Team I.D. number: – – – – – –

Bus Rapid Transit Competition, Stage 2.

Meet the Aircoach.

Key features:

Family of buses to meet the needs of any community.
Fast, robust and bold exterior appearance inspired in the World's fastest cars.
Detachable sub-frames supporting drivetrain, HVAC, etc, for improved serviceability.
Bodywork designed to lower repairing costs.
Flexible interior offers the possibility to carry bikes and heavy baggage.
A rotating banner in the rear side of the buses offers an innovative, attractive service for advertising.
A TV dedicated broadcast –the BRT Channel– offers news, information and entertainment to commuters, and it also solves the advertising issue in the interior of the buses.
"How can I get to?..." on-board booths offer information of destinations and routes.
See-through "A" pillars for improved visibility.
Fail-proof navigation system.

Inspiration

Aircoach is a family of buses, sharing modular components. The basic idea surrounding our project is to provide a fast, safe, comfortable and efficient service of transportation.
For the exterior design, we started asking ourselves: What makes a vehicle to look fast?... We chose as inspiration the World's fastest racing cars: Formula One and CART automobiles, and borrowed from them their cues communicating speed.

Exterior design

A bus should not be designed as a fashion vehicle, but as a timeless, broad range taste one, since it is a transport intended for any kind of people, and its life cycle has to be long last.
The Aircoach designation evokes aerodynamics. Aircoach's streamlined, forward-going profile is intended as an expression of speed.
Aircoach's aggressive front facial expression tries to communicate a solid, fast image of the Bus Rapid Transport system.

A whole family of new vehicles

Aircoach family consists of 4 city buses: GT1, GT2, GT3 and GTU.
GT1 is a 40 feet-long bus with capacity of up to 31 passengers, or 28 and 2 wheelchairs.
GT2 is an articulated bus, while GT3 is a double articulated one.
GT1, GT2 and GT3 coaches share basic components: front and rear end exterior panels, seats, and drive train parts. Engines with different power ranges should propel each version, according to curb weight.
An inclined windshield, a massive rear spoiler and a fierce facial expression are the cues, which make the Aircoach GT1, GT2 and GT3 to be seen as fast vehicles.
These are designed to run in dedicated ways at a maximum estimated speed of 70 mph.

As opposite to the rest of the Aircoach family, GTU is a 30' 3" long bus that has a friendly, still solid and fast appearance. This is designed to share its space with normal automobiles, so it has low height, car compatible bumpers.
In addition to the Aircoach range of buses, it would be a good option to count with the availability of hybrid-powered mini-cars that would move people in either –or both– cab or rental service schemes.
We prefer a family of buses instead of train-like detachable vehicles, since we found that attach/detach procedure is difficult to carry-out in real-life operation. Besides, a similar system does not worth the extra cost.

Safety
Safety is a major concern for everyone, so we propose to use the help of electronic devices as described below.
A drive-by-wire throttle, braking and steering system would allow to deliver a fail-proof service, in joint work with telematics. Check points –installed through the dedicated way– would send a signal that could be used by an on-board electronic processor to keep the bus in the right way, and allowing to predict hazardous traffic situations. Telematics would also be used for monitoring driver's health and behavior, and, in the event of detecting a dangerous situation, the system shall be able to override any or all of the driver's inputs, thus avoiding accidents.
In addition, the driver's visibility is optimized thanks to the use of see-through "A" pillars, similar to those of Volvo Security Concept Vehicle (SCC), which have a lattice covered with a translucent material, in such a way that the structural rigidity is not compromised.

Drivetrain
The range of Aircoach buses would be powered by Caterpillar engines, which have proven as a reliable choice in the city that is our study case. The engine is transversally mounted and the power is sent to the wheels through a special transmission similar to those of Allison "V" Type ones. Concerning energy recovery systems, we do not recommend to use devices such as flywheels, because we have found that these often waste as much energy as they recover (not mentioning the space that they use), i.e., the most of the recovered energy by a flywheel is wasted to carry the extra weight. Even though, we recommend the recovery of braking lost energy with the combination of a starter/drive motor/generator and a NiMH battery pack, mounted in the front, at the right side of the driver.
This sophisticated drivetrain could be exchanged to mount a conventional, less expensive one.

Chassis
A heavy-duty frame consisting of closed section members offers a stiff basement for the bus. Two additional detachable sub-frames give support for the bus' hardware. Drivetrain, fuel tank and twin rear axle are mounted in the rear sub-frame. Meanwhile, front axle, HVAC, battery pack, cockpit, and navigation systems are mounted in the front sub-frame. This lay-out also serves to improve weight distribution. The sub-frames shall have crumple zones for energy absorption. The ability to detach the sub-frames would allow lowering repairing costs and improving serviceability.
Another proposal is to use 17.5" wheels for the rear, instead of 22.5" ones. This option would save space in the interior, since the wheelhouses could be smaller, and so, less obtrusive.

