



An Energy Efficiency Workshop & Exposition

Palm Springs, California

Denver's 16th Street Mall
A Public Transportation Success Story

Featuring TransTeq & Denver's RTD

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TransTeq

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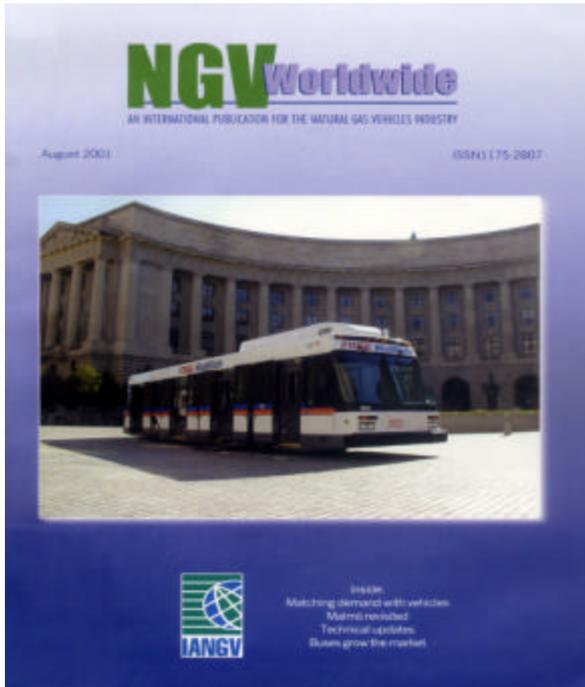


TransTeq *An Introduction*

- **World's Largest Fleet Of Heavy Duty Hybrid Electric Vehicles, 36 Vehicles for Denver's RTD**
- **Not Just A Concept, Serving 60,000 Passengers Daily, Operating In Brutal 75 Second Headways, 18 Hour Days, In Altitude And Temperature Extremes**
- **Featured In American Environmental Review, A PBS Show Hosted By Morely Shafer, For Innovation And Advances In Public Transportation**
- **Vehicles Designed and Manufactured For LAX in 2002**



TransTeq *An Introduction In Pictures*



FTA BRT Meeting, Washington, D.C.



In Service, Denver, Fall 2000

June 2-5, 2002

www.energy2002.ee.doe.gov

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Global Transportation Challenges

- **Ease Urban Congestion**
- **Lessen Dependence on Oil**
- **Improve Air Quality**
- **Improve Service to Passengers**
- **Increase Utilization of Public Transportation**
- **Stimulate Economic Vibrancy**

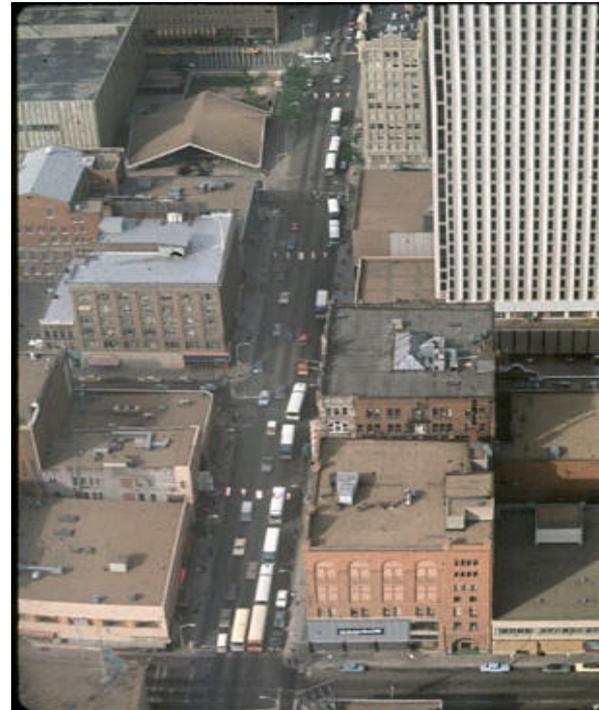
Denver's Solution...

**The 16th Street Mall – A Transit Pedestrian Mall
Providing Transportation & Economic Solutions**



Denver Pre-16th Street Mall A Depressed Downtown

- ❑ **Circa 1977**
- ❑ **Traffic Congestion
During Rush Hours**
- ❑ **Diesel Buses**
- ❑ **Limited Pedestrian
Traffic During Day**
- ❑ **Streets Vacated After
Dark**
- ❑ **Office Vacancy Rate
Leading the Nation**





Transformation

- ❑ **Community Leaders Join With Denver RTD To Develop Mall in 1977**
- ❑ **Downtown Denver Partnership, An Urban BID, Begins In 1978**
- ❑ **I. M. Pei Hired To Design Mall**
- ❑ **Cost of \$76 Million**





