



Massachusetts Bay Transportation Authority

Integrated Fleet and Facilities Plan (IFFP)

Part Three: Bus

December 4, 2017



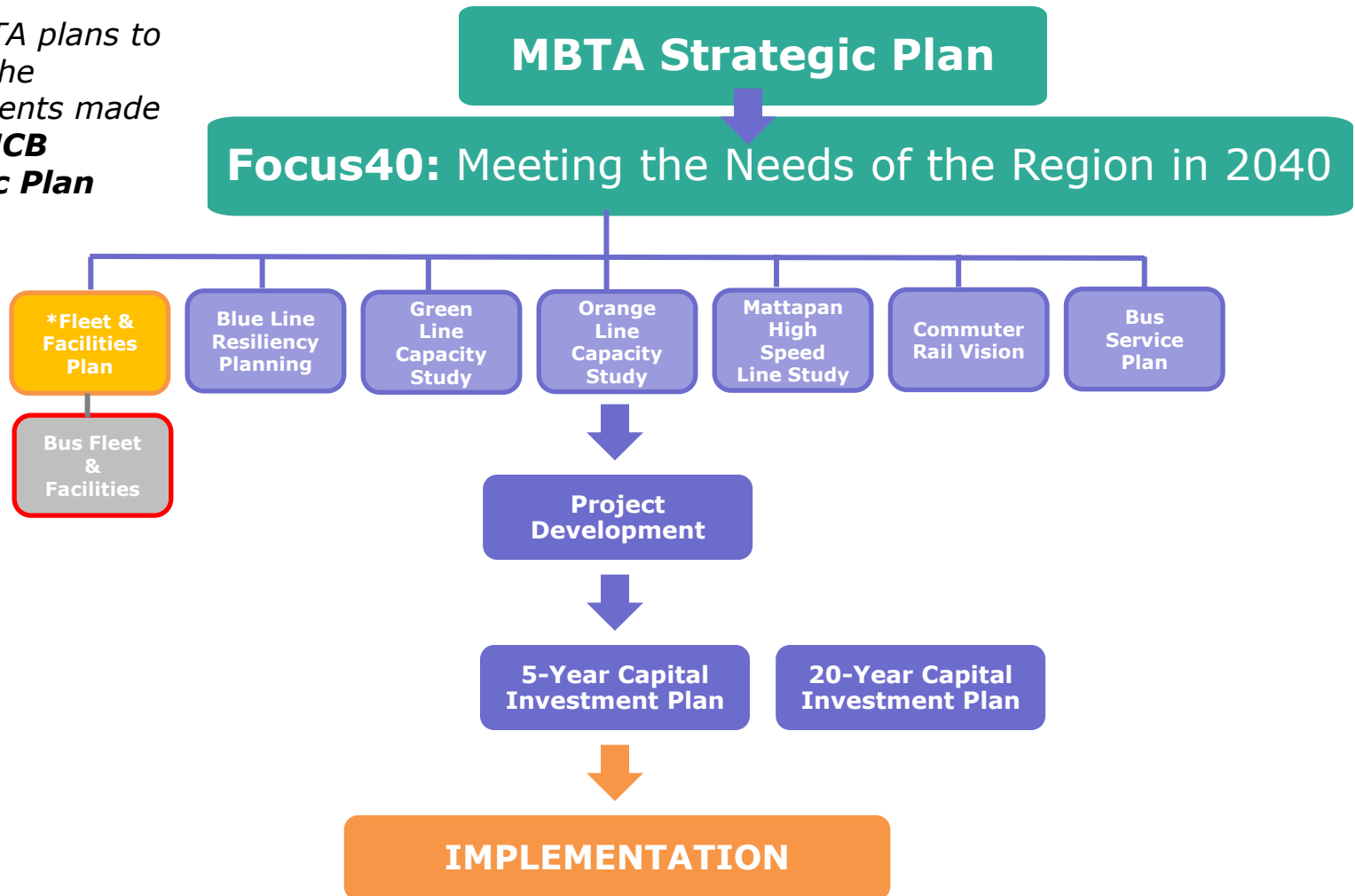
Goals of the Presentation

- General update on the state of the bus fleets and facilities
- Provide FMCB an update on Focus40 bus ridership projection and fleet growth methodology
- Highlight critical fleet and facilities investment needs
 - Opportunities for alternative procurement and financing
- Review of the next generation MBTA fleet – Zero / No emission goals



Aligned with MBTA Strategic Vision - Focus40 Planning

*The MBTA plans to execute the commitments made in the **FMCB Strategic Plan**



A row of five yellow and white CNG buses parked in a lot. The buses are viewed from a front-quarter perspective, receding into the distance. Each bus has a blue diamond-shaped logo with the letters 'CNG' on its front. The license plate of the bus in the foreground is '2040'. The background is a clear, light blue sky.

