



# UTC Power

A United Technologies Company



**Michael Tosca**  
**UTC Power**

# United Technologies Corporation



**UTC  
Fire & Security**



**Pratt &  
Whitney**



**Carrier**



**Otis**



**Sikorsky**



**Hamilton Sundstrand**



**UTC Power**



**Research Center**

# UTC POWER - Markets

## Transportation Fuel Cells



## On-Site Power Solutions



# Transportation

## Automotive



## Fleet (Fuel Cell Bus)



## Space



# UTC Power Bus Experience



1998



Georgetown  
University

40 Foot NOVA Bus  
100 kW  
Phosphoric Acid  
Methanol  
FC/battery hybrid

2002



SunLine, AC Transit,  
LAMTA, Chula Vista

30 Foot Thor  
"Thunder Power" Bus  
60 kW S300 PEM  
Hydrogen  
FC/battery hybrid

2004



EMT Madrid, ATM  
Turino

40 Foot  
Irisbus  
60 kW S300 PEM  
Hydrogen  
FC/battery hybrid

2005



AC Transit/  
Sunline

40 Foot Van Hool  
Bus  
120 kW S900 PEM  
Hydrogen  
FC/battery hybrid

# Fuel Cell Bus Benefits

- Air quality
- CO<sub>2</sub> emissions reductions
- Low noise
- Energy security
- Lower operating costs
- Exportable power



# FUEL CELL BUS EMISSION BENEFITS



**Replacing a fleet of 4000 diesel buses with fuel cell hybrids buses avoids...**

CO <sub>2</sub>		NO <sub>x</sub> + NMHC		PM	
Tons	acres	tons	# cars	tons	# cars
492,000	378,000	5,900	308,000	70	51,000

Notes: On an annual basis. Using Fleet of 4000 buses and 50,000 miles per bus per year. Diesel emission data based on that reported in DART's LNG Bus Fleet Final Results (produced for D.O.E. by N.R.E.L., in October 2000). Each car is assumed to emit 38 lbm/year of NO<sub>x</sub> [EPA]. Each car is assumed to emit 0.06 g/mile of PM per year [EPA]. "Nox" above includes NO<sub>x</sub>, NMOG/NMOC's and CH<sub>4</sub> emissions... all ozone precursors. Ave. car assumed to run 21,000 mi/yr.

# ADVANCED FUEL CELL BUS PROGRAM



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- Team developed and produced Hybrid-Electric Buses
- Superior efficiency and range over “standard” buses



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- Incorporates most advanced fuel cell power system
- Commercial product
- Provides commercial path for transit buses and fleet vehicles

**PureMotion™ 120**

# 40' Fuel Cell Bus – In service

- AC Transit Official Grand Opening March 13, 2006
- All buses are in revenue service

