Presentation Outline

- DART Overview
- Bus Fleet Summary
- AFV Deployment & Capital Investment [CNG Fuel / Electricity]
- CNG & BEB Charging Infrastructure(s)
- Electric Bus Program – Performance Experience
- Implementation – Bus Operations / Training
- Future Fleet Outlook

Presented By:
Darryl E. Spencer, P.E.
Sr. Assistant Vice President, Engineering
Dallas Area Rapid Transit (DART)

Mon., Jan. 13, 2020
684 buses

163 LRVs

4 streetcars

256 Miles & 64 Stations

64 Million passenger trips/year

Fleet

Assets ($5.5B)

Infrastructure

Operating Profile
### DART Bus Fleet Summary

<table>
<thead>
<tr>
<th>Fuel Type</th>
<th>Total Qty</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>26’ CNG</td>
<td>115</td>
<td>17%</td>
</tr>
<tr>
<td>30’-40’ CNG</td>
<td>475</td>
<td>69%</td>
</tr>
<tr>
<td>40’ Transit CNG (2019 Delivery)</td>
<td>41</td>
<td>6%</td>
</tr>
<tr>
<td>40’ Suburban CNG</td>
<td>46</td>
<td>7%</td>
</tr>
<tr>
<td>35’ Electric</td>
<td>7</td>
<td>1%</td>
</tr>
<tr>
<td>Total (ALL) (Clean Fleet)</td>
<td>684</td>
<td>100%</td>
</tr>
</tbody>
</table>
AFV Service Deployment & Capital Investment [CNG Bus Fleet]

In-Service CNG Fleet Deployment: Oct. 2012

CNG Bus Fleet Miles Logged: 153,892,445 Miles

CNG Bus Fleet Capital Investment: $315 Million

Added: Forty-One (41) 2019 CNG Urban Transit Buses

Supply Cost of CNG:

- **Contract Term:** Apr., 2010 to Sept., 2020
- **Awardee:** Texas General Land Office (GLO)
- **Contract Value:** $86.3M
- **Fuel Cost:** $7.36/MMBtu
- **Fuel Cost(2):** $0.97/DGE

CNG National Average: $2.17
Texas CNG Average: $2.02
The Texas General Land Office

GLO manages an Oil and Natural Gas program and a state Electric Power Program.

$86,389,758 / 10-year CNG Fuel Contract

**Electricity rates** per kWh are budgeted at $0.06740.
- $11.34 kWh/car mile consumption rate for light rail vehicles (LRV).
- $2.20 kWh/bus mile for the Battery Electric Bus average.

*Electricity Contract extension from 2019 through 2023*
**Infrastructure Design/Build**

- **4 facilities**
  - Compressors/Dispensers
  - Methane Detection/Alarms

- **Transtar Energy Company, LP**
  - ~$40.4M

- **Design & Construction of CNG fuel stations & facility modifications**

- **Startup – 10/2012**
<table>
<thead>
<tr>
<th>Description</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bus Manufacturer's Contract</strong></td>
<td></td>
</tr>
<tr>
<td>7 - Proterra EcoRide™ V2 35ft Transit Buses</td>
<td>$6,995,047</td>
</tr>
<tr>
<td>4 – Chargers:</td>
<td></td>
</tr>
<tr>
<td>(2) In-Route/Overhead &amp; (2) Facility/Shop</td>
<td>$810,000</td>
</tr>
<tr>
<td>Training &amp; Spare Components</td>
<td>$191,051</td>
</tr>
<tr>
<td><strong>Total Proterra Contract</strong></td>
<td><strong>$7,996,098</strong></td>
</tr>
<tr>
<td><strong>Project Support Contracts</strong></td>
<td></td>
</tr>
<tr>
<td>Engineering Support (Design)</td>
<td>$148,396</td>
</tr>
<tr>
<td>4 - Charger Installs (Construction)</td>
<td>$1,013,000</td>
</tr>
<tr>
<td><strong>Total Project Budget</strong></td>
<td><strong>$9,157,494</strong></td>
</tr>
</tbody>
</table>
Customer Experience: Passengers think the vehicles are Great! Enjoy the Roominess of the Interior layout and the A/C system.

Vehicle Reliability
- 70% (5 of 7) Average Availability → 143K Fleet Miles
- Refresher Training Planned
  - HVAC, PMI, Doors, and Electrical Systems Training

Overhead Fast Chargers Exp.: Various Chargers (A/B) Intermittent Faults.
(A = 56/28 Average per Month || B = 42/10 Average per Month)

Plug-In Depot Chargers: OEM Upgrade Completed.
**TRAINING, OPERATORS [BUS OPS]**
- Train-the-Trainers [8]
- Operators Trained [110]
- Field Supervisors [5]

**TRAINING, MECHANICS**
- SOC Bus Mechanics [43]
  - Central Support [10]
- On-Route Charger
  - TES (Traction Electrification Systems) Mechanics [37]