State of the Fleet & Maintenance Facilities



Inventory and Condition Approach

- Fleet and facilities inventory and condition assessment activities performed between January and March 2017
- Consistent with MBTA asset management plan and strategy (MAP-21)
- Physical assessments utilized the FTA 1-5 condition rating scale
- Report cards were prepared summarizing key findings for fleets and facilities

ASSET REPORT CARD - BUS

Neoplan, AN440 LF ECD	Property	MBTA		Average Rating:		3.6					
	Evaluation Year	2017									
	Delivered	2004 – 2005 (13yrs)									
	Est. Retirement	2018 – 2019 (15yrs)									
	Quantity	192									
	Last Overhaul	2015									
	Location(s)	Albany St / Fellsway									
Avg. LTD Mileage	304,108										
Asset Type	Fuel Type		Frame	Body	Ownership						
<input checked="" type="checkbox"/> Bus <input type="checkbox"/> Articulated Bus <input type="checkbox"/> Trolley Bus	<input checked="" type="checkbox"/> Diesel <input type="checkbox"/> Electric <input type="checkbox"/> CNG <input type="checkbox"/> N/A <input type="checkbox"/> Hybrid <input type="checkbox"/> Other:		<input type="checkbox"/> Carbon Steel <input type="checkbox"/> Stainless Steel <input type="checkbox"/> Aluminum <input type="checkbox"/> Other:	<input type="checkbox"/> Carbon Steel <input checked="" type="checkbox"/> Stainless Steel <input type="checkbox"/> Aluminum <input type="checkbox"/> Fiberglass	<input checked="" type="checkbox"/> Owned Outright <input type="checkbox"/> Lease <input type="checkbox"/> Contractor Owned <input type="checkbox"/> Other:						
Current Condition	Under-structure	Air System	Front Susp.	Rear Susp.	Vehicle Exterior	Service Doors	Passenger Area	Driver's Area	Engine		
	3.8	3.1	3.4	3.5	3.8	3.8	3.8	3.8	3.5		
<ul style="list-style-type: none"> • Vehicle fleet recently completed a major overhaul and buses are in fair to good condition 											
Reliability	Failures by Subsystem					Period: 2016					
	Air System	Brake System	Cooling	Doors	Elec. & Lighting	Engine	Fuel	HVAC	Steering & Susp.	Trans.	Body & Frame
9	6	16	8	3	83	1	1	7	9	14	7
Total Failures		164	Total Fleet Mileage 2016		4,247,348		MMBF	25,898			
<ul style="list-style-type: none"> • Engine reliability has suffered recently 											
Summary	<ul style="list-style-type: none"> • This fleet should be able to operate reliably in service until replacement vehicles are delivered in the 2018-2019 timeframe. 										

Ratings based on FTA SGR Standard

1 - Poor	2 - Marginal	3 - Fair	4 - Good	5 - Excellent
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PROJ1537:117B05



APRIL 2017



Inventory and Condition – Bus Fleet 40 ft

40' Bus Fleet



<i>Fleet</i>	<i>Age</i>	<i>Total Qty</i>	<i>Condition Rating</i>
Neoplan ECD	13	192	3.6
Neoplan ETB	13	28	3.4
New Flyer ECD	11	155	4.0
New Flyer ECD	9	155	3.0
New Flyer Hybrid	2	60	4.1
New Flyer Hybrid	1	150	5.0*
New Flyer CNG	1	175	5.0*
<i>Fleet</i>	<i>7.0</i>	<i>887</i>	<i>4.1</i>

- 40-foot fleet assessment excludes contingency fleet and hydrogen bus

- 325 New Flyer buses delivered in 2016-17 assumed as 5.0 “Excellent”

*Not physically evaluated



Inventory and Condition – Bus Fleet 60 ft

60' Bus Fleet

<i>Fleet</i>	<i>Age</i>	<i>Total Qty</i>	<i>Condition Rating</i>
Neoplan DMA	13	32	2.9
New Flyer Hybrid	7	25	2.8
New Flyer Hybrid	1	44	5.0*
<i>Fleet</i>	<i>6.3</i>	<i>101</i>	<i>3.8</i>

*Not physically evaluated

- DMA overhaul currently underway
- 25 New Flyer Hybrid overhaul in planning
- 44 New Flyer buses delivered in 2016-17 assumed as 5.0 “Excellent”





