

# Baggage Handling Systems

**DAIFUKU**

# Baggage Handling Systems

Daifuku Airport Technologies is a leading global provider of end-to-end Baggage Handling Systems, offering an unparalleled network of expertise and support from project conception through system maintenance.

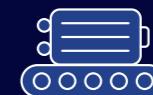
Our leading-edge technology continues to revolutionize airport operations around the world, enhancing the productivity, accuracy, and passenger service levels of our partners, and creating a seamless airport journey for their passengers.

End-to-end  
Airport  
Solutions

DAIFUKU



Self-Service  
Technologies



Baggage Handling  
Systems



Airport Operating  
Systems



Checkpoint Security  
Screening



Operations &  
Maintenance



Baggage Software  
Solutions








# Baggage Check-In

## Bag-UX | Baggage Hygiene



Bag-UX is the first solution of its kind

### Features

-  10" touch screen
-  Flip out panel for easy maintenance
-  Built-in maintenance application
-  Modern design and small footprint
-  Adjustable Sensor pod height
-  Dual cameras sense baggage moving toward and away from the unit
-  3D and AI sensors for baggage orientation and dimensioning

### Optional peripherals

- Additional cameras for bag tag data capture and images

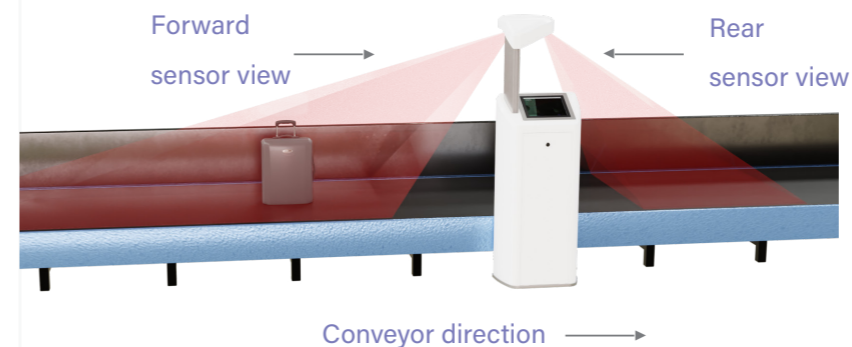
Baggage jams, throughput issues, and items requiring further identification for IATA Resolution 753 are all common issues resulting in delays or the misplacement of bags.

Bag-UX analyzes individual bags by shape and hygiene before being introduced to the baggage handling system. This crucial step prevents incorrect items from being directed into the system or other vital locations within the airport.

Bag-UX leverages Daifuku's Self Bag Drop vision technology for baggage analysis. Combining a deep learning artificial intelligence model to quickly and accurately analyze bags in motion on a collector conveyor, Bag-UX can detect unwanted items entering the Baggage Handling System (BHS), significantly reducing downstream issues.

### Functionality and smart design

- Bag-UX's imaging capabilities allow a bag's condition to be seamlessly compared pre-departure and on arrival for loss/damage waivers
- Bag-UX has the ability to classify bags in accordance with the IATA Baggage Identification Chart providing improved tracking and identification of baggage
- Bag-UX can pause the collector conveyor, allowing staff to remove or reorient the bag, or the system can redirect or automatically handle the bag
- Bag-UX can be used for inbound baggage analysis to identify baggage types



### Identifiable baggage issues:

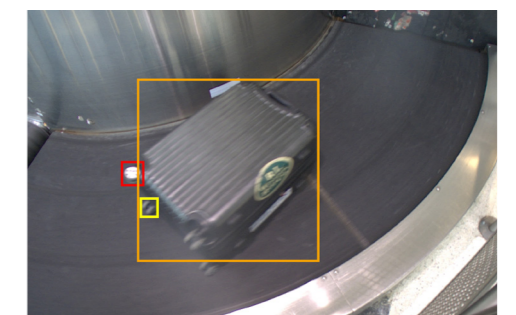
- Bag conveyability - orientation, position, handle extended
- Multiple bags/baggage spacing issues
- Tray/tub detection/usage
- Upright bag
- Images of bags for loss/damage \*
- Bag tag presence and location \*
- Detection of documents left on baggage \*
- Open or spilled baggage \*
- IATA Baggage Classification Type \*

