… FROM CONCEPT TO PRODUCTION

Quantum Hydrogen Prius

Andris R. Abele
Executive Director, Strategic Development

ARB ZEV Technology Symposium
Sacramento, CA
September 25-27, 2006

QUANTUM TECSTAR

Why Hydrogen and HICE?

- Enable energy diversity
  - Hydrogen production from a variety of sources, including renewables
- Low tailpipe emission potential
  - Virtually no HC's, CO, CO_2, and PM
  - Low NO_x potential
- Cost-effective
  - Relative to fuel cells
- Near-term technology availability
  - Now, not 10 years from now

HICE Added Benefits

- “De-mystification” of hydrogen
  - Familiar technology in familiar vehicles
- Lay public education
  - Technology and vehicle transparency
- Permitting authorities familiarization
  - Facilitation of hydrogen C&S, based on mature technologies

SCAQMD HICE Vehicle and H_2 Infrastructure Program

- Objective: To demonstrate the viability of hydrogen as a vehicle fuel in conjunction with hydrogen fueling stations
- RFP released July 11, 2003
- Award to Quantum approved March 5, 2004
- First 5 vehicles to AQMD for evaluation in Q3 2005
- Deliveries of 25 vehicles to 5 cities completed in Q2 2006
  - Burbank, Ontario, Riverside, Santa Ana, Santa Monica
  - Scheduled as H_2 refueling stations were completed
- Training of representatives from AQMD and all City staff completed

QUANTUM TECSTAR

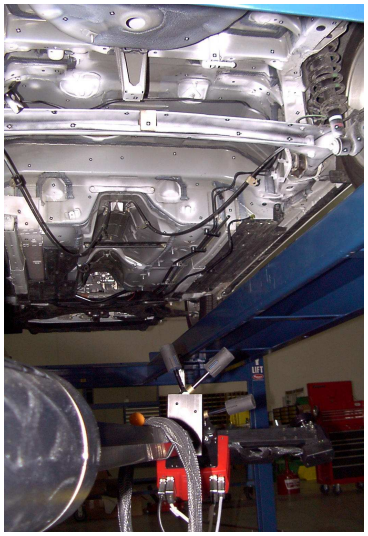
Performance Targets

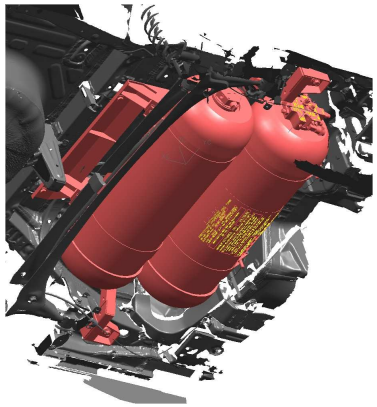
- Drivability
  - Similar to base gasoline
- Cargo Capacity
  - Interior space unchanged from production vehicle
- Refueling
  - Compressed gas coupling installed in gasoline fill cup area
  - SAE compliant
- Emissions
  - SULEV
  - Negligible CO_2 emissions
- Range
  - Compressed H_2 ~ 60-80 miles

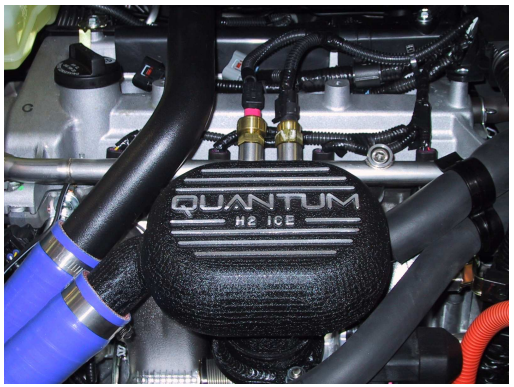
Verification Testing

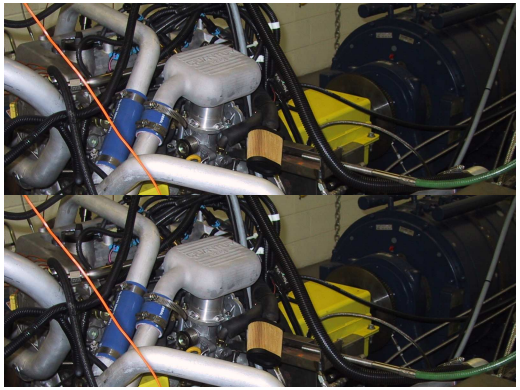
- Mileage Accumulation
  - 10,000 miles
  - Highway / City Driving Cycle
- Engine Durability
  - 200 hour accumulation
- Barrier
  - No current federal requirements exist for hydrogen fuels
  - FMVSS 303 for compressed natural gas as appropriate
    - Front, Rear Moving and Side Move barrier hits