**Special Tools**
- Tow adapters / Laptops

**PPE (Personal Protection Equipment)**
- Insulated tool sets for work on the E-Bus.

**Spare Parts / Inventory [115 Line Items]**

**Contract Spare Parts [22 Line Items]**

**Manuals [Technical Publications]**
- Operators ▲ Parts ▲ Maintenance

**Charging Station Commissioning**

**Maintenance Templates [PMI]**

**Bus Make-Ready / Marketing & Communication**

**Bus Deliveries / In-Service Deployment**

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Readiness Review [Electric Bus Program]
<table>
<thead>
<tr>
<th>Year</th>
<th>OEM</th>
<th>Length (ft.)/Passenger Seats</th>
<th>Bus Qty</th>
<th>Fuel Type</th>
<th>Unit Cost (Yr. Purchased)</th>
<th>Replacement Year [Programmed]</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-2016</td>
<td>ARBOC</td>
<td>26/17</td>
<td>28</td>
<td>CNG</td>
<td>$220K</td>
<td>2021</td>
</tr>
<tr>
<td>2017</td>
<td>ARBOC</td>
<td>26/17</td>
<td>73</td>
<td>CNG</td>
<td>$220K</td>
<td>2022</td>
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<tr>
<td>2018</td>
<td>ARBOC</td>
<td>26/14 26/17</td>
<td>14</td>
<td>CNG</td>
<td>$172K / $220K</td>
<td>2023</td>
</tr>
<tr>
<td>2013</td>
<td>NABI</td>
<td>31/26 40/37</td>
<td>186</td>
<td>CNG</td>
<td>$435K / $460K</td>
<td>2025</td>
</tr>
<tr>
<td>2014</td>
<td>NABI</td>
<td>31/26 40/37</td>
<td>183</td>
<td>CNG</td>
<td>$435K / $460K</td>
<td>2026</td>
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<tr>
<td>2015</td>
<td>NABI</td>
<td>40/37</td>
<td>106</td>
<td>CNG</td>
<td>$467K</td>
<td>2027</td>
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<tr>
<td>2016</td>
<td>New Flyer (Express)</td>
<td>40/39</td>
<td>46</td>
<td>CNG</td>
<td>$513K</td>
<td>2028</td>
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<tr>
<td>2018</td>
<td>Proterra</td>
<td>35/27</td>
<td>7</td>
<td>Electric</td>
<td>$971K</td>
<td>2030</td>
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<tr>
<td>2019</td>
<td>New Flyer</td>
<td>40/37</td>
<td>41</td>
<td>CNG</td>
<td>$527K</td>
<td>2031</td>
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<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>684</strong></td>
<td></td>
<td></td>
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<tr>
<td>Small MD Shuttle Bus</td>
<td>Heavy Duty 40’ Bus</td>
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<tr>
<td><strong>Battery Electric</strong></td>
<td><strong>Battery Electric</strong></td>
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<tr>
<td>□ Cost Est: $150-300K</td>
<td>□ Cost Est: $750-850K</td>
<td></td>
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<tr>
<td>□ Range: 80 – 150 miles</td>
<td>□ Range: 175 – 250 miles</td>
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<tr>
<td><strong>Hydrogen Fuel Cell Electric</strong></td>
<td><strong>Hydrogen Fuel Cell Electric</strong></td>
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<tr>
<td>□ Cost Est: N/A</td>
<td>□ Cost Est: $1.25M</td>
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<td>□ Range: N/A</td>
<td>□ Range: 225 – 300 miles</td>
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<tr>
<td><strong>CNG</strong></td>
<td><strong>CNG</strong></td>
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<tr>
<td>□ Cost Est: $190-250K</td>
<td>□ Cost Est: $625-650K</td>
<td></td>
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<td></td>
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<tr>
<td>□ Range: 250 miles</td>
<td>□ Range: 400 miles</td>
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</tbody>
</table>
DART Principles

DARTing to the Future...

Board Governance

DART Board Strategic Goals serves as our cornerstone commitment to operating a Clean Vehicle Fleet within the DFW Area and North Texas Region. DART has made a commitment to the Environment.

Technology Optimization

We continue to push the envelope for optimizing vehicle reliability and leveraging OEM continuous improvements within CNG fuel systems and BEBs technology. We have one of the most modern fleets in the industry.

Maintenance & Operators

National Recognitions

National & International skills performance competition achievements.
DART hired Uber to drive around riders. Now, it’s considering driverless buses

DART has joined a national consortium that will study the safety of driverless buses and how they could reduce congestion.

DART Sets Its Sights on Automated Buses

The Dallas area transit agency is partnering with other agencies to study driverless buses and their role in the future of transit systems.

By working together, the transit agencies aim to lower the cost of testing and share best practices, the news release said.

Dallas Area Rapid Transit is part of the Automated Bus Consortium, a group of transit agencies exploring the future of automated driverless buses, reports Melissa Repko.

"For the first 12 months, the consortium plans to study the feasibility of autonomous buses. It plans to buy an initial fleet of 75 to 100 full-sized, automated buses, which it will test in 2022 or 2023 on routes chosen by the transportation agencies," writes Repko.

DART, along with transit agencies across the country, is contending with ridership decreases.

With much of the agency's costs related to labor, DART officials see autonomous buses as a way to lower operations costs. The consortium approach will allow the agencies to work together to test the vehicles and lower purchase costs.

DART’s fleet of electric buses roll out in downtown Dallas

The seven new buses started running on DART’s free downtown service, the D-Link route, early this month.

The Dallas News | 2018-07-10 2pm | Melissa Repko | Editor, transit desk | @melissa_repko

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