\* Under active development with industry

26 M bags were mishandled in 2019, costing the industry \$2.6 billion

66% improvement in global bag delivery rates for airlines that track bags at check-in and arrival

Source: SITA 2020 Baggage IT Insights Report



# Baggage Check-In Check-In Conveyors











The check-in conveyor is the primary hardware unit between passengers and the baggage handling system. The integrated scale belt is used to weigh and label baggage while the dispatch conveyor is used to induct baggage onto the main collector conveyor.

## Reduced on-the-job injuries

About 10% of all airline customer service agent's injuries occur at the ticket counters due to lifting of heavy bags. This number drops significantly with our check-in conveyors due to reduced manual handling of bags by airline employees. The reduced on-the-job injuries will attribute to increased profitability and employee satisfaction.



## Features

-  Automatic bag weighing and dispatch onto take-away systems
-  High quality stainless-steel finish
-  Eliminates trap points for fingers, straps, and labels
-  Tamper-proof weighing scales
-  Removable side panels and roll-out system provides easy access for cleaning and maintenance
-  Adaptable operation to suit remote and self-service check-in
-  Integrates seamlessly with both Daifuku-based and third party self-bag drop devices
-  Integrated controls are adaptable to different systems needs

## Fully integrated controls

- Easily serviceable connected solution
- Works with different controls architecture systems - Ethernet, ControlNet, DeviceNet, Profibus, Profinet, Asi, etc.
- Merge logic can run from either the main BHS PLC or within the Check-UX PLC

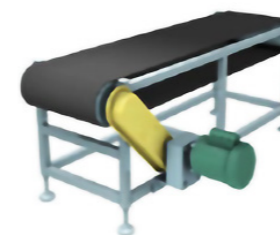
## Integrated drum motor

- Maintains slim profile of the overall unit
- Available in IE3 and IE4 motor efficiency ratings
- Safer and more efficient than traditional belt motors

Drum Motor



Conventional Drive



## Easy access

Daifuku's scale dispatch units have hinged conveyors that can be propped open to access the internal controls and drive packages underneath each unit for easy serviceability.

## Modular conveyor design

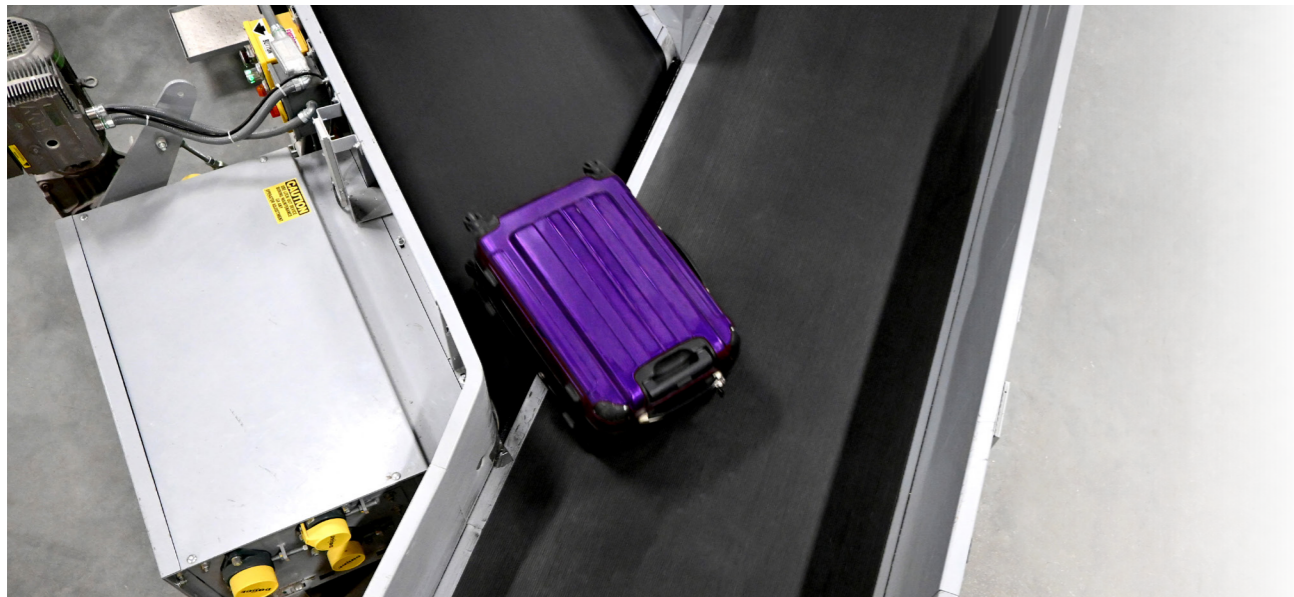
Conveyor bed sections are removable with quick disconnects to easily remove a conveyor section and replace it within minutes.

