STAFF REPORT

TO: Planning Committee
   AC Transit Board of Directors

FROM: David J. Armijo, General Manager

SUBJECT: Double Deck Bus Analysis and Demonstration

ACTION ITEM

RECOMMENDED ACTION(S):

Consider receiving a report on the analysis and feasibility of operating double deck buses at AC Transit, and authorize the General Manager to enter into an agreement with Alexander Dennis for an in-service demonstration of one double-deck bus.

EXECUTIVE SUMMARY:

A feasibility study of operating double deck buses at the District was conducted. The study included an evaluation of bus specifications, review of facility infrastructure limitations, analysis of the benefits and limitations on existing bus routes, and interviews with other agencies utilizing double deck buses.

The advantages of double deck buses include increased passenger capacity within a typical 40 to 45 foot bus platform to ease crowding on popular commuter lines as well as residential streets. Double deck buses will be less costly to operate than the longer articulated buses, which require considerable maintenance on the articulation joint in the middle of the bus.

Alexander Dennis is the only double deck bus manufacturer that currently meets Buy America requirements. Alexander Dennis is planning to complete Altoona bus testing with the model Enviro 500 by late April 2015. The Enviro 500 model is Americans with Disabilities Act (ADA) compliant with a 1:6 ratio front door ramp and two forward facing wheelchair securement positions on the lower salon.

Pending Board authorization, a double deck bus demonstration is currently being planned at the District in February 2015 to assist Planning, Transportation, Maintenance and Technical Service Departments to confirm any required operational requirements and compare the vehicle to published American Public Transportation Association bus procurement configuration standards.

BUDGETARY/FISCAL IMPACT:

The preliminary cost estimates for each Alexander Dennis Enviro 500 is $850,000 to $900,000, not including any support equipment, extended warranty packages, and delivery costs.
BACKGROUND/RATIONALE:

A feasibility study of operating double deck buses at the District was conducted, that included an evaluation of bus specifications, review of facility infrastructure limitations, analysis of the benefits and limitations on existing bus routes, and interviews with other agencies utilizing double deck buses. In the United States, double deck buses are being used at the following locations:

- Unitrans in Davis, CA currently operates a fleet of six double deck buses - four AEC London Regents and two Alexander Dennis buses, acquiring their first double deck bus in 1968.
- Las Vegas, NV operates over 100 Alexander Dennis Enviro 500 models in regular passenger service, with the first double deck bus being delivered in 2005.
- Community Transit in Everett, Washington currently operates 23 double deck buses and has 17 additional double deck buses on order with delivery in early 2015.
- New York, NY currently has 73 Alexander Dennis open top Enviro 500 models in use as tour buses.
- Gray Line Tours in San Francisco, CA currently has 12 Alexander Dennis buses in operation as tour buses.

Alexander Dennis meets Buy America requirements for the Enviro 500 model bus with United States corporate offices in Las Vegas, Nevada and a new factory based in Nappanee, Indiana. Currently, Alexander Dennis builds the majority of their buses at factories in the United Kingdom (England and Scotland), but the new production facilities in the United States allows Alexander Dennis to be the only double deck bus manufacturer that meets Buy America requirements. Alexander Dennis has initiated Altoona bus testing with the Enviro 500 bus and expects completion of the testing by late April 2015.

The projected cost estimate for the Enviro 500 is $850,000 to $900,000 without including any support equipment, extended warranty packages, and delivery. Currently, there are no joint procurement "piggyback" opportunities available with other transit properties to purchase double deck buses. The current lead-time for bus availability for the Enviro 500 is approximately 12 to 14 months from the date of order.

Demonstration of Buses

In August 2014, staff from the Planning, Transportation and Maintenance departments visited UC Davis to observe Unitrans' double deck buses in operation. Unitrans operates four Alexander Dennis Enviro 500 2009 models, which have an 81 seat capacity and are 13.5 feet high and 40 feet long.

UC Davis operates their double deck buses on service with different characteristics than AC Transit fixed route service. Students dominate the passenger base, so the ridership patterns are quite regular and the trip length is relatively short. However, their staff was very positive about the general double deck bus operations. The UC Davis staff organized a road test in regular local
service and on the freeway to allow District staff to observe how the buses performed on surface streets and to assess passenger comfort in high speed operations.

The results from the road test were generally positive. The freeway experience on the top deck was very smooth with only a slight increase in lateral movement, which should not affect seated passengers. Bridges and overpasses were not an issue and all participants enjoyed the elevated view of the landscape. The main issue experienced by Unitrans has been low tree limbs hitting the buses and resulting in replacement of expensive imported parts. As a result, Unitrans has equipped their vehicles with windshield guards and has not replaced a windshield since they started operating these buses.