Inventory and Condition – Bus Facilities

Facility	Age	Capacity	Condition Rating
Albany	76	116	2.7
Arborway	13	118	3.1
Cabot	42	180	2.8
Charlestown (maint.)	42	254	2.0
Charlestown (storage)	42	-	2.5
Fellsway	92	76	2.4
Lynn	81	90	2.7
North Cambridge	38	28	3.2
Quincy	87	86	2.4
Southampton (maint.)	15	98	3.6
Southampton (storage)	13	-	3.1
Fleet	49	1046	2.8

- Most facilities are in marginal condition and are at or over practical capacity
- Some facilities also suffer from capability limitations, which impact efficiency

ASSET REPORT CARD - FACILITY

PROPERTY Address: 1171 GARDEN STREET City: Boston State: MA Zip: 02127 Last Occupied: 2022 (Year) Operated: 2022 (Year)		Average Rating: 2.7
UTILITIES Water: [X] Sewer: [X] Gas: [X] Electric: [X]		
SPACING Capacity: 116 Current: 116 Spare Capacity: 0		
CONDITION Overall: 2.7 Structure: 2.8 Equipment: 2.6		Spare Capacity - Building: 0 Spare Capacity - Yard: 0

• The overall condition of the facility is marginal. The facility is at or over practical capacity. The facility is at or over practical capacity. The facility is at or over practical capacity.



Inventory and Condition – Bus Facilities



- Poor layouts
- Uneven / Degraded floors
- Outdated Shop Equipment



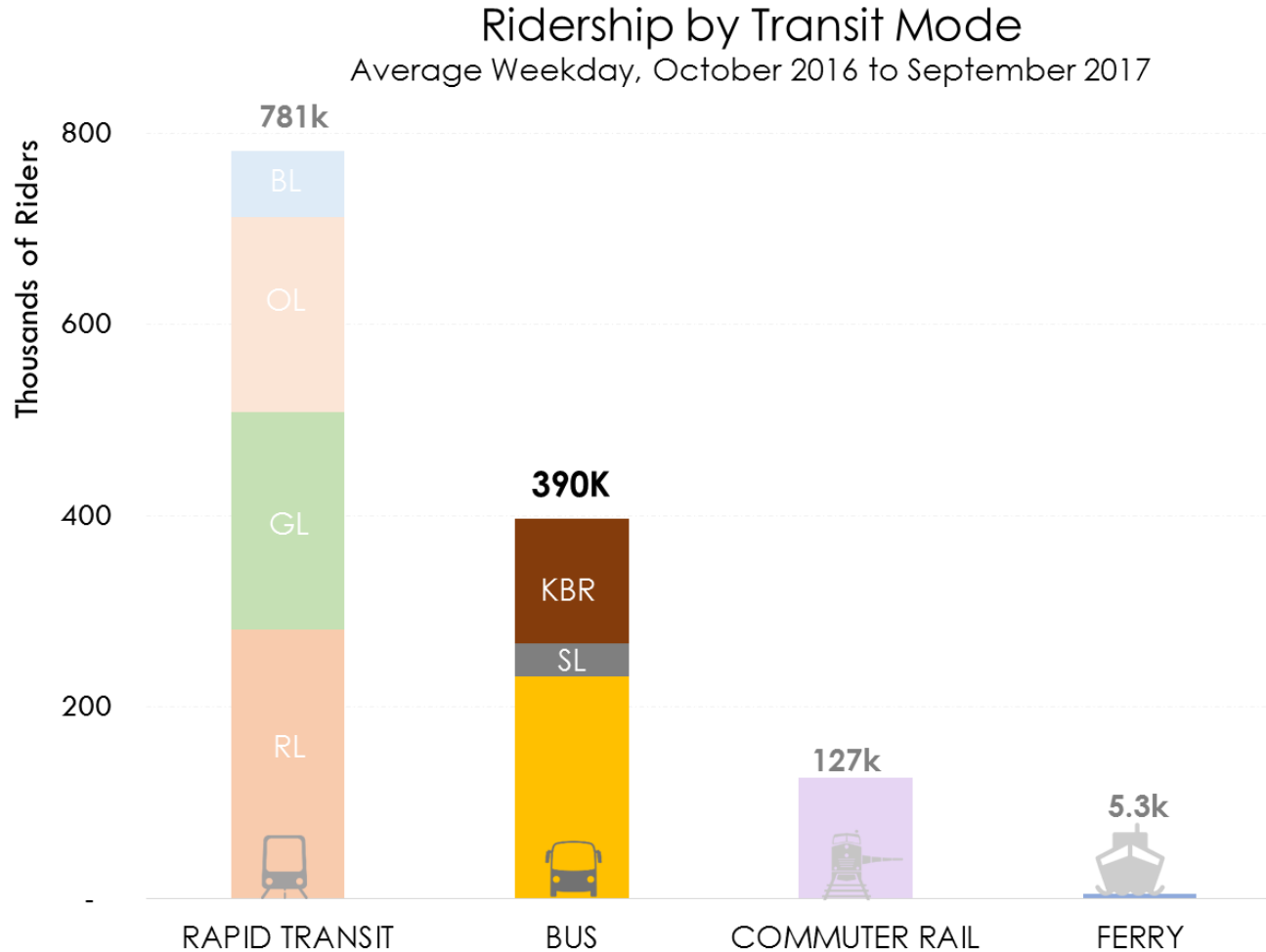
- Low roof restricts maintenance
- Door size restricts bus size
- Maintenance pits poor