## Drum motors

The Daifuku scale dispatch units utilize drum motors, which allow the design to be modular and easily replaceable. A drum motor is a one-component conveyor drive where the motor, gear drive, and all moving parts are enclosed inside the drum.



# Conveyors



The general transport conveyor is a straight belt conveyor used to transport all types of standard baggage and can be supplied with high side walls or stainless steel cladding to accommodate various uses throughout the airport.

This style of conveyor is designed to transport in a straight line and can be programmed to provide a variety of functions such as merging, accumulating, inducting, and sorting baggage.

General transport conveyors can be supplied as a horizontal surface or at any degree of incline or decline to a maximum angle of 20 degrees.

## Metering Conveyor

The metering conveyor is a short straight conveyor used for metering or queuing bags, or it can be used for creating bag separation.

This unit is implemented before conveyor junctions, merges, or places where accumulation or separation is required. For this reason, the conveyor is designed with robust components to cope with a high number of stops/starts.

## Merge Conveyor

Highly functional in design, this conveyor features an angled edge where two conveyor lines meet. This allows merging baggage to move from one conveyor line to another at either low or high speeds. The merge conveyor can be programmed in a variety of configurations so that the merge priority is given to the appropriate conveyor line.

Daifuku merge conveyors are typically used in standard baggage systems, and can be integrated with other queue type conveyors, power turns, or standard horizontal conveyors. They are available in forward and reverse operation modes, and various center line lengths.

## Collector Conveyor

The collector conveyor performs a specific function of collecting baggage at the check-in area. Bags can be loaded directly onto the conveyor by the check-in operator or, if used with check-in conveyors, bags can be injected automatically.

Most typically constructed with a stainless steel rim, it can be used as a stand-alone belt conveyor or to collect bags that are transferred from the check-in conveyors.



Our conveyors are capable of discharging baggage at a continuous rate of up to 40 bags per minute

# Carousels

Daifuku's baggage carousels require minimal maintenance and are designed to operate continuously and quietly, ensuring consistent, reliable performance.

As one of the few providers that make both flat plate and slope plate carousels, Daifuku provides flexible alternatives to accommodate the various demands for any airport.

Friction drive carousels with rubber slats are also available, providing energy efficiency.