Early Operations



- **Mall Opens in 1982 – Much Fanfare**
- **Riders Average 15,000 Per Day**
- **RTD’s Hub Route Eliminated Over 300 Downtown Crossings**
 - Market Street & Civic Center Stations for Arterial & Commuter
 - Mall Vehicles
 - European Airport Design
 - 70 passenger capacity
 - Mostly Diesel powered, 4 Battery
- **Provided Future Connectivity For Multi-Modal Transit Expansions**
 - Four Light Rail Lines, BRT and Union Street Station (Rail)



Phase II Vehicle Dilemma Circa 1997

- **Improve Vehicle Capacity from 70 to 116**
 - Lighter Vehicle for Higher Payload
- **Unload and Board 116 Passengers in 20 seconds**
 - Four doors for Passengers
 - Level and Flat Floor
- **Utilize Compressed Natural Gas Fuel**
- **Deliver 20+ Hour Operating Range**
- **Right Hand Steering For Safety**
- **Utilize Hybrid Electric Drive Train**
- **Industry Response – No Bid, Not Possible**



TransTeq Solution White Paper Design Solution

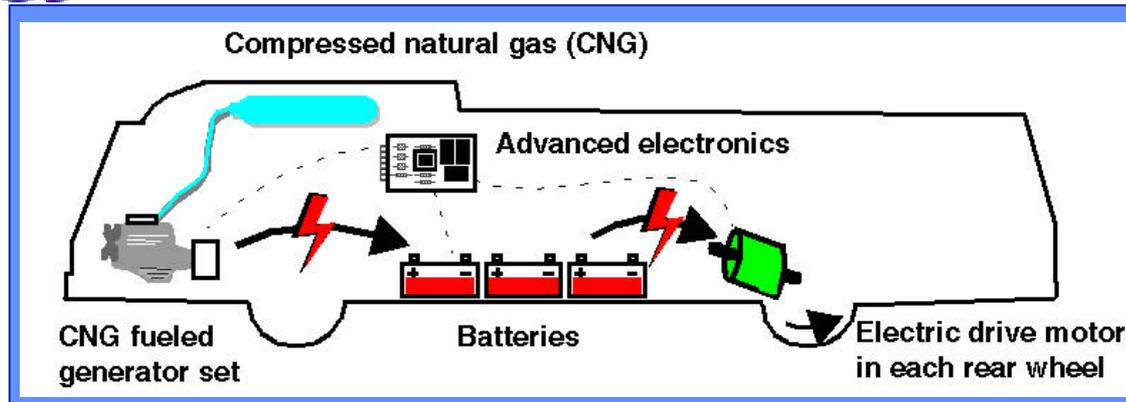
- **Best In Class Deliverables**
 - **Passenger Service**
 - **Life Cycle Costs**
 - **Emissions**
 - **Operating Ease**

- **TT Core Competencies**
 - **Adaptive, Series Hybrid Technology**
 - **Innovative Vehicle Design**
 - **Speed to Market**
 - **Political Awareness**





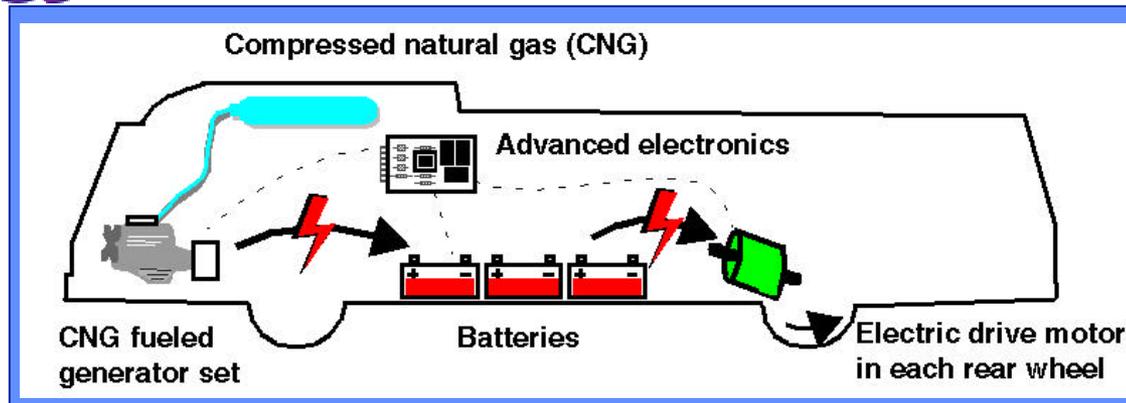
TransTeq's Hybrid Technology Benefits Today and Tomorrow



- ◆ Series HEV - Electric Vehicle With On-Board Battery Charger
- ◆ Zero Emission Capability – Run With The Engine Off
- ◆ Engineered For Alternative And Developing Technology
 - ◆ **Fuel Cells Included!**
- ◆ Minimizes Risk to Technological Obsolescence



