"Crystal Mover" Automated People Mover for Miami International Airport

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1. Introduction

Mitsubishi Heavy Industries, Ltd. (MHI) received an order from the Miami-Dade County Airport Authority for an automated people mover (APM) system to connect the terminal gates at the Miami International Airport North Terminal. MHI's successful APM delivery records in Hong Kong and Singapore were key considerations in the award of this contract. The newly introduced Crystal Mover APM system offers safe and comfortable transportation with an unconventional design. This paper provides an overview of the APM system and its vehicles.

2. APM system outline

The APM system is a fully automated, driverless, medium-volume passenger transport system that utilizes rubber-tired vehicles, a signaling system, a power distribution system, a communication system, stations, platform doors, exclusive tracks, and maintenance facilities. The APM system, which is generally considered to exist on the scale between a bus and railway system, and also is well-suited for operation in the range of 1,000–15,000 passengers per hour per direction (pphpd). The rubber tires of the APM set it apart from conventional railway cars because of its silent operation, ride quality, and performance on gradients.

3. Miami International Airport APM system

This APM system includes 0.7 miles (1.12 km) of double track connecting Concourses A through D in the North Terminal, each with its own station. The system is rated at a transport capacity of 9,000 pphpd. The system is located in a secured area (air side) after security check points. There are four trains, each consisting of four cars, plus one standby train (20 cars in total) in service. The platforms in each station are equipped with platform doors to ensure passenger safety. This system is fully automated and driverless system that continuously operates for 19 hours per day (**Figure 1**).

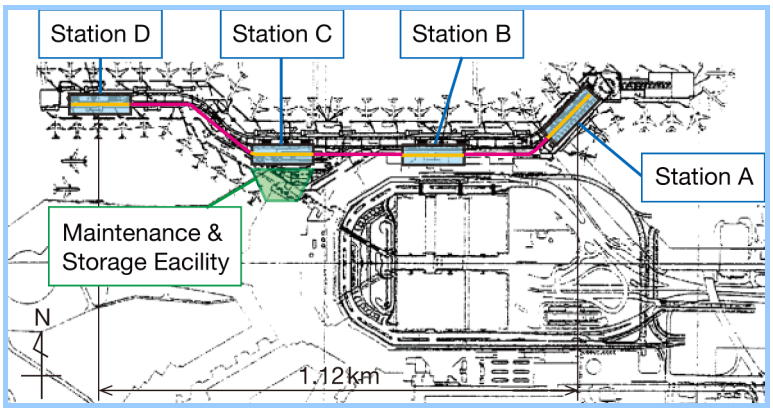


Figure 1 Miami International Airport North Terminal

4. The Crystal Mover for Miami International Airport

The Crystal Mover is an APM vehicle developed for overseas markets. The basic specifications and performance are based on standard design, the exterior color scheme, interior design, and other features are tailored as per customer preference.

While the basic APM vehicle model uses a single vehicle configuration (operable as one vehicle alone), MHI has used a fixed married-pair vehicle for Miami International Airport to increase the passenger volume. By combining two married-pair vehicles into a train, to accommodate departing (domestic and international) passengers on one vehicle and international arrivals (customs) on the other, the four-car train maintains the security status for the passengers during operation. **Table 1** shows the main features of the vehicle. **Figure 2** shows a general schematic of the vehicle. **Figure 3** is a photograph of the exterior of the complete train set.

Table 1 Main vehicle features

Item	Particulars
Train configuration	Fixed married-pair vehicle
Capacity (passengers)	93 (including 8 seated)/car × 2 car
Tare weight/vehicle (tons)	16.8 tons
Vehicle dimensions (mm)	11 750 long × 2 690 wide × 3 725 high
Guide system	Side guided, two-axle, 4-wheel steering system
Electrical system (VDC)	750
Track gauge (mm)	1 850
Vehicle performance	Maximum speed, 80 km/h Acceleration, 0.97 m/s^2 Deceleration: normal maximum, 0.97 m/s^2; Emergency, 1.33 m/s^2
Control system	Variable-voltage variable-frequency inverter vector control(VVVF) (load-sensing control with regenerative braking)
Braking system	Electrically controlled pneumatic brakes with regenerative braking (with safety brakes and parking brakes)

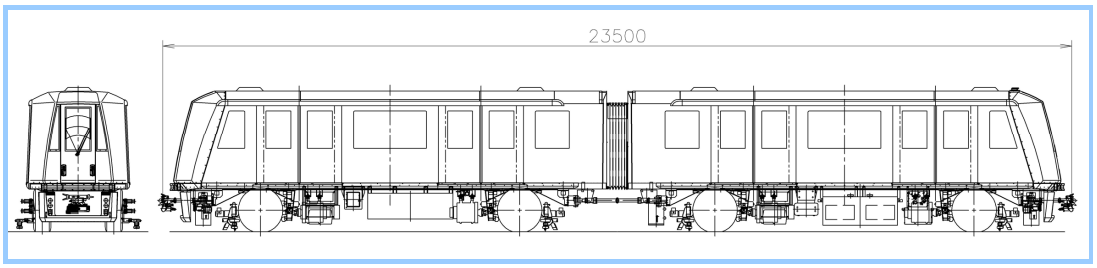


Figure 2 APM vehicle schematic

Figure 3 Photograph of two fixed married-pair vehicles

Since the people mover system operates only at the airport, the Crystal Mover takes less than a minute to travel the short distance from one station to the next. When a large aircraft arrives, it can cope with the large volume of passengers very efficiently. Also Crystal Mover has eight seats in the passenger compartment to provide more space for standing passengers. In accordance with the requirements of *Americans with Disabilities Act* (ADA), there are two wheelchair spaces, and the stanchion layout facilitates the passage of wheelchairs. **Figure 4** shows the interior layout.

Figure 4 Passenger compartment layout

The first Crystal Mover delivered to the USA complied with US codes and standards including the ADA above. The basic structure and performance characteristics of the vehicle complied with the American Society of Civil Engineers (ASCE21-98) specifications and with the National Fire Protection Association (NFPA130 and NFPA70) standards for fire resistance and electrical fire prevention.

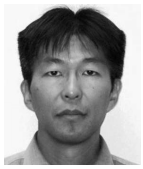
To meet vehicle collision safety requirements and avoid damage to the vehicle body, the Crystal Mover absorbs collision energy in two stages using shock absorbers in the couplers and bumpers on the body. Based on applied automotive techniques, MHI developed aluminum bumpers of its own design. Although the vehicles for the Miami International Airport meet the basic Crystal Mover specifications, they are actually a model in a new series that exceeds current the U.S. codes and standards as well as meeting individual customer requirements.

5. Conclusion

The contract for this APM system has contributed to further APM system orders such as for Washington Dulles International Airport and Atlanta Hartsfield-Jackson International Airport. MHI has also received another contract for a second APM project at Miami International Airport, proving that MHI's APM system is highly regarded in the USA. MHI hopes that its APM system will operate not only in the USA but also elsewhere in the world, so that it can offer safe, comfortable passenger transportation.

The author expresses his sincere appreciates to those who have provided advice and extensive assistance with the successful completion of this APM.

Authors



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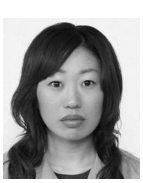

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