Versatile design, capable of handling virtually any shape and size of luggage



Designed to operate continuously and quietly, ensuring reliable performance and minimal maintenance



Solutions are designed to withstand high-volume BHS operations



Flexible alternatives can accommodate variations in height and configuration to meet the BHS demands

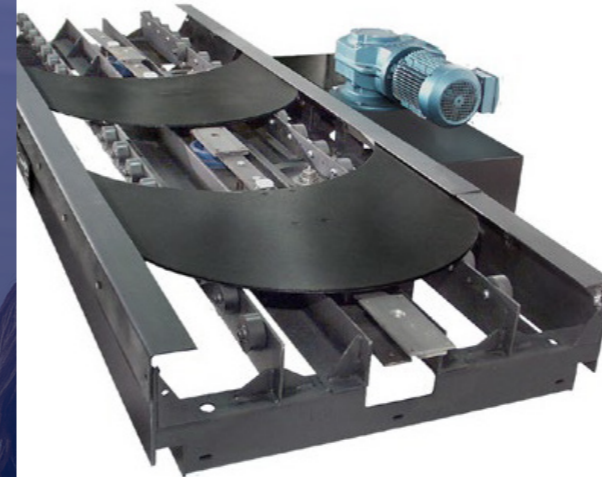


Flat Plate Carousel



Slope Plate Carousel

## Flat Plate Carousels



The Flat Plate Baggage Carousel is a high-capacity, motor-driven, crescent plate closed-loop device that can function as an inbound baggage claim device or an outbound baggage make-up device. Both functions feature high capacity and reliability with smooth, quiet operation.

This baggage carousel has been designed using modular construction, allowing pre-fabrication and pre-assembly at the factory. The modular construction also offers design engineers the flexibility to accommodate tight space requirements and single or multiple feeds at a variety of locations.



The flat plate carousel's standard direction of travel is counterclockwise to allow comfortable baggage removal for passengers and baggage handlers. Clockwise travel is also available to accommodate other considerations.

Make-up units are provided with flat black (or a customer-specified color) painted trim and cover panels, while passenger baggage claim units are provided with 12-gauge stainless steel trim and cover panels for a uniform, pleasing appearance.



## Slope Plate Carousels

The Slope Plate, also known as an Incline Claim, baggage carousel is a high capacity, motor driven, closed loop device that can function as an Inbound Baggage Claim Device or an Outbound Baggage Make-up Device. Both functions feature high-capacity reliability with smooth, quiet operation.

This baggage carousel has been designed using modular construction, allowing pre-fabrication and pre-assembly at the factory. The modular construction also offers design engineers the flexibility to accommodate tight space requirements and single or multiple feeds at a variety of locations.

Carousel pallets are designed to be reversible, allowing pallet installation with the overlap opposite the direction of travel. The standard direction of travel

is counterclockwise to allow comfortable baggage removal by most passengers and baggage handlers. Clockwise travel is also available to accommodate other considerations.

These reversible pallets minimize the possibility of baggage, bag straps, or tags from wedging into the overlap in the event of a jam. This feature is not available from most other domestic suppliers of carousels.

The standard Baggage Claim Carousel is provided with 14-gauge stainless steel pallets and 12-gauge stainless trim for excellent functional characteristics as well as appearance. Make-up Devices are provided with flat black painted trim cover panels in lieu of stainless steel.



We offer two pallet materials to meet the needs of make-up or baggage claim devices



Stainless Steel Pallets



Rubber Pallets



Our carousels come in a variety of configurations to meet the needs of any environment

# Early Baggage Storage and Sortation

01

## Baggage Tray System

Daifuku's Baggage Tray System (BTS) is among the world's fastest systems providing transportation and sortation of passenger bags from check-in counters to baggage make-up areas with the use of individually trackable trays.

## Early Baggage Storage

The Early Bag Storage (EBS) system is primarily used to store and release bags that have been delivered to the airport early, with the capacity to hold bags indefinitely, enhancing operations at the makeup stage.

In addition to standard Lane-Based storage, Daifuku also offers high-speed Automated Storage and Retrieval Systems (AS/RS). AS/RS can utilize either a combination of cranes and shuttles or automated guided vehicles to meet the storage and performance needs of any airport.