Planning for the Future





Average Weekday Ridership by Mode



Draft

Source: MBTA Back on Track Data

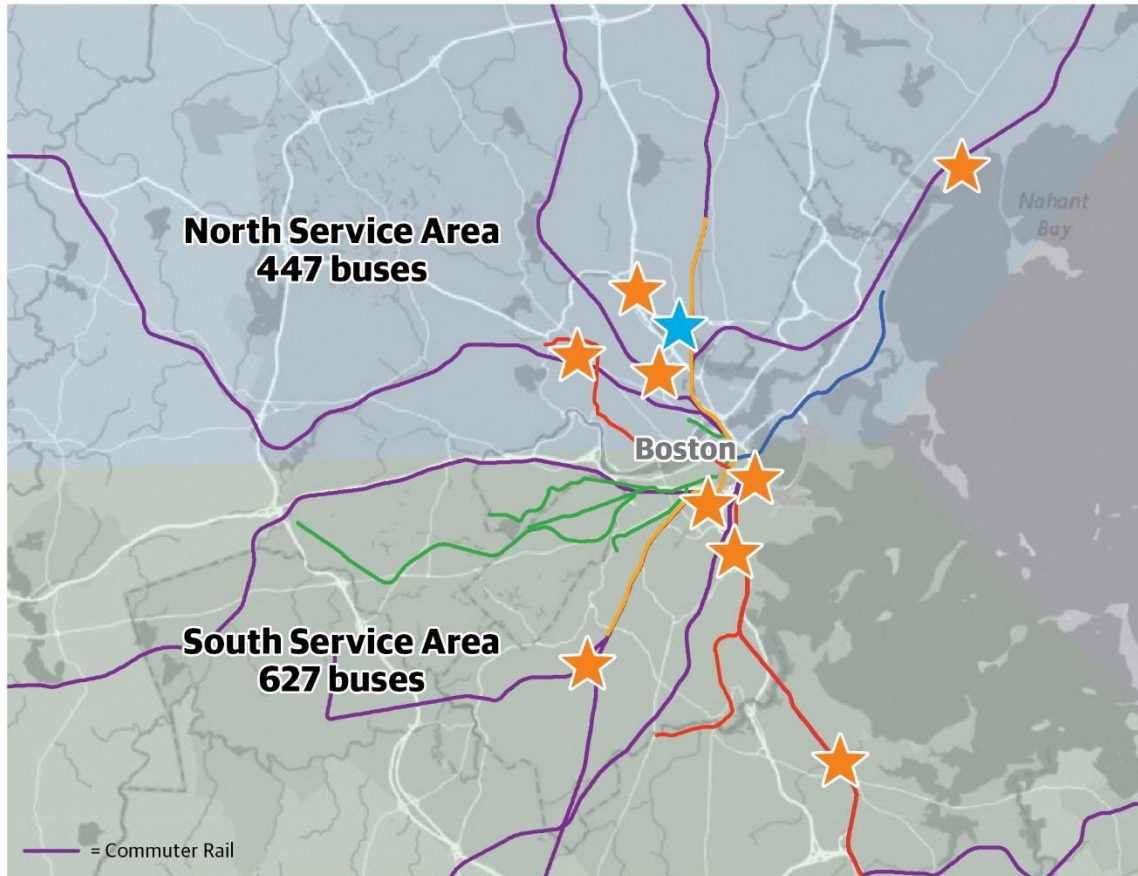


IFFP Key Planning Objectives and Actions – Bus

- Achieve State of Good Repair (SGR) in 15 years
- Modernize and build new maintenance facilities
- Replace the entire 40' and 60' bus fleet
- Expand the 40' and 60' vehicle fleet to satisfy projected increases in ridership
- Establish goals and timelines for moving toward a zero/no emission fleet
- Move toward long term procurements with scheduled annual deliveries
- Improve standardization and improve the versatility of the overall fleet
- Implement RCM program for new buses and avoid major midlife overhauls