Servicing and repairing
An often forgotten bottleneck in public transportation systems is both servicing and repairing of the fleet buses. That is why we propose a repairing store with a pits-like scheme, inspired in F1 and CART racing. The full range of Aircoach buses has two detachable sub-frames supporting all the serviceable parts: drivetrain, HVAC and some others. In the event of a scheduled service or reparation of a bus, the sub-frame –with the parts that would receive service– is exchanged for another in perfect running conditions, allowing the BRT system to keep all the buses working.

Comfort
Another advantage of the detachable/separated sub-frame is the noise isolation that it offers of the passenger area from the drivetrain. Furthermore, a car-like ride sensation could be reached through a fuzzy-logic electronic drivetrain control, which would command throttle and shifting to offer smooth acceleration and braking. Seating would offer generous –but not excessive– space to encourage people to leave their cars at home.
Opposed to the aggressive exterior image, the interior offers a relaxing atmosphere. Neutral colors and soft surfaces are used to deliver a clean image.
We do not suggest to mix "first" and "second" class passengers in the same bus. We rather propose special buses for special needs: business class and wheels class –for bike/scooter/skate riders, i.e.–
The business class is a service that offers individual seating with curtains in both the front and the side of the passenger. It also offers armrests, cupholder, table, 110 Volts source, audio out, and a communications wireless port offering info about the BRT system.

Special services
The wheelhouses, a very obtrusive part, are rarely used. We propose to install over the front wheelhouses two terminals with monitors offering information, such as routes and destinations, with a so-called "How can I get to?" service.
A TV dedicated broadcast can be seen in the monitors of the buses. The "BRT Channel" would have shows offering news and information. The BRT Channel would serve as a basis to communicate the benefits of the public transport, while offering entertainment to the commuters.

Advertising
The paid publicity in the interior of the buses could be exchanged for commercial ads in the BRT Channel, thus helping to conserve a visually clean interior.
In addition, a display at the right side of the passengers that will descend of the bus –just at the side of the rear door– provides space for social interest announcements and offer postal-sized flyers to users.
Meanwhile, the exterior publicity is displayed in a rotating banner installed in the rear end of the buses. This dedicated space would offer a dynamic, innovative, flexible service to those who want to communicate a message to the citizens. Furthermore, the cities will not be plagued of chaotic messages displayed in the buses anymore.

Aircoach GT1 Specifications

Measures
Total length, ft/mm: 40/12,192
Height, inches/mm: 126/3,200
Width, inches/mm: 102/2,591

Floor height inches/mm
  Running: 22/560
  Boarding (lowered) position: 15/380
Ground clearance (minimum), inches/mm: 10.2/260
Ceiling height, front, inches/mm: 88.6/2,250
Wheelbase, inches/mm: 236.2/6000
Estimated turning diameter, inches/mm 905.5/23,000

Passenger capacity:
Seated: 31, or 28+2 wheelchairs.

Body
Plastic reinforced fiberglass parts for front and rear end. Metal sheet bonded panels for sides and roof. All-round bumpers, 5 mph crash resistant, in body-colored resin.

Engine
Make/model: Caterpillar 3126B
Type: 4-stroke, Diesel
Number of cylinders, layout: 6 in line
Aspiration: air-to-air after cooling (ATAAC), turbocharged
Displacement cu in/l: 493/7.2
Rated HP/kW: 210/156 @ 2,200 rpm (governed)
Peak torque lb-ft/Nm: 605/820 @ 1,440 rpm

Energy recovery system
Electricity recovery through built-in alternator/generator/drive motor
(in the flywheel of transmission), and NiHM battery pack (mounted in the front of the bus)

Transmission (suggested, does not exist)
Allison V type, 4 speed automatic, with electronic fuzzy-logic control,
retarder, built-in electric starter/alternator, and lock-up hydraulic torque converter

Chassis
Closed section members frame, with 2nd additional detachable sub-frame for drivetrain Diesel tank and rear suspension, and 3rd additional sub-frame for front suspension, air conditioning, battery pack and cockpit. 2nd and 3rd sub-frames have energy absorbing crumple design.

Suspension (with pneumatically height adjustment)
Front: Axle with 2 air bellows and 4 shock absorbers
Rear, 2nd axle: Unequal length A arms with 2 air bellows and 2 shock absorbers
Rear, 3rd axle: Axle with 2 air bellows and 2 shock absorbers

Brakes
Dual-circuit compressed air brake system, with discs all round and ABS.

Heating/Ventilation and Air Conditioning (HVAC)
Thermostat-controlled gas heater
Non-CFC air conditioning mounted in the front of the bus
2 ceiling-mounted fans