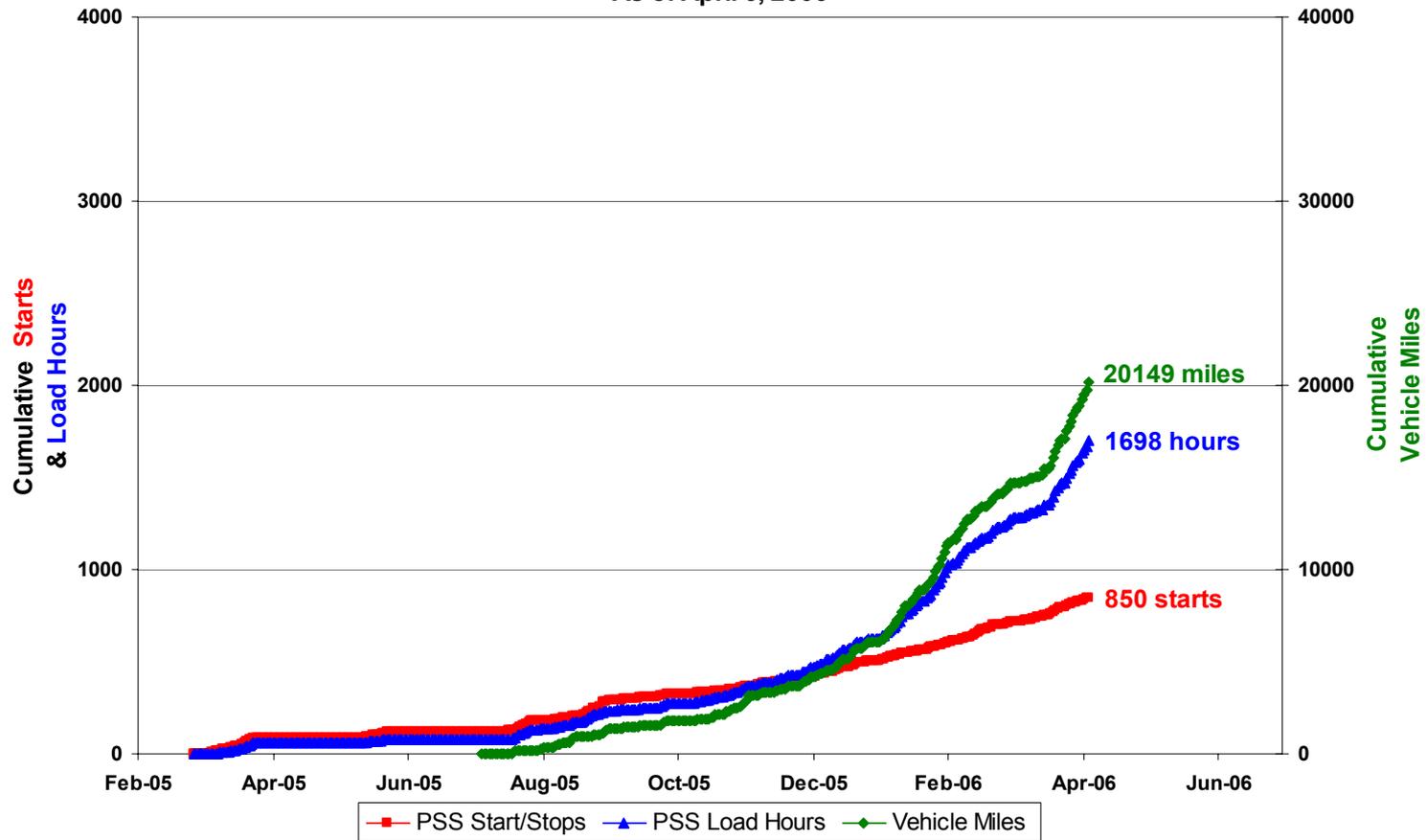
***"Our new hydrogen hybrid fuel cell bus has surpassed our expectations for a zero emissions transit bus. We have treated the bus as a commercial unit and put it in full service Lines that operate up to 16 hours and over 250 miles per day. Our most pleasant surprise is the superb fuel economy that has been seen in the preliminary stages of operation".***