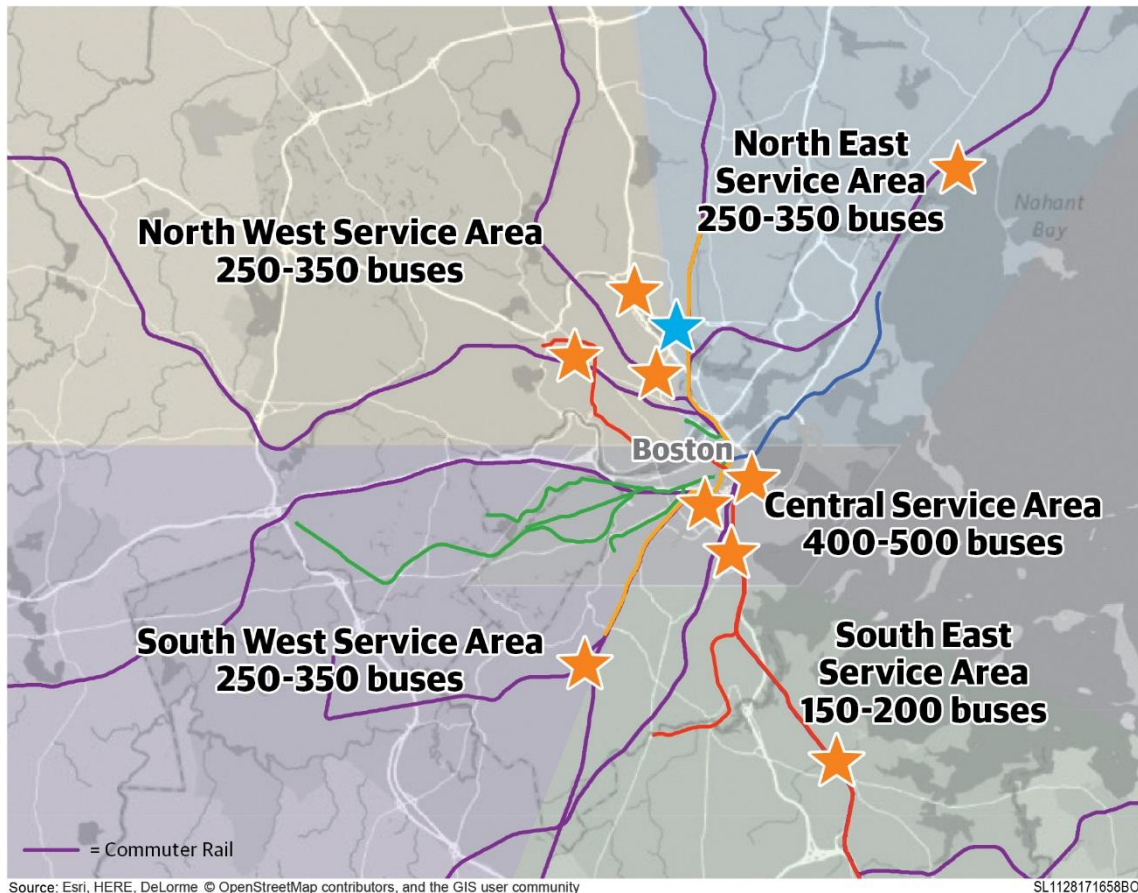
Current Service Areas



- Average age 54 years old
- Strained capacity
- No room for expansion
- Fuel infrastructure dependent
- Maintenance constraints
- No facility redundancy
- Quincy & Albany garages can not physically accommodate new buses



Conceptual Service Areas



- Framework for the future
- Geographic approach to bus facility needs
- 5 service areas
- Increased capacity
- Modernized facilities
- Operational flexibility – 40' & 60' fleet
- Facilities will comply with sustainable initiatives



IFFP Bus Fleet Investment Strategy

- Based on traditional procurement model
- Expansion garage needed before capacity can be added
- Short term – execute available hybrid bus option (194 buses)
- Implementing RCM program

Discussion Points

- Long term – execute new procurement (5 year contract)
 - Predictable annual replacements
 - 100 buses per year
- Zero / no emission bus strategy



