual industry perspectives
- ◆ Draft plan complete, awaiting new leadership approval at DOT for rollout
- ◆ Many elements of plan already incorporated into DOT planning documents



Orion Hybrid Bus. MTA;
New York City, NY

New Program: TIGGER

- ◆ **TIGGER: Transit Investment in Greenhouse Gas and Energy Reduction**
- ◆ **Part of the ARRA**
- ◆ **\$100 Million in discretion grants to transit agencies**
 - Reduce Energy Consumption
 - Reduce Greenhouse gas emissions
- ◆ **100-percent Federal share available**
- ◆ **Proposals were due to FTA May 22, 2009**
 - Hundreds of project proposals received
 - Funding requests total several times amount available
- ◆ **FTA currently reviewing proposals, selections expected by September 2009**
- ◆ **Multiple fuel cell projects proposed**

For More Information



Thank you!

Christina Gikakis
202-366-2637

Christina.Gikakis@dot.gov