

## “Crystal Mover” Automated People Mover for Hartsfield-Jackson Atlanta International Airport



Transportation Systems and  
Advanced Technology Division

Mitsubishi Heavy Industries, Ltd. (MHI), with local partners including MHIA, received an order for its APM (Automated People Mover) system, a passenger transport system connecting the main terminal of Atlanta International Airport and the new rental car facility (CONRAC: Consolidated Rental Agency Complex), from the City of Atlanta, Department of Aviation, in October 2005. It was the third APM system project awarded to MHI in the U.S., following similar systems at Miami International Airport and Washington Dulles International Airport, and was the first to enter into operational service, in December 2009. MHI's APM system and associated technologies are introduced below.

### 1. System overview

The APM system at Atlanta International Airport comprises of 2.2 km (1.4 miles) of elevated double tracked guideway connecting the airport main terminal (Airport Station) and the rental car facility (Rental Car Center Station). There are three stations in total, including one intermediate station (GICC/Gateway Center Station) (**Figure 1**). The system is used by customers of the rental car facility, and by people visiting the convention center (GICC: Georgia International Convention Center), which is adjacent to the intermediate station. At the west end of the system, there is a vehicle Maintenance and Storage Facility (M&SF), which also accommodates the Central Control Center for the operation and supervision of the system.



Figure 1 CONRAC APM system overview at Atlanta International Airport

The system is fully automated and unmanned, operating 24-hour per day in correspondence with the operation of the airport. During peak daytime hours, four two-car trains are operated, providing a line capacity of 2,868 pphpd (passengers per hour per direction). An additional train can be added for five trains to run, in response to a temporary demand for increased line capacity.

When multiple trains make traffic jam especially in the 5 trains operation, the automatic train control (ATC) system will automatically adjust the distance between the trains to an interval that will allow smooth operation. Therefore, a train does not have to stop between stations until the train running ahead leaves the station. During off-peak times, when there are fewer passengers, the system can be switched to 'on-call' mode, under which a single vehicle runs only when one of the 'on-call' buttons, located on each station platform, is pressed, considering energy saving and flexible operation.

The station platforms are entirely equipped with platform screen doors and CCTV cameras for remote monitoring and supervision from the Central Control Center to ensure passenger safety. In order to prevent freezing of the track due to snow accumulation during winter weather, which may cause slip and slide of rubber tired vehicles, electrical heating cables for melting snow are embedded in the concrete running surface throughout the guideway.

## 2. Vehicles used in APM system at Atlanta Airport

The "Crystal Mover" vehicles are developed for the overseas markets (Table 1, Figure 2). The basic model is a single car, able to run as a single-car train. The two-car coupled model (Married-pair model), which was developed for the Miami Airport APM system, was used because it was most appropriate size for the Atlanta Airport APM system, based on the requirements of line capacity and the maintenance plan.

In the development phase of the vehicle for the Atlanta Airport APM system, the basic specifications of the "Crystal Mover" vehicle remained the same, with some modifications to meet U.S. standards. Specifically, the vehicles comply with the "APM Standard" stipulated by ASCE21 (American Society of Civil Engineers) in respect to the basic performance of the vehicle and the NFPA130 Standard stipulated by NFPA (National Fire Protection Association) in respect to fire resistance properties and the prevention of electrical fires. The cars also comply with the ADA (Americans with Disabilities Act) requirements, which specify barrier-free requirements. In addition, the vehicle was designed suitable for cold regions intended for Atlanta Airport, including interior heating equipment, snow removal equipment and built-in heaters to prevent the freezing of devices (such as the brake systems and couplers). These specifications are not included in the basic model of the "Crystal Mover", but were modifications made based on the devices developed for the vehicles intended for Washington Dulles International Airport, and parts used in vehicles for Japanese APM systems, aiming at standardization.

