



**Massachusetts Bay  
Transportation Authority**

# Bus Fleet Update

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Fiscal and Management Control Board

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# MBTA Bus Fleet Investments

MBTA Vehicle Engineering has procured buses over the last several years with advanced technology in an effort to improve fleet fuel economy, reduce greenhouse gas emissions, and improve the passenger experience.

Bus Fleet	Year	Quantity
New Flyer 60-ft Hybrid	2010	25
New Flyer 40-ft Hybrid (option)	2014	60
New Flyer 40-ft Hybrid	2016-17	156
New Flyer 40-ft CNG	2016-17	175
New Flyer 60-ft Hybrid	2016-17	44
New Flyer 60-ft Ext Range Hybrid	2018	1
New Flyer 60-ft Battery Electric	2019	5
New Flyer 40-ft Advanced Hybrid*	2019-2020	194
40-ft Advanced Hybrid**	Est. 2020	60

*\*MBTA Vehicle Engineering is in-process of taking delivery of this fleet*

*\*\*Potential procurement of additional buses using State of Virginia contract options*



# Advanced Hybrid Bus Fleets

Starting in 2010, the MBTA began procuring buses with diesel-electric hybrid technology to replace diesel fleets and will no longer purchase new diesel buses

- MBTA's current hybrid fleet includes **216 forty-foot** and **69 sixty-foot buses\***
- Diesel-electric hybrid technology is capable of **improving fuel efficiency ~30%**
- Hybrid technology and advancements in battery technology allow for **significant increases in zero-emissions (engine-off) operation** for extended periods of time, as well as geofenced operation
- 194 New Flyer 40-ft advanced hybrid buses to be delivered now (compared to diesel fleet) **reduce 2.8 million gallons of fuel used**, emissions of **greenhouse gases (GHG) by 41,000 tons**, emissions of **nitrogen oxide (NOx) by 28,000 tons**, and **fleet idle time by 900,000 hours** over the life of the fleet



*\*Additional hybrids are being procured 2019-2020 and will increase 40-foot hybrid fleet to 410 buses*

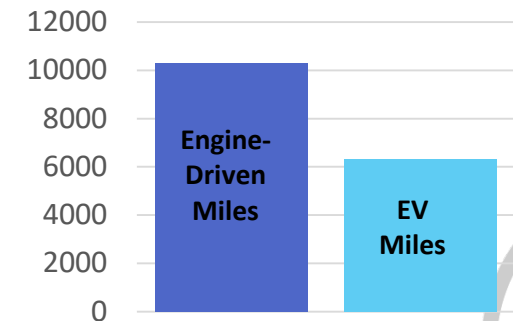
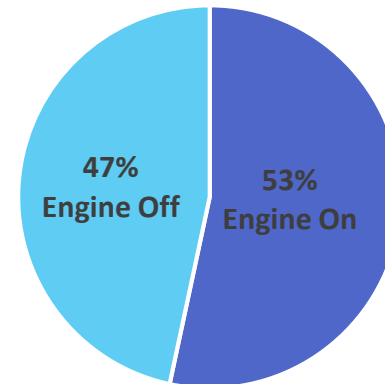
# Extended Range Hybrid Bus

Following successful deployment of hybrid buses in Boston, industry advancements in battery technology, and further optimization of hybrid technology, Vehicle Engineering executed an existing contract option with New Flyer for one 60-foot extended-range hybrid bus

- The extended range bus, with BAE Systems hybrid propulsion, has exceeded MBTA expectations and is operating in the Silver Line Transit Way Tunnel with zero emissions (engine off)
- Reliability and operating costs are comparable to existing MBTA hybrid fleet

Milestone	Date
Conditional Acceptance	9/21/2018
Testing Begins	September 2018
Testing/Evaluation	Ongoing
Operator Training Complete	December 2018
Entered Passenger Service	January 2018

Total Miles	Avg Speed (mph)	EV Miles (mi)	Engine Stops/Hr (#)	Engine Off (%)	Fuel Economy (mpg)
16654	9.2	6340	9.0	46.6%	4.85