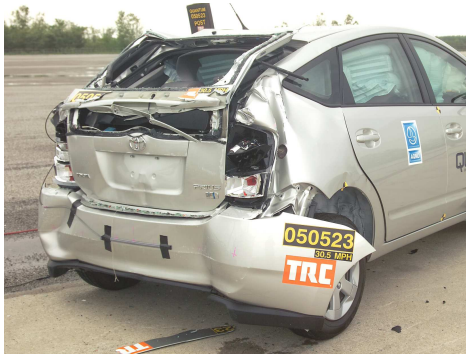
HICE – What does it take?

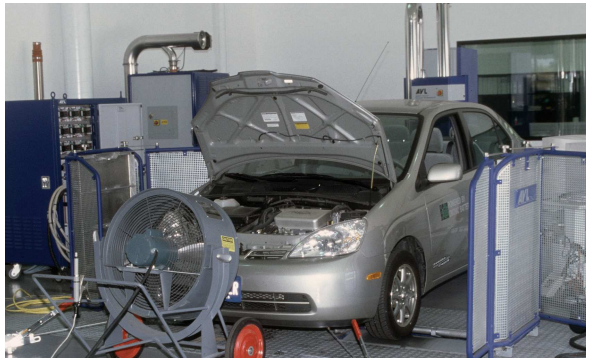


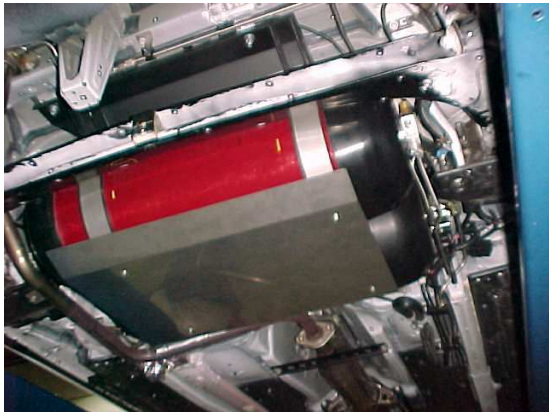












QUANTUM TECSTAR

Interest Increasing Worldwide

H_2 Prius Count

- AQMD: 30
- eVermont: 1
- LLNL: 1
- American Wind Power (NY): 2
- HyNor (Norway): 15
- ARB: 4
- Stay tuned: ?

What's Next?

- Extended range package for H_2 Prius
  - Additional tank to increase range to >100 miles
- H_2 Ford Escape Hybrid
  - Concept under development for US Army National Automotive Center
- H_2 PHEVs

QUANTUM TECSTAR

Challenges for HICE

- Liquid vs. gaseous fuels
  - E85 – a domestic renewable alternative fuel receiving significant attention
  - Will hydrogen be more accepted as a gaseous alternative fuel than CNG or LPG?
- Hydrogen safety
  - Perceptions … misperceptions
- Range – What is acceptable?
- Niche or potential volume - finding the market
  - Moving beyond government fleets?
- Is being a “transitional” technology good enough?
  - Corporate investment for a niche, short-lived technology?

In Summary

- Over 30 H_2 Priuses in operation
  - Extensive testing completed
  - In use experience growing
  - Inquiries from around the world continue to come in
- Refueling infrastructure being implemented to support HICE and FC vehicles
- Challenges remain
  - Cost (limited production)
  - Range (maintain passenger and storage capacities)
  - Warranty (base vehicle impact)

QUANTUM TECSTAR

Special Thanks

- To the South Coast AQMD for its foresight, leadership, and funding support to turn a concept into reality – a reality that has caught the interest of hydrogen programs worldwide.

… FROM CONCEPT TO PRODUCTION

QTWW.COM

Nasdaq: QTWW

QUANTUM TECSTAR