IFFP Bus Facilities Modernization – Conceptual Strategy

Year	Project	Garage Capacity Impact	Net Capacity Impact
2020	New Southeast Garage – 200 buses	+200	+114
	Close Quincy	-86	
2022	Expand Southampton – 250 buses	+150	+54
	Rehab Cabot – 200 buses	+20	
	Close Albany	-116	
2024	New Southwest Garage – 250 buses	+250	+132
	Close Arborway	-118	
2028	New Northeast Garage – 250 buses	+250	+160
	Close Lynn	-90	
2032	New Northwest Garage – 200 buses	+200	+96
	Rehab Charlestown – 250 buses	+0	
	Close Fellsway	-76	
	Close North Cambridge	-28	



Factors to Consider for Strategic Bus Facility Planning

- Community Interests
- Land Acquisitions
- Environmental Stewardship and climate resiliency
- Service planning (growth areas, route profiles, and dead head miles)
- Optimal facility capacity and size
- Ownership of new and existing facilities
- Timing and location of future back shop support



IFFP Task Force – Bus Maintenance Facilities

- Develop and prioritize bus maintenance facility strategy
- Actionable plan addressing
 - Maintenance facility replacements
 - Expansion
 - Rehab
 - Closures
 - Alternative procurement and financing models
- Key Stakeholders
 - Focus40
 - Operations & Maintenance
 - Vehicle Engineering
 - Transit Facility Maintenance
 - Service Planning
 - Capital Delivery
 - Real Estate
 - Budget Office



New DART Leed Gold bus maintenance facility



IFFP Bus Investment Impact

**1200-1350 New Buses
(75% 40-foot, 25% 60-foot)
\$1.1 – 1.3B (not programmed)**

- Increase passenger capacity
- Improve headways
- Increase fleet reliability
- Improve customer experience
- Reduced emissions

**Reliability Centered
Maintenance Program
Scope under review**

- Increase fleet reliability
- Reduce lifecycle costs
- Eliminate major fleet overhauls

**Maintenance Facility
Modernization
\$808M (not programmed)**

- Enable facilities to continue supporting revenue fleet
- Increase fleet reliability
- Reduce maintenance costs
- Improve technical capabilities

**Fleet Overhauls
\$218M (Partially programmed,
Scope under review)**

- Complete ongoing and upcoming overhaul programs
- Begin transition to light overhaul approach
- Increase fleet reliability
- Reduce lifecycle maintenance costs
- Maximize asset lifecycle



Alternative Procurement and Financing Models

- An initial review of global and domestic procurement and financing models has been conducted
- For each project, delivery options will be screened in light of specific policy objectives and benefits and costs will be fully evaluated
- Key considerations in selecting a delivery strategy:
 - Alignment with MBTA policy objectives
 - Risk transfer and risk mitigation
 - Performance incentives
 - Efficiencies and lifecycle cost optimization
 - Procurement and delivery speed and ease of execution
 - Private sector market
 - Federal funding and credit assistance

Models \ Responsibility Allocation	Responsibility Allocation						
	Technical Specification	Design	Build/ Manufacture	M aintain	Operate	Finance	Oversight
Facility Design-Bid-Build	○	○	●	○	○	○	○
Facility Design-Build	○	●	●	○	○	○	○
Vehicle Outright Purchase	○	●	●	○	○	○	○
Leasing	○	●	●	◐	○	○	○
Franchising	○	●	●	◐	●	○	○
Public-Private partnership	○	●	●	◐	◐	●	○