*\*Data as reported by BAE Systems to date*

# Battery Electric Bus (BEB) Procurement

The Authority utilized a Federal Transit Administration (FTA) Low or No Emissions technology demonstration grant with a procurement of five 2019 New Flyer 60-foot BEBs

- Energy Storage System – 466 kWh capacity (estimated 125 miles under ideal conditions)
- Center drive axles (four-wheel drive) for safer and more reliable operation in winter conditions
- All electric accessories (including electric heat, power steering, compressed air, and thermal management)
- The MBTA is installing additional chargers to support ongoing evaluation of BEB vehicles in Silver Line service
- This prototype fleet will provide the MBTA with valuable insight into facility/infrastructure charging requirements, operational logistics, and issues/impacts due to varying local weather



Milestone	Date
Conditional Acceptance	5/10/2019
Testing Begins	May 2019
Testing/Evaluation	Ongoing
Operator Training	Ongoing
Entered Passenger Service	July 2019



# Battery Electric Bus (BEB) Expanded Bus Testing Program

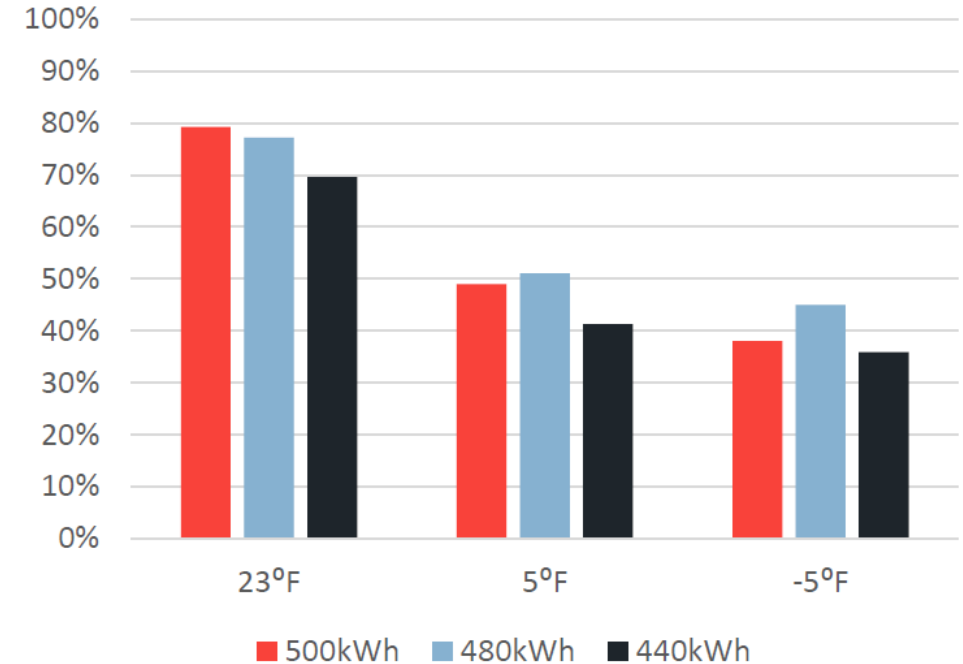
## BEB evaluation program in Boston:

- Request for Information (RFI) released to the industry August 2019
- Four-season BEB testing in Boston to include participation from several major North American bus builders
- Climate impacts to BEB vehicles and appropriate HVAC solutions (estimated 40% reduction in range due to heating demands)
- MBTA currently investigating industry available alternatives for passenger compartment heat

## Planning stages for BEB procurement with options:

- North Cambridge facility targeted for electrification (35 buses)

### Temperature Effect on Operating Range



*\*Based on North Cambridge bus route profiles and current industry vehicle offerings*



# Future Silver Line 60-foot Fleet

The MBTA's Dual Mode Articulated (DMA) fleet is aging and in need of a replacement to provide expanded Silver Line service, including operation in the zero-emissions Silver Line Transit Way Tunnel