**Passenger Accessibility**

When compared to a typical commuter bus, the Enviro 500 provides more passenger seating with a total of 77 passenger seats - 27 seats in the lower level and 49 seats in the upper level. In reviewing the bus seating layout for the lower level, the majority of passenger seats (21) would require a passenger to step up to access each seat, which has been problematic for some passengers with disabilities. The provision of 27 passenger seats in the lower level may limit seating for passengers with disabilities, strollers, shopping carts and require passengers to walk up the stairs to the upper level. The Enviro 500 model is ADA compliant with a 1:6 ratio front door ramp and two forward facing wheelchair securement positions on the lower level. Both UC Davis and SF Muni stated that they experienced longer dwell times with the double deck bus, which may impact on-time performance.

**California Air Resources Board Compliance**

The propulsion system currently being used on the Alexander Dennis double deck bus is a California Air Resources Board (CARB) certified Cummins ISL engine rated at 330/380 horsepower coupled with an Allison B500R transmission. The Cummins ISL engine and Allison transmission are currently used in other buses at the District; therefore, both the Maintenance and Stores departments would be familiar with the existing propulsion system in these buses. The performance information for the buses has not been provided from Alexander Dennis as of this writing to determine bus acceleration and grade ability.

**Axle Weight**

The rear drive axle weight of the Enviro 500 exceeds the current 20,500 lbs. maximum axle weight provided in Section 35554 of the California Vehicle Code. Effective January 1, 2013, a new bus exceeding 20,500 lbs. cannot be purchased unless certain provisions are met, including the Board adopting a finding at a public hearing that the fleet class expansion or change in fleet class is necessary to address a need to serve a new or existing market pursuant to its most recently adopted short-range transit plan, or to meet a federal, state, or regional statuary requirement that include a consideration of vehicle needs and fleet size.

**Safety and Security**

Passenger security for the upper and lower salon areas is achieved by numerous security cameras. The bus operator area provides a small LCD screen specifically to view the upper salon
and stair areas. Staff and the union have noted that the LCD screens could take away operator attention from viewing the road while driving. The area of most concern for passenger safety is the stairs between the lower and upper levels. Although equipped with handrails, the stairs may increase the opportunity for passenger injury especially while the bus is moving. Unitrans staffs the bus with an ambassador to help monitor the stairs. Interior dimensions supplied by Alexander Dennis provide a maximum ceiling height of 6 feet 5 inches at the tallest locations dropping to 5 feet 6 inches at the rear of the bus, which may provide a challenge for taller passengers.

Operation

California Vehicle Code 35250 states that double deck buses may not exceed a height of 14 feet 3 inches. The height limit may present some challenges to the District’s towing contractor, since the height of 14 feet 3 inches cannot be exceeded by law when towing a double deck bus. The District’s towing contractor advised that the bus height may create safety considerations and is looking at various options for towing these buses.

The fuel tank capacity of 118 gallons along with an estimated 3.5 miles per gallon provides for a range for the vehicle of approximately 413 miles. The actual range of the Enviro 500 bus could be confirmed by operating a demonstration vehicle on District routes to verify fuel economy and range.

Service and Maintenance

An assessment of existing facilities was performed to evaluate the feasibility to service and maintain a double deck bus with a clearance of 14.5 feet. Staff measured the clearances of the bus wash, fuel island, steam bay, and one maintenance bay at each of the maintenance shops to ensure proper clearance to hoist up a double deck bus for maintenance activity.

Bus Washers

- The District bus washers are not designed to clean buses with a height of 14 feet. The current bus wash brushes reach just over 12 feet with wash equipment structural arches at about 13 feet. To accommodate double deck buses, the wash racks will need to be modified or replaced with new wash equipment designed to clean both 14 foot and standard buses. The surrounding structural bus wash buildings have enough room to accommodate a taller wash rack at Division 2 (D2), Division 4 (D4), Division 6 (D6) and Division 3 (D3) but the building structural supports at the Central Maintenance Facility (CMF) will need major modifications.

Fuel Islands

- The fuel islands at D2 and D6 will not need any modifications; however, the fuel island at D4 has a sprinkler line running across the fueling lanes with a 14 foot clearance that will need to be raised to accommodate double deck buses.

Maintenance Shops

- A maintenance bay at D2, D6, CMF can accommodate a double deck bus with minor modifications. The relocation of a sprinkler line, exhaust system metal ducting, existing lighting, and bird netting will be required to accommodate double deck buses.
D4 would require major structural modifications to the maintenance bay to accommodate double deck buses. Multiple fluid piping and electrical lines would need to be raised or relocated; also the major structural beams for the building are only 18 feet from the floor. Sprinkler lines would also need to be relocated or adjusted to accommodate the height clearance requirements.

