

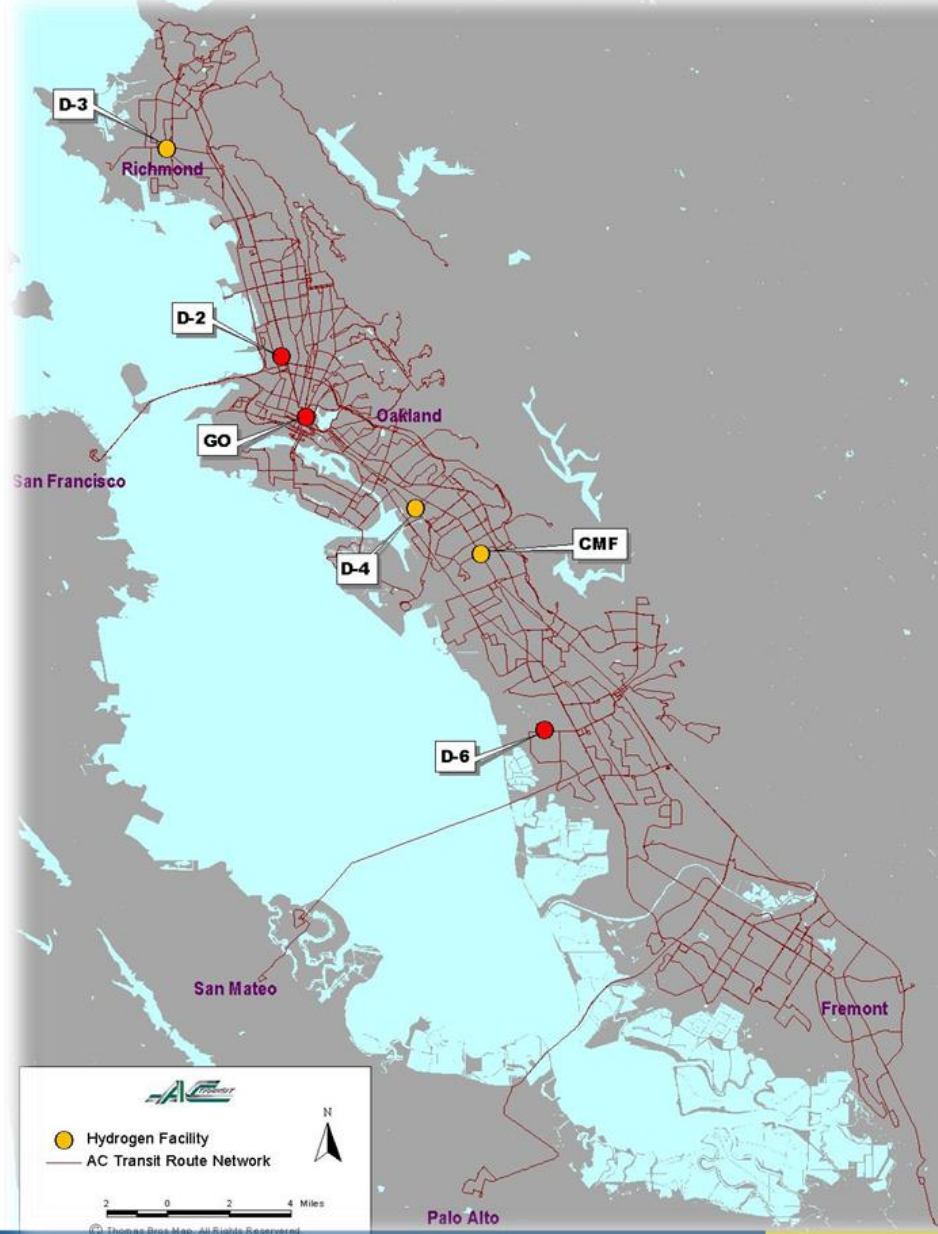
Successful Zero-Emission Bus Transition from Demonstration Program to Full Transit Service Deployment



Salvador Llamas

*AC Transit, Director of Maintenance
Oakland, California*

- Oakland - SF East Bay
- Board of Directors
- Michael Hursh - GM
- 1.5 million people
- 364 square mile
- 151 lines (31 Transbay)
- 18.4 M service miles
- 630 buses (13 – ZEB)
- 6 facilities
- 2,243 employees



Zero-Emission Bay Area (ZEBA) Advance Demonstration Program



- **CARB Fuel Path Mandate**

- Three bus demonstration
- Twelve bus advanced demonstration

- **Consortium Agencies in ZEBA Program**

- Funding support for AC Transit program
- Requirement to operate buses in revenue service



