

**ARIELI ASSOCIATES**  
MANAGEMENT, ENGINEERING AND OPERATIONS  
CONSULTING

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HIGH-CAPACITY BUSES FOR LOS ANGELES METROPOLITAN  
TRANSPORTATION AUTHORITY (LACMTA)

## CURRENT AND FUTURE REQUIREMENTS

LACMTA has an immediate need for alternate fuel, high-capacity buses to support its highly successful Rapid Bus and other high demand routes. **Due to the “Consent Decree” restrictions, for LACMTA high-capacity is strictly related to the number of seats offered by the different vehicles.** Moreover, reducing the trip time is in effect increasing the capacity of the existing fleet. Previous studies have clearly shown that approximately 25% of the time the busses are in revenue service they are loading and unloading passengers at the stops. The major reasons for delays are high floors(steps), wheelchair lifts, on-board fare payment, limited number of doors, and impediments to passengers’ flow inside the vehicle. **Because of the high seating requirement , the LACMTA’s buses are configured with 2 rows of 2-seats each all along the length of the vehicle. Consequently, the aisle is very narrow impeding the flow of passengers. Also, in order to maximize the seating, LACMTA’s 40-foot busses have only 2 doors, thus increasing the distance the passengers have to travel inside the bus.**

Another immediate need is the reduction, or at least the containment, of the operating costs. **An analysis (see Attachment) of the efficiencies obtained from the use of buses in revenue service by the top 20 transit agencies in the USA, shows that LACMTA is one of the bottom 3 agencies in both absolute \$ and in units of merit for efficiencies normalized for regional cost variances.** Unable to cut salaries and/or service or to change the work rules, LACMTA must find ways to either cut cost by providing the same service with fewer vehicles (i.e. fewer operators) or to avoid higher cost by providing more service with the same number of vehicles. Higher capacity buses can enable both of the above approaches. The downside is that high-capacity buses might require additional capital expenditures for depot infrastructure as well as result in higher emissions and fuel and maintenance costs. **Since 1992, LACMTA has invested over \$10 million in the development and test of hybrid buses. These buses have the potential to reduce the operating costs by 30% or more, and thus enabling the introduction of high-capacity buses at, at least, no additional cost.**

## GOALS

LACMTA needs to procure vehicles that will meet the current and future fleet needs while balancing multiple requirements, namely:

- achieve maximum number of seats with 45- and/or 60-foot busses
- minimize the dwell time at stops by configuring the buses with low floor throughout; have a minimum of 3 doors, preferably 4; and, wheelchair ramps.
- achieve low pollution (air emissions, visual and noise) through use of hybrid propulsion, and microturbines; appealing external shapes and design, and use of sacrificial coatings and layers on body and windows.

- reduce the operating costs through lighter busses (less wear and tear); less components (smaller or no IC engines; eliminate transmissions; one axle and one set of tires in the rear); better fuel consumption and better reliability by using more power electronics and less hydraulics and/or mechanical actuators.

## APPROACH

LACMTA must develop a negotiated procurement based on a performance specification that relates the future bus to the goals. In addition, it is imperative that it will allow multiple manufacturers to have their products evaluated in an even field. Otherwise, the agency will become indentured to one manufacturer and/or one bus design/technology. The competing vehicles must be evaluated on “mission-specific” criteria such as:

- \$/seat
- lbs/seat
- PM grms/seat
- NOx grms/seat
- minimum of 3 doors; 2 seats credit for each additional door
- no subsystem should take longer than 4 hours to remove and replace; \$ 10,000.00 penalty (for bid evaluation purposes) for each extra hour; \$10,000.00 credit (for bid evaluation purposes) for each hour less.
- \$15,000.00 , \$10,000.00, and \$5,000.00 credit (for bid evaluation purposes) to the 1<sup>st</sup>, 2<sup>nd</sup>, and 3<sup>rd</sup> external design, respectively.
- In revenue service experience of the actual design proposed should receive \$xxxxx credit (for bid evaluation purposes) based on the feedback received from the users.
- Altoona testing should receive \$xxxx credit (for bid evaluation purposes) based on the test report’s results.

## CANDIDATES

- **NABI** has on the drawing board a 45-foot composite structure bus with LNG power plant. The first customer will be Phoenix, AZ. This vehicle is, supposedly, in testing at Altoona. It has a CNG IC engine, a conventional drivetrain and a low front floor.
- **NABI** plans to join with Neoplan to further develop for the LACMTA’s needs the Neoplan CNG, 60-foot articulated vehicle. This vehicle is on the drawing board and the first customer will be Boston, MA. It has a conventional CNG ic engine, a conventional drivetrain and a low lfront floor.

- **Volvo/Nova Bus** has a 45-foot bus on the drawing board. It is based on the RTS 40-design and incorporates an Allison hybrid propulsion that consists of an IC engine and generator that send the rotational motion to the wheels through a conventional transmission, differential and axles. The system will be tested as a 40-foot bus in NYC. It is a high floor bus with wheelchair lift.
- **TransTeq** has a 45-foot CNG-hybrid in operation in Denver, CO. The Denver RTD ordered these buses with only 18 seats and an upper speed limit of 30 mph. The bus is designed to withstand speeds up to 72 mph and has been tested at Altoona in the current configuration. It can accommodate up to 54 seats and is a low floor throughout with 4 doors. It is powered by a 90 hp engine and wheelmotors. It has on the drawing board a model with a microturbine replacing the IC engine and the generator and a composite body.
- **E-bus** is in the possession of the loosing design in the Denver competition and plans to manufacture it with the microturbine-hybrid power plant that they have in their 22-foot bus. They plan both 45- and 60- foot models, using Rockwell axles with Siemens wheelmotors.
- **Irisbus** (the bus subsidiary of Renault) has a 60-foot CNG, conventional drivetrain, low floor throughout, in revenue service in Paris, France. They are also developing the Civis bus that is a 60-foot articulated, low floor throughout, hybrid with hubmotors, ATTB-alike vehicle.

ATTACHMENT  
SERVICE EFFICIENCY RANKING\* (IN DECREASING ORDER)

AREA SERVICED	NORMALIZED SERVICE EFFICIENCY	ACTUAL (1999) \$/VEHICLE REVENUE HOUR
Portland, OR	.84	78.95
Denver, CO	.86	80.57
Houston, TX	.89	75.30
Chicago, IL	.90	75.21
Miami, FL	.91	76.49
Atlanta, GA	.93	78.06
Boston, MA	.94	87.54
Pittsburgh, PA	.98	82.09
Philadelphia, PA	.99	92.04
New Jersey, NJ	1.00	92.98
Cleveland, OH	1.00	83.70
Washington, DC	1.02	94.48
Oakland, CA	1.01	95.73
Seattle, WA	1.03	97.39
Saint Louis, MO	1.03	85.90
New York, NY	1.06	98.31
Detroit, MI	1.08	90.41
Los Angeles, CA	1.11	104.82
San Jose, CA	1.15	109.03
Dallas, TX	1.27	107.26

\*From the National Transit Data Base