## Sortation

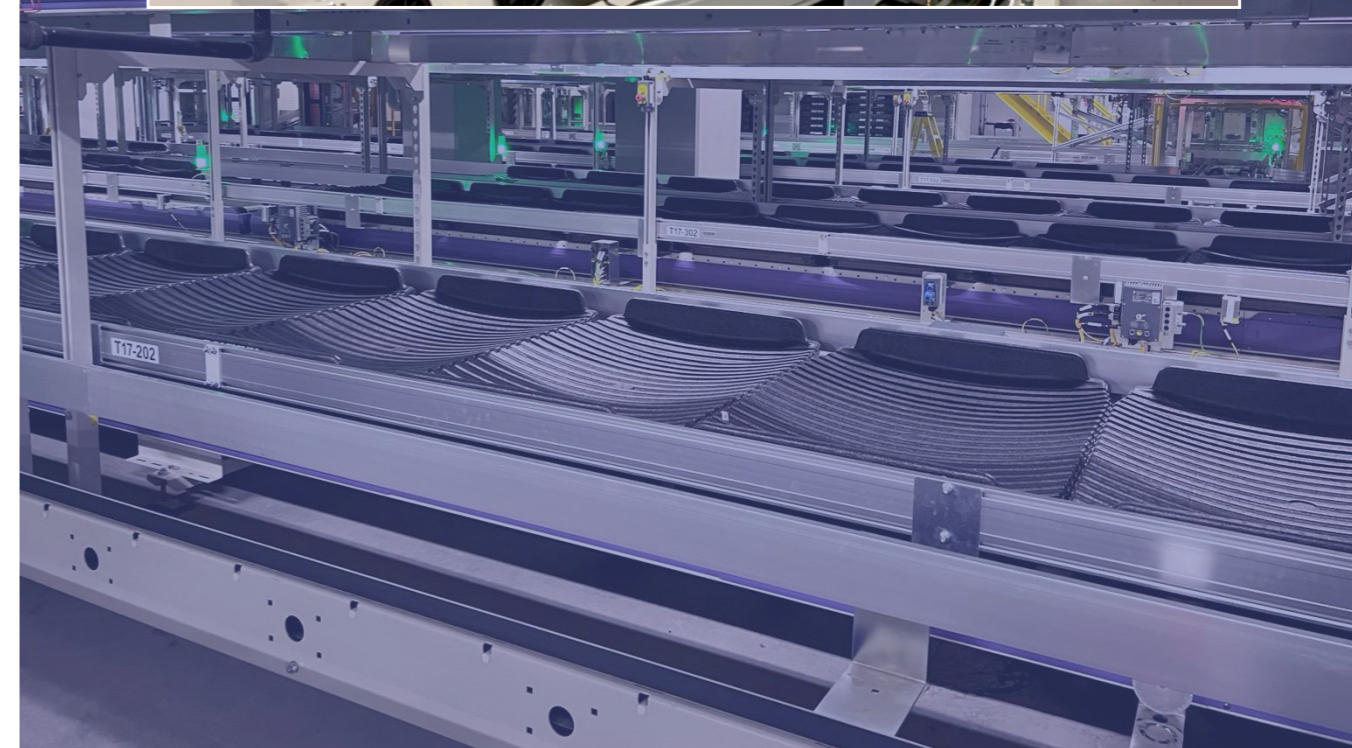
Daifuku is a leading global provider of efficient, high-speed solutions for the transportation and sortation of passenger bags from check-in counters to baggage make-up areas. Our dynamic solutions are among the world's fastest. They have the unique ability to mix standard and oversized baggage, offering a range of operational benefits to our partners.

From planning to installation and ongoing support, our dedicated team works closely with our airport partners to develop solutions that are tailored to meet the unique operational needs of their terminal environments.

## Lane-Based Storage

Lane-based storage is a conventional storage system where bags are grouped with related bags according to the flight they will be on or by the time they will need to depart. Lane-based storage requires groups move together. When it is time, bags are released as entire lanes and then resorted as necessary.

Our lane-based storage solutions can be integrated into both conveyor systems and our Baggage Tray Systems (BTS) solutions, facilitating buffer applications for bag storage in small-to-medium sized airports.