***C. Mikel Oglesby  
General Manager  
SunLine Transit***



# PUREMOTION™ 120 FLEET UPDATE

PureMotion™ 120  
Bus Fleet Summary  
As of April 6, 2006



# 40' Transit Bus Comparison



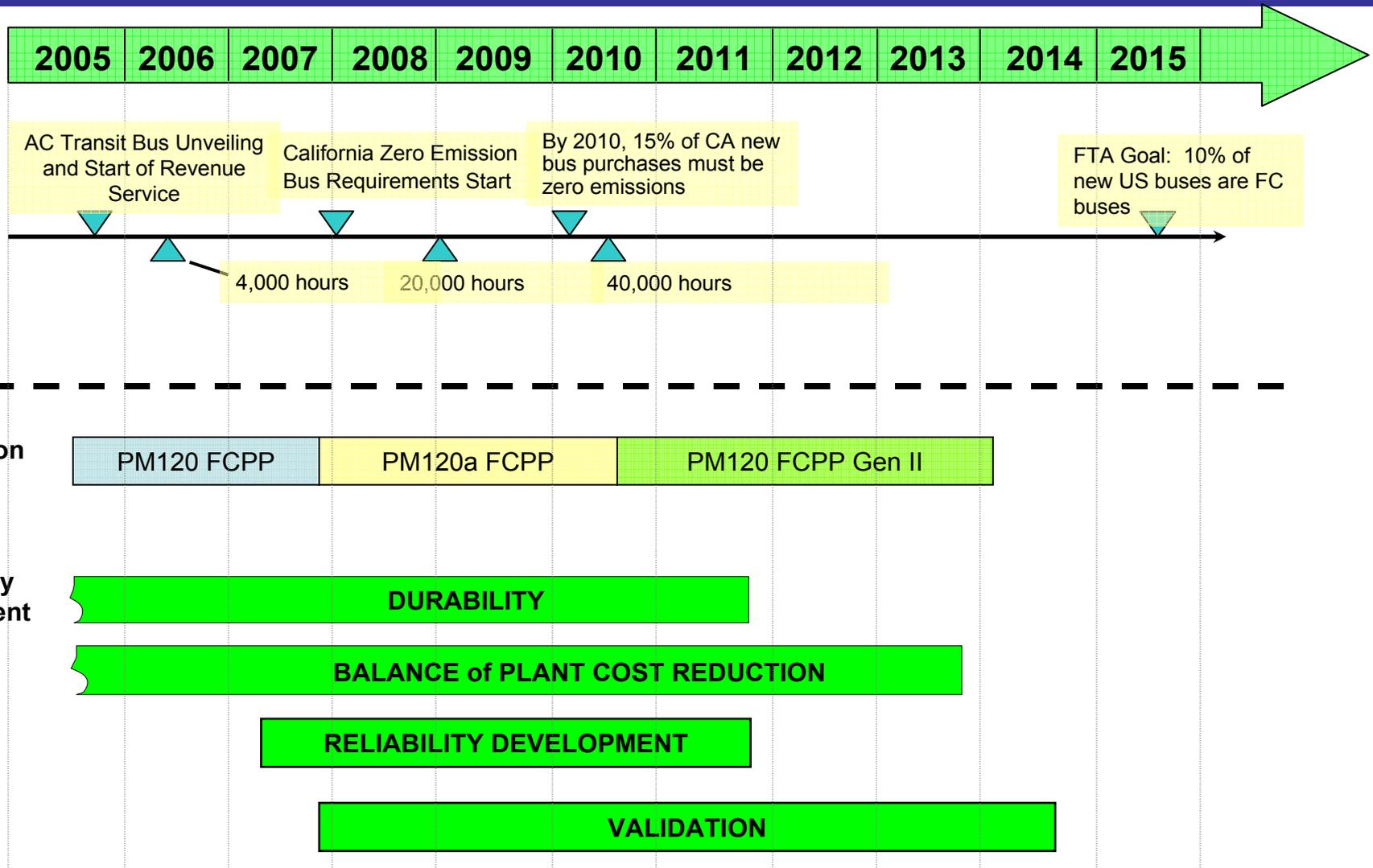
PARAMETER	VanHool A330 FC Bus *	DIESEL BUS
Acceleration (0-30)	15 sec	20 sec
Acceleration (0-50)	36 sec	31 sec
Weight	36,000 lbs	29,000 lbs
Interior Noise (Stopped)	56 dB	72 dB
Interior Noise (50 MPH)	69 dB	78 dB
Fuel Consumption	7.6 mpg	3.7 mpg

\* Preliminary Data from AC Transit/Sunline Transit

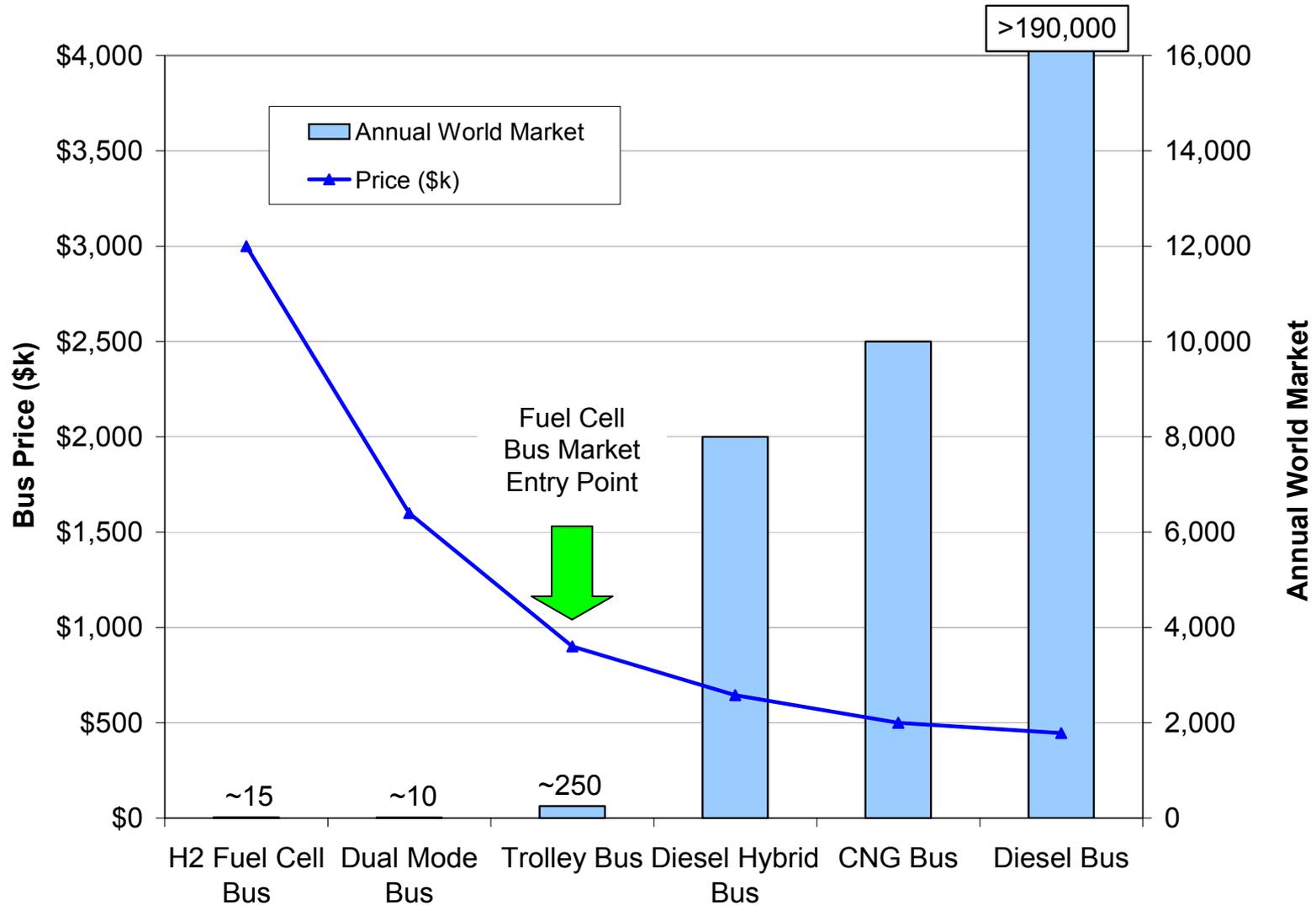
# PUREMOTION™ 120 – Fuel Economy Comparison