TransTeq's Hybrid Technology Efficient Energy Management



- CNG fueled, 70 hp, four cylinder industrial ICE, provides electricity to charge pack of 26 lead acid batteries
- DC Electric Motors deliver 440 hp to drive wheels electrically
- Advance Electronics Controls and Manages Energy Creation, Storage & Use
- Captures Energy Normally Lost During Idle and Braking
- Eliminates the “Black Cloud Of Acceleration”



Innovative Approach Adaptive Vehicle Design

“Ride Like A Train, Update Like A Plane”

- **Patented series hybrid propulsion technology**
 - True Electric Vehicle Operation
 - Drive By Wire, High Voltage Systems
 - Integrated Advanced Control Electronics

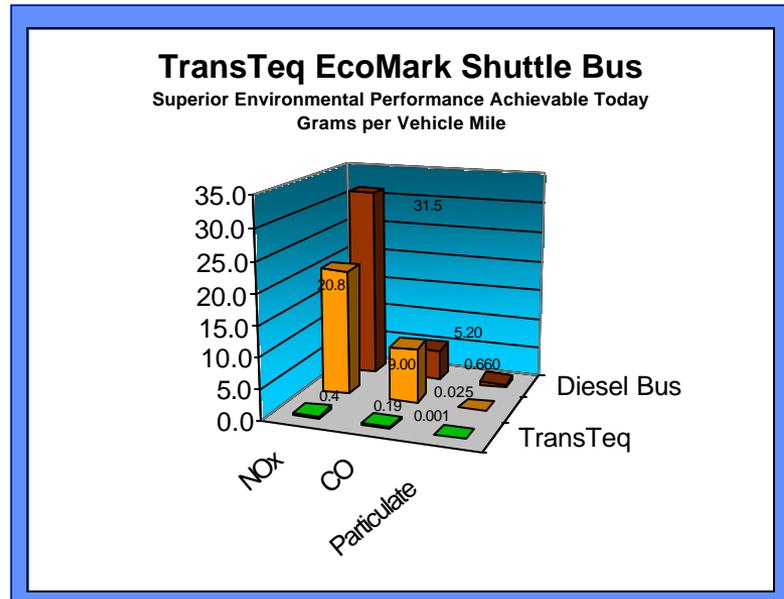
- **Fuel, Power Creation and Energy Storage Neutral**
 - Embraces Developing Technology
 - Accommodates Operator Preferences/Infrastructure

- **Lightweight, High Capacity, Stainless Steel Space Frame**
 - Lower Weight, Long Life
 - Ability to “Re-Skin”



Environmental Performance Why Wait?

- **Adaptable to All Urban Vehicles**
- **Fuel Neutral**
- **Most Out of Fuel, Least Into Air**
- **Favorably Compares Wellhead to Wheel**
- **Zero Emission Capable**



Sources: Tests performed on TransTeq 2.5 liter Ford LRG-425 engine May, 1999 by Colorado State University at its Engines & Energy Conversion Laboratory representing optimal performance. Comparative data obtained from SAE technical paper, Natural Gas and Diesel Transit Bus Emissions, 1997. Orange bars are CNG bus.



TransTeq Leadership In Hybrid Technology



The EcoMark Bus Carries 116 Passengers with only a 70 HP Engine

	Toyota Prius	Honda Insight	TransTeq EcoMark
Engine Power	70 HP	68 HP	70 HP
Hybrid Type	Parallel - Gas	Parallel - Gas	Series - CNG
Curb Weight	2,765 lbs	1,847 lbs	25,300 lbs
Gross Weight	3,650 lbs	2,200 lbs	42,700 lbs
Passengers	5	2	116



Impact of 16th Street Mall Now No. #1 Tourist Destination



- **Improved Air Quality**
 - Non-Attainment Status Addressed
- **Increased Public Transportation**
 - Last Mile Solved! Riders Grow From 15,000 To Over 60,000 Per Day
- **Real Estate Investment Soars**
 - Over \$1 Billion in 20 Years
- **Urban Vibrancy Returns**
 - Professional Sports, New Stadiums, Return Downtown
 - Residential Growth
 - Place To Go After Dark



Next Applications & Markets *LAX, National Parks, BRT*

- **BRT, Bus Rapid Transit, Combining The Best of Light Rail and Bus Services**
 - Not just a vehicle, but a complete transportation solution
 - Rail-like service with flexibility and significant cost advantages
 - Dispel the bus image of dirty, slow & noisy
 - Utilize technological and roadway design improvements
- **Major FTA Effort To Develop Vehicles Underway**
 - Legal and Political Issues Open For TEA 3
 - Buy America, Testing Requirements, Foreign Government Funded Vehicles