# Automated Storage Retrieval System Based Storage

Daifuku Automated Storage Retrieval System (AS/RS) solutions allow for the high-speed vertical storage of individual bags. They are used in conjunction with Baggage Tray Systems (BTS) for large terminal environments. AS/RS support 100% tracking and traceability, so the location of each bag can be found at any given time. Daifuku AS/RS solutions are fast and reliable with a longstanding history of use since 1966 in a variety of industries. Daifuku offers two configurations for AS/RS based storage for maximum flexibility within any airport footprint.







## Crane based storage

We have developed over 40,000 cranes worldwide across a myriad of industries and offer multiple configurations for our AS/RS technologies to suit the operational needs of our airport partners. Redundancy measures of two cranes per aisle can be provided. The crane-based systems provide more efficient use of make-up space and ground operations.

## Shuttle rack storage

Each rack level in the system is serviced by a dedicated shuttle vehicle. They utilize leading-edge technology to store individual trays with bags. These high-speed shuttles can quickly store and retrieve bags as needed with rates of up to 33 bags per minute.

### Features

-  Flexible design can accommodate various airport footprints
-  Utilizes leading-edge AS/RS technology to store individual trays with bags
-  100% tracking control and traceability of all bags
-  Longstanding history of use
-  Flexible and fast carrying for any amount of airport traffic
-  Faulty cranes/shuttles can be replaced with little disruption to the system while others continue to operate



The shuttle rack system can store bags at rates of 30-33 bpm

Shuttle rack storage



Crane based storage

20,000+ AS/RS based storage solutions installed worldwide







# Baggage Tray System/ Individual Carrier System

Daifuku's Baggage Tray System (BTS), also known as Individual Carrier Systems (ICS), is among the world's fastest and can convey bags at speeds of up to 10m/s (36 km/h or 22 mi/h). It offers an efficient solution for the transportation and sortation of passenger bags from check-in counters to baggage make-up areas. Unlike conventional systems where bags are placed directly on conveyor belts, our BTS solution transports bags in individual trays and offers a range of operational benefits.

It can also be integrated with Daifuku's Automated Storage and Retrieval Systems (AS/RS), as well as other automated storage systems, to provide temporary bag storage for passengers who check-in early or have extended layovers at large airports.

Trays are equipped with individually identifiable RFID tags that allow 100% tracking and traceability of baggage throughout the Baggage Handling System. This dramatically reduces the operational issues caused by low tracking performance, a common problem for conveyor-based systems.

## Features

-  100% tracking control and traceability of all bags
-  One of the world's fastest high-speed carrier systems
-  Flexible design can accommodate various airport footprints
-  Capable of handling a variety of baggage sizes

Our BTS conveys bags at  
up to 36 kph (22.4 mph)



Discharge



Top Loader



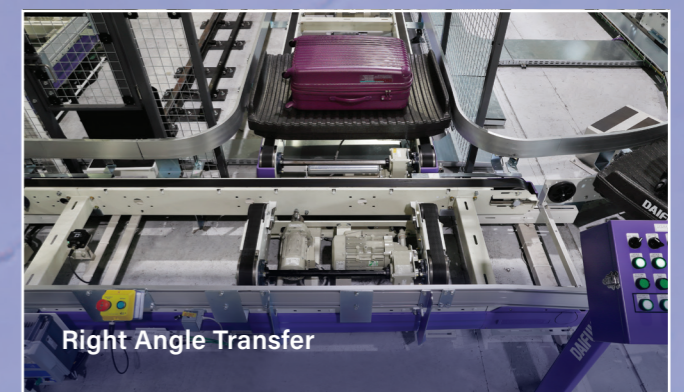
Merge/Diverge



Curve Conveyor



Straight Conveyor



Right Angle Transfer

## Vertical Sorting Unit

The Vertical Sorting Unit (VSU) has the ability to divide the baggage flow into two vertically separated paths, based on individual tray or route selections. A compact design allows it to be incorporated within the Baggage Handling System of any airport, accommodating both regular and fragile items on any type of conveyor line.