Program Advancement



2003-2006

- (1) 30' Thor
- 60kW UTC
- 48, 12v Panasonic
- 25kg H2 storage
- 175-200 miles

2006-2010

- (3) 40' VanHool
- 120kW UTC
- Zebra battery
- 50kg H2 storage
- 250-300 miles

2010 - Present

- (13) 40' VanHool
- 120kW UTC
- EnerDel battery
- 40kg H2 storage
- 200-220 miles

Hydrogen Fuel Stations

Emeryville D2 Station

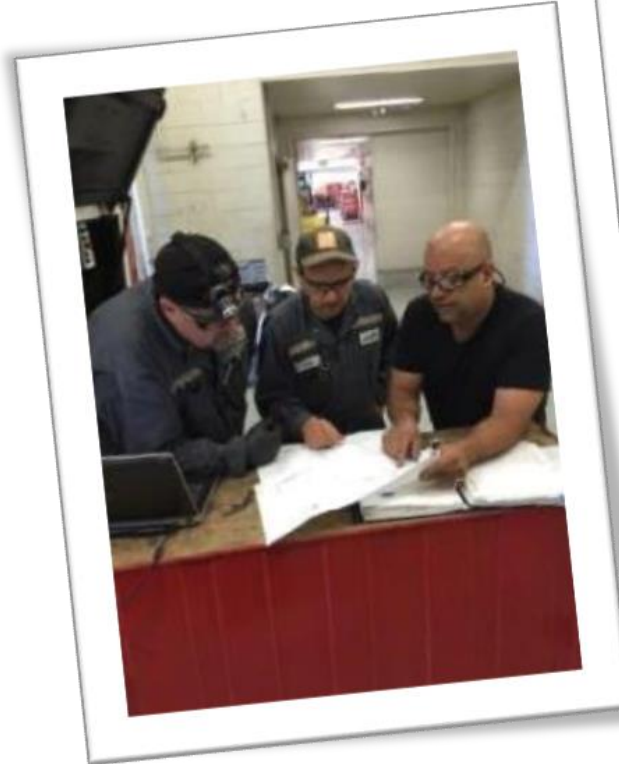


Oakland D4 Station



ZEB Training Initiatives

- H2 Fuel Cell Safety & Familiarization
- Lithium Ion Battery Safety
- Fuel Cell Power Plant
- Siemens Drive System



Hands-On Technical Experience



5 week program

- ✓ Basic P.M.I.
- ✓ Basic Diagnostics & Repair
- ✓ Advanced Diagnostics & Repair



Training Provided:

- 223 Mechanics
- 8,744 Hours
- Every Bus Operator



Fuel Cell Bus to Reno, NV



- Test FCEB durability
- APTA 2017 Bus & Paratransit
- Inclement weather
 - ❖ rain & snow flurries
- Steep terrain
 - ❖ Donner Pass - 7,057 feet



Results

- Over five hour drive
- 224 miles (one-way)
- Avg. 10.91 MPG



Fuel Cell Fleet Advancements

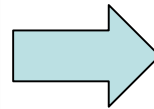
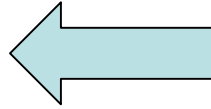
	Units	2016 Target	Ultimate Target
Bus lifetime	years/miles	12/500,000	12/500,000
Power plant lifetime	hours	18,000	25,000
Power availability	%	85	90
BUS #	HOURS	LTD MILES	
FC4	19,880	185,890	(<10 min)
FC5	18,938	177,092	600,000
FC6	19,750	151,608	450,000
FC7	26,063	173,752	1 (<10 min)
FC8	18,325	114,572	
FC9	18,442	155,599	
FC10	22,124	195,431	
FC11	21,920	188,539	
FC12	22,686	190,888	
FC13	10,532	109,292	
FC14	22,268	186,183	
FC15	17,654	152,177	
FC16	22,074	175,833	
Total	Hours	Fleet LTD	
	260,656	2,156,856	



- DOE/FTA targets for FCEB
- 5 fuel cells met target in Oct 2016
- 11 fuel cells achieved target by 2017
- **FC7 achieved “Ultimate Target” on June 23, 2017**

Future ZEB Programs

- New Flyer Xcelsior XHE60
- 60 foot fuel cell transit bus
- Target range of 250 miles



- (10) Xcelsior XHE40 (FCEB)
- (5) Xcelsior XE40 (BEB)
- True Side-by-Side Comparison
 - Same Agency
 - Same Service Environment
 - Same OEM
 - CTE – Performance Report

The End



Thank You!
😊