Steam Bays
- D2, D6, and CMF would require minor modifications to relocate sprinkler lines, lighting, and bird netting.
- D4 requires major modifications if the bus is to be raised more than 3 feet. Structural beams that support the building will need modifications to accommodate double deck buses.

The Richmond division was not included in this assessment; however, staff will work with the Architectural and Engineering contractor for the D3 property to include double deck bus accessibility into the design of the refurbished facility.

Service Planning for Double Deck Buses

The primary benefit and purpose for incorporating double deck buses into the AC Transit fleet is to increase passenger capacity on Transbay express buses while minimizing additional operating expense. To maximize this benefit, Planning staff has developed the following criteria to identify service routes for the double deck buses:

1. High ridership demand for service
2. Limited-stop service to minimize dwell time and delay
3. Lines that serve at least one major ridership generator
4. No vertical clearance constraints

Based upon the criteria noted above, the Planning Department has identified lines FS, J, L, NX, NX1, NX2, and U as potential routes that could best accommodate and benefit from the use of double deck buses. The U Line meets all of the criteria identified above with only 11 bus stops along the route, major trip generators at the Fremont BART Station, ACE Train Station, and Ardenwood Park & Ride, along with the highest ridership productivity among all Transbay lines. The FS and the J have similar characteristics as the U with service through Downtown Berkeley and Emeryville, respectively; however, both routes have over 20 bus stops. The NX lines that serve the MacArthur Boulevard corridor in East Oakland have between 11 and 28 stops. The L Line serves the San Pablo Boulevard corridor in Contra Costa County with 30 stops, which is the most stops of the selected lines for the demonstration. Staff will monitor the dwell times during the proposed demonstration and measure the impact to on-time performance from the number of stops on the line with service being provided by double deck buses.

Double Deck Bus Demonstration

Pending Board authorization, Alexander Dennis has agreed to loan the District a bus for testing in revenue service beginning in February 2015 for up to six weeks on the FS, J, L, NX, NX1, NX2, U and 51B lines. The routes selected will provide feedback on both transbay and local service. While line 51B does not meet all of the criteria for double deck buses, the test on a local route
will allow staff to analyze passenger reactions and operational constraints. The routes identified were investigated by staff to ensure there are no non-negotiable vertical constraints along the path of travel and at stops, including the Bay Bridge.

The demonstration will also assist Planning, Transportation, Maintenance and Technical Service Departments to confirm any operational requirements and compare the vehicle to published American Public Transportation Association bus procurement standards in vehicle configuration. Staff will also exhibit the bus to local agencies, stakeholder groups, and advisory committees.

Ambassadors will be on board the bus to assist passengers and provide information about the pilot and to ensure the operations run smoothly and safely. The ambassadors will also conduct passenger surveys to solicit feedback on the use of double deck buses. Staff will interview the operators and maintenance employees at the end of the test to collect their opinions of the bus. The passenger and internal feedback will help staff determine if the double deck bus is a vehicle the District should consider procuring for replacement vehicles. The findings from the demonstration will be reported to the Board after completion of the demonstration.

ADVANTAGES/DISADVANTAGES:

The advantages of utilizing double deck buses is the increased passenger capacity while providing less road space and easing crowding on popular commuter lines and residential streets. Double deck buses are expected to have less maintenance when compared to articulated buses that require considerable maintenance for the articulation joint that is located in the middle of the bus.

The disadvantages to the proposed use of double deck buses would include the safety considerations identified in this report, issues with towing the double deck buses, and increased dwell time. The District will also need to work with local cities to ensure trees are properly trimmed to avoid incidents affecting the operators and buses.

ALTERNATIVES ANALYSIS:

The analysis in this report was provided at the request of the board. The demonstration for the double deck buses and any further consideration for procurement could be discontinued; however, this alternative is not recommended since the continued increase in ridership will result in either the need for higher capacity buses or for the District to take on the additional costs to provide a higher number of lower capacity buses and trips in response to the increased ridership demands.

PRIOR RELEVANT BOARD ACTIONS/POLICIES:

None

ATTACHMENTS:

1: Photo
2: Specification Sheet – Alexander Dennis Double Deck Bus
Department Head Approval: James Pachan, Chief Operating Officer / Interim Chief Financial Officer

Reviewed by: Denise C. Standridge, General Counsel

Prepared by: Stuart Hoffman, Manager of Technical Services
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## VEHICLE GENERAL SPECIFICATION

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## VEHICLE WEIGHT DETAILS

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