Description	Key Operating Parameters
Length	3130 mm (123.2 in)
Height	1340 mm (52.8 in) Minimum
Speed	1.2, 1.5, 2.0 m/s (1.3, 1.6, 2.2 yd/s)
Motor Size	0.75 - 2.2 kW (conveyor)
Throughput	1800 trays/hr



## Tilt Tray Sorter



The Tilt Tray Sorter (TTS) is a component of the Baggage Handling System (BHS), tasked with controlling and discharging bags for a variety of applications, such as pre-sortation, final sortation to make-up locations, and early bag storage; it can also be used for screening applications within the overall BHS.




The TTS operates at a high-speed, with intelligent features to maximize baggage throughput at very low operating costs. Our patented technology delivers a high degree of efficiency, preventing bags from being inducted together or in between trays. By ensuring bags are inducted into the center of the tray each time, it reduces the need to be tipped into a common chute and then double-handled by baggage handlers.

Daifuku's TTS utilizes dynamic speed change technology to reduce component wear and energy consumption. With features including built-in maintenance attributes with condition-based monitoring, this reduces the lifetime costs of the system.

The tilting trays can be accessed remotely to provide intelligent operating information and connection for remote upgrades.

All TTS hardware features a lightweight build and ergonomic, low-profile design, making it suitable for installation within any airport environment. This also facilitates simple system flexibility to meet passenger growth and increased baggage demands.

### Features

-  Easy maintenance
-  Real-time communication enabling speed changes and baggage rerouting
-  Advanced fault monitoring allows for fast recovery times

# Checked Baggage Security Screening

## Mobile Inspection Table

The Mobile Inspection Table (MIT) is designed for use inside airport Checked Baggage Reconciliation Areas (CBRAs), and is implemented as a replacement for traditional belt conveyors and static search tables. Utilizing leading-edge robotic technology, the MIT has revolutionized operations throughout CBRAs globally and offers a range of benefits for both airports and airlines.

### Autonomous, functional design

Bags are loaded automatically onto the MIT unit, which autonomously delivers them to Transportation Security Officers (TSOs) by natural feature or magnetic tape/bar guidance navigation. TSOs can then search the bag directly on top of the MIT unit, which is equipped with a stainless steel table top that meets all PGDS 7.0 requirements. Upon search completion, the MIT delivers bags back to the appropriate conveyor to proceed onwards.



### Built using proven technology

The MIT solution has been developed using technology found inside our 100ST SmartCart® Automatic Guided Vehicle (AGV). We have been making AGVs since 1962 with a current install base of over 13,000 globally.

Throughout this period, the AGV has demonstrated itself to be an extremely reliable solution within high-intensity manufacturing environments where maximum uptime is demanded; much like baggage handling systems.






### Integration with any OEM

MITs are designed to be a standalone system able to integrate with any OEM mechanical equipment provider and/or any controls provider for Baggage Handling Systems (BHS).

As a result of this design, MIT systems have been successfully integrated with outside providers and the product is well suited to continue this success on future projects.

There are two connections that occur with the BHS when implementing an MIT system. For bags entering the CBRA, there is an interlock to the BHS system starting at the Daifuku-provided top loader area. There is also an interlock to the BHS system at the unload points to start the conveyors.

### Equipment provided for all MIT installs:

-  MITs and associated equipment (charger and guidance requirements)
-  Inspection stations and all associated equipment (excluding the secondary viewing stations)
-  Top loader and two upstream queue conveyors
-  Equipment associated with tipping mechanism (tipping bar and transfer plate)
-  All MIT-related electrical devices (PLC cabinet, wireless access points, MIT server, control panels, photocells, and other miscellaneous field devices)



Easily integrates with outside providers to suit all airport needs



**DAIFUKU**

[daifukuatec.com](http://daifukuatec.com)