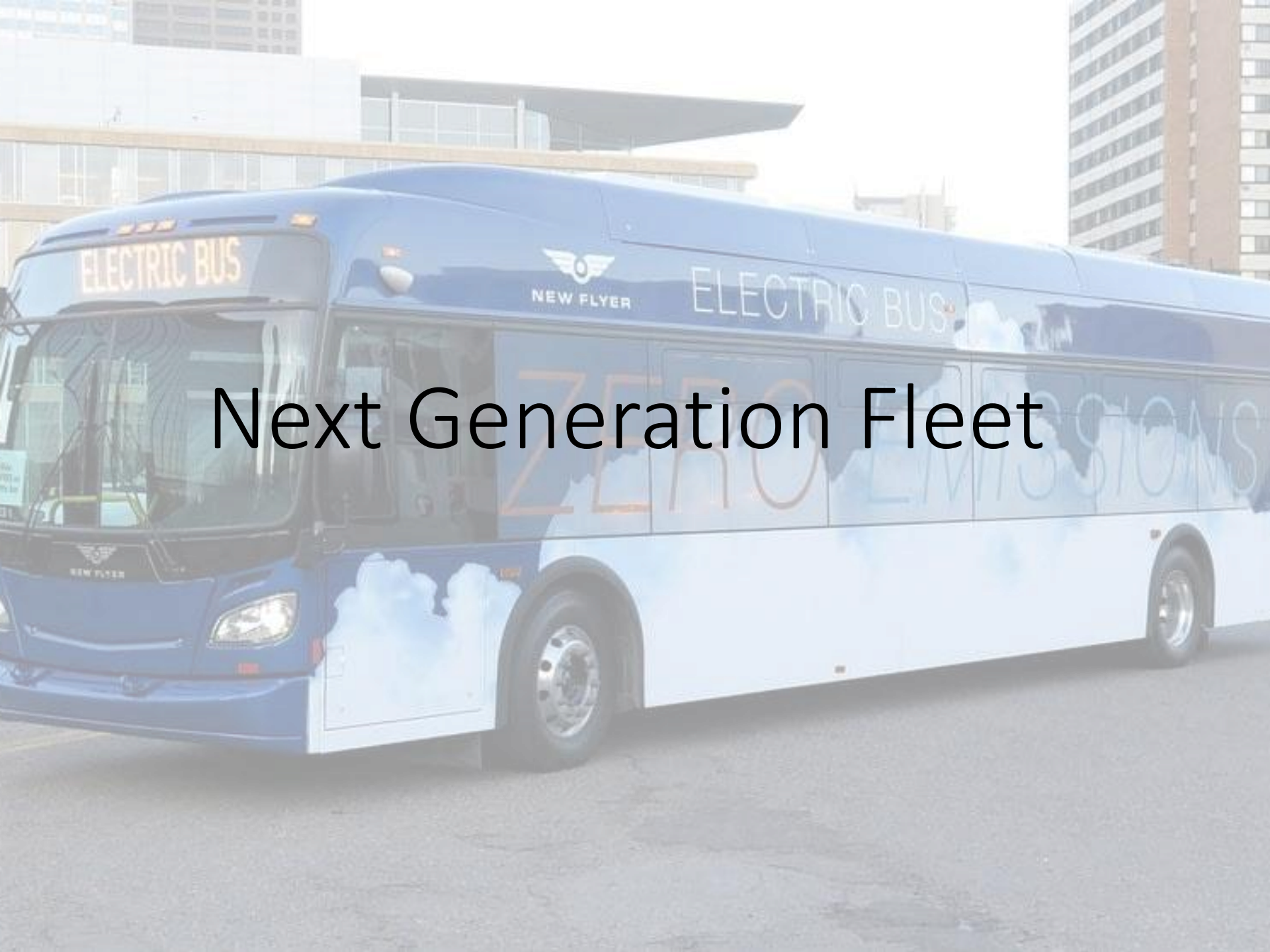
Legend:

- Public responsibility
- Private responsibility
- ◐ Either public or private responsibility depending on contract options



Alternative Procurement and Financing Considerations

Policy Objectives	Improve budget stability and visibility	Improve incentives for acceleration & time certainty	Incentivize performance	Mitigate cost overrun risks	Mitigate interface risks	Mitigate technology risks	Opportunity for innovation	Opportunity for lifecycle cost optimization	Opportunity for economies of scale	Control design and specifications	Control operation and/or maintenance decisions
Models											
BUS											
Outright Purchase	●	●	●	●	●	●	●	●	●	●	●
Bus Leasing	●	●	● Dry Wet	●	●	●	●	● Dry Wet	●	●	● Dry Wet
Bus Franchising	●	●	●	●	●	●	●	●	●	●	●
FACILITIES											
DBB	●	●	●	●	●	●	●	●	●	●	●
DB	●	●	●	●	●	●	●	●	●	●	●
DBF	●	●	●	●	●	●	●	●	●	●	●
DBFM	●	●	●	●	●	●	●	●	●	●	●
COMBINED FLEET & FACILITIES											
P3 / DBF(O)M	●	●	●	●	●	●	●	●	●	●	●



Next Generation Fleet



Path to a Zero Emissions Fleet

2000: First Compressed Natural Gas Bus

2004: Electric Trolley Bus (ETB) Fleet

2004: Dual Mode Articulated (DMA)- Silver Line Fleet

2010: 60' Diesel Hybrid Fleet

2015: 40' Diesel Hybrid Fleet

2015: 40' Hydrogen Fuel Cell Bus (Pilot)