- Current fleet of 32 buses beyond useful life by up to 4 years
- Increased fleet size to support current and future growth (evaluation of fleet size underway)
- Continued testing of extended range 60-foot hybrid and battery-electric buses
- Current contract options for 45 additional extended range hybrid buses available through December 2020
- Battery electric bus technology is rapidly maturing and will be evaluated alongside extended range hybrid technology through the 2019/2020 winter and spring months in the Boston operating environment
- Final fleet technology and size decision will be made by summer 2020
- Massport has committed to provide funds for half of the new vehicle replacement fleet
- The MBTA is coordinating with Massport to support expansion of Silver Line airport service, including evaluating options/benefits associated with available vehicle technologies



# Strategy: Upcoming Investment in MBTA Bus Fleet

MBTA Vehicle Engineering is evaluating future options for hybrid and battery-electric vehicle technology to support modernization of the bus network.

Bus Fleet / Program	Year	Quantity	Comment
40-ft Battery Electric	2020+	35+	Evaluation of BEB manufacturer offerings and performance
60-ft Replacement Fleet	2021-2022	45+/-	Available contract Option through December 2020
40-ft Next-Generation Fleet	2021-2024	TBD	Increased energy storage capacity, reduced emissions, modular design



Today

Battery Electric Bus Evaluation Program

60-foot Fleet Procurement

40-foot Fleet Procurement (Battery / Hybrid)





# MBTA Bus Fleet: Next Steps

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- Delivery of 194 advanced technology hybrid 40-foot buses complete by late summer 2020
  - Explore/optimize geofencing technology to maximize benefits of hybrid technology and reduce localized emissions
- MBTA exploring options for an additional 60 hybrid 40-foot buses through a Virginia state contract
- 25-bus hybrid 60-foot fleet overhaul Notice of Award (FMCB vote on 9/23/2019)
- Ongoing evaluation of extended range hybrid and battery-electric bus technologies
  - MBTA is reviewing major bus builder responses to RFI for a four-season battery-electric bus testing program in Boston
- Development of Technical Specifications for future 40-foot & 60-foot fleet procurements (includes Silver Line fleet replacement in 2021-2022)



# Appendix



# Current MBTA Bus Fleet

Bus Fleet	Year	Quantity
Neoplan 40-ft Electric Trolley	2004	28
Neoplan 40-ft Diesel	2004-2005	191
Neoplan 60-ft Dual Mode	2004-2005	32
New Flyer 40-ft Diesel	2006-2007	155
New Flyer 40-ft Diesel	2008	155
New Flyer 60-ft Hybrid	2010	25
New Flyer 40-ft Hybrid (option)	2014	60
New Flyer 40-ft Hybrid	2016-17	156
New Flyer 40-ft CNG	2016-17	175
New Flyer 60-ft Hybrid	2016-17	44
New Flyer 60-ft Ext Range Hybrid	2018	1
New Flyer 60-ft Battery Electric	2019	5

Bus Type	Total Quantity
Diesel 40-ft	501
Diesel 60-ft	32 (Dual Mode)
Diesel-Electric Hybrid 40-ft	216
Diesel-Electric Hybrid 60-ft	69
CNG 40-ft	175
Battery Electric 40-ft	28 (Trolley)
Battery Electric 60-ft	5 (BEB)
<b>TOTAL</b>	<b>1,026</b>



# 194 Hybrid 40-foot Procurement Schedule

Milestone	Date
Configuration Audit	July 2019
Pilot Bus Delivery	July 2019
First Production Bus Delivery	September 2019
Weekly Production Rate	3 - 6 buses per week
Last Production Bus Delivery	July 2020
Completion of 1-year Complete Vehicle Warranty	July 2021



# Battery Electric Bus Fleet Procurement Schedule

Milestone	Date
Bus 1 Conditional Acceptance (1295)	May 10, 2019
Bus 2 Conditional Acceptance (1296)	June 19, 2019
Bus 3 Conditional Acceptance (1297)	June 20, 2019
Bus 4 Conditional Acceptance (1298)	June 26, 2019
Bus 5 Conditional Acceptance (1299)	July 12, 2019