Vehicle	Fuel savings over diesel	Fuel Economy	Comments
Allision Diesel Hybrid – 60'	20% - 43%	3.2 – 3.8 mpg	Seattle
Conventional diesel – 60'	-	2.5 mpg	Seattle
New Flyer Gas Hybrid – 40'	-	3.1 mpg	OCTA
New Flyer Diesel Hybrid – 40'	-	4.1 mpg	OCTA
AC Transit Fleet Average		4.0 mpg	AC Transit (5/04 – 5/05)
SunLine Fuel Bell Bus	-	7.6 mpg	Palm Desert

# Bus/Fleet Technology Roadmap



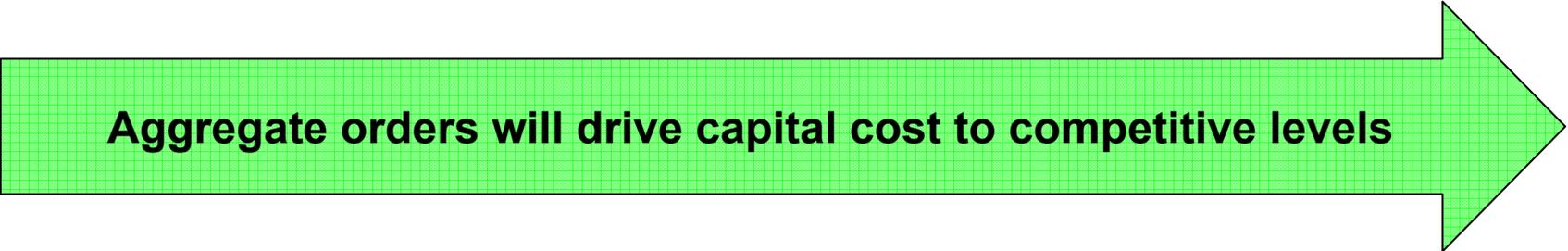
# Bus / Fleet Markets



# Zero Emission Bus Commercial Fleets

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- **Zero Emission Fuel Cell Hybrid buses lower total life cycle costs**
  - **Efficiency, lower fuel costs**
  - **lower maintenance costs**
- **Commercial business case with competitive capital cost**
- **Zero emission standards needed to drive larger orders resulting in lower capital cost**



**Aggregate orders will drive capital cost to competitive levels**

***100 + buses will drive bus cost to \$1M***



# Summary

- UTC is a leader in bringing products to commercial market – continued investment
- The PureMotion™ 120 is available - commercial product
- Superior efficiency results in lower total life cycle costs, supporting business case for commercial fleets
- Zero emissions standards needed to drive fuel cell buses into transit fleets
- Aggregate bus orders will make fuel cell buses cost competitive with “standard” technologies