Table 1 Vehicle specification

Item	Specification
Configuration	Fixed married-pair vehicle (2-car consist train)
Capacity (passengers)	93 passengers (including 8 seats)/car x 2
Tear weight	17.2 ton/car
Vehicle dimensions (mm)	11,750 (L) x 2,690 (W) x 3,725 (H)
Guidance system	Side-guided 2-axis, 4-wheel steering system
Power supply system	DC 750V
Track Gauge	1,850 mm
Vehicle performance	Max. speed: 80 km/h Acceleration: 0.97 m/s <sup>2</sup> Deceleration Normal: 0.97 m/s <sup>2</sup> Emergency: 1.33 m/s <sup>2</sup>
Propulsion control system	Variable-voltage variable-frequency (VVVF) inverter vector control (with variable load control and regenerative brake)
Brake control system	Electrically commanded pneumatic brake with regenerative brake (with stand-by brake and parking brakes)

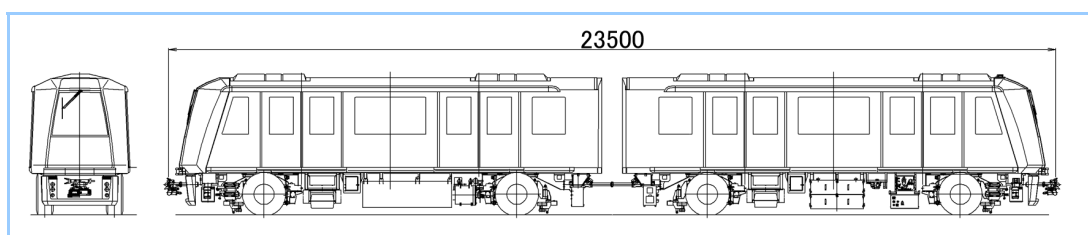


Figure 2 APM vehicle schematic

For passenger safety, in case of emergency evacuation, the emergency door release handles are provided with an interlock to prevent passengers from unlocking cliff-side<sup>(\*)</sup> doors. Technologies developed for the vehicle intended for the Asian market were used in this cliff-side protection function, keeping standardization strictly in mind. As described above, the “Crystal Mover” vehicle for Atlanta Airport was successfully customized by incorporating proven technologies with a focus on the standardization of designs, satisfying required specifications without sacrificing safety and reliability.

(\*) cliff-side: either side of the vehicle which does not have walkway for passenger evacuation

### 3. Operation and Maintenance

Operations and Maintenance (O&M) of the system are handled by Crystal Mover Services, Inc. (CMS). CMS, formed by Mitsubishi Heavy Industries America, Sumitomo Corporation of America and Sumitomo Corporation, is an O&M company established to execute operation and maintenance contracts for MHI’s APM systems in the U.S. Through the test and commissioning stage, training was provided for the CMS personnel to obtain necessary skills for the operation and maintenance activities, by actually working with engineers, such as manipulating the system, manually driving trains, etc. (Figure 3) A training program was established based on MHI’s experience and expertise obtained through the O&M business in Asia. Furthermore, after the start of service operation, periodical training is provided by engineers so that CMS can continue stable operation. The "Availability" (100% when the system in complete conformance to the operation schedule) that indicates operating stability has remained at 99.8% or higher since the service operation began. Atlanta Airport APM system has been providing stable services to passengers and demonstrating the reliability and safety of our APM system, which is contributing to win the trust of the City of Atlanta, Department of Aviation.



Figure 3 Training program

### 4. Conclusion

MHI APM systems in the U.S. started service operation at Washington-Dulles International Airport in January 2010, following the system at Atlanta International Airport, and is scheduled to start service at Miami International Airport within this year. We have also received an order for a second system in Miami (scheduled to start service in 2011). Our APM system “Crystal Mover” is expected to be widely adopted across the United States. The achievements of our APM system at Atlanta International Airport, one of the busiest airports in the world, will be a real test for our APM system to promote the system and associated technologies to the U.S. and, eventually, the global market. MHI intends to introduce our “Crystal Mover” system from Atlanta to every corner of the world.

In closing, we would like to extend our gratitude to everyone who has contributed to the completion of this APM system.