2017-18: 40' Battery Electric Bus (BEB) Feasibility Study

2018: 60' New Flyer XE60 – Battery Electric Bus



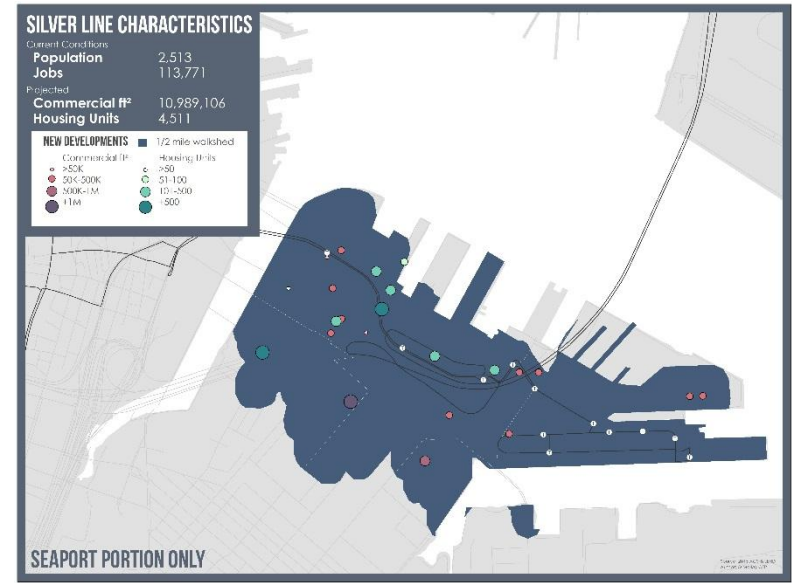
Silver Line – Zero Emission Bus Project

- February 2015 – FTA Awarded the MBTA - Zero Emissions Silver line Project
 - Low or No Emission (LoNo) Vehicle Deployment Program
 - 2 Grants totaling -\$10.1M
 - FTA Objectives:
 - Deploy the cleanest and most energy Efficient U.S. manufactured transit buses that are not yet widely deployed in transit fleets.
 - Focus on nonattainment areas for ozone and carbon monoxide
 - Partnered with CTA, New Flyer and Transworld Associates LLC, UTCCEM.
 - 5 - 60ft Battery Electric Buses
 - Buses enter production spring 2018
 - Buses expected to be delivered 2018
-



Seaport District Growth – Transit Focus

- Silver Line service requires focused attention to meet growing ridership demand, particularly in the Seaport District
- Rapid development in the Seaport District suggests that models based on urban population growth will understate demand
- MBTA’s plan to move toward a 100% “Transitway Tunnel” 60-foot fleet will improve service and overall vehicle utilization in the medium term
- 60-foot bus maintenance capacity is critical to support long term fleet growth
- MBTA’s partnership with Massport should continue to be leveraged to support Silver Line service





40 ft. Battery Electric Bus (BEB) Feasibility Study

- Joint Partnership – MassDot Transportation Planning & MBTA
 - Massachusetts Global Warming Solutions Act (GWSA)
 - 25% Reduction of GHG Emission by 2020
 - 80% reduction of GHG Emissions by 2050
 - MBTA Bus Fleet Contributed over 25% of the MassDot Total GHG Emissions FY2016
 - Strategic Planning Approach
 - Align BEB Integration roadmap with Fleet & Facilities plan
 - Estimated Completion Fall 2018
-



40 ft. Battery Electric Bus Feasibility Study – Objectives

1. Identify key pilot components through in-depth route, vehicle technology and supporting systems assessment
 - Real world Driving Cycle Simulations
 - Advanced Route & Vehicle Performance Analysis
 - Charging Infrastructure Plan
 - Facility and Infrastructure Strategy
 - Operations & Maintenance Cost estimates
2. Pilot Implementation Plan
 - North Cambridge Pilot
 - Performance Monitoring and Evaluation Plan
3. Roadmap Report
 - Action Plan & Time Line for large Scale Deployment
 - Capital Investment & ROI
 - GHG Benefits





Key Takeaways

- Execute option with New Flyer for 194 hybrid buses to replace aging Neoplan diesel fleet
- Bus facilities are in critical need of modernization and replacement
 - Remaining buses which can be physically accommodated at Quincy and Albany garages will be retired by 2023
 - Critical action required to begin planning efforts for replacement facilities
- Outcome of battery electric Bus feasibility Study will have a significant impact to future fleet profile and maintenance facilities.
- Long term bus procurement strategy will continue to evolve as ridership projections are refined



Upcoming Presentations

- Commuter Rail, Ferry, and Paratransit – December 11th
- Light Rail (Green Line and Mattapan) – December 18th