



The 30 Solutions for Advancing All People's Comfort in Air Travel

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Preface

Constant efforts have been made to create a barrier-free and accessible society. However, air passengers, particularly those with disabilities, are still required to endure physical and psychological burdens during flights because of the confined space and unique environment in the cabin. The Japan Aerospace Exploration Agency (JAXA) has undertaken research and development focused on realizing “Universal design for advancing all people’s comfort in air travel” in terms of equipment and systems, with the objective of relieving burdens and creating a comfortable experience in all aspects of air travel for all people, including those with disabilities, older people, children, and cabin crew.

The initial phase involved a thorough examination of various issues faced by airplane passengers, with a particular focus on people with disabilities. Subsequently, we engaged in discussions to generate ideas for new equipment and systems that could address these issues, considering technological, safety, and operational perspectives. The outcome of this process was a compilation of 30 concrete and effective solutions, which are presented herein.

Note that these solutions are currently in the conceptual design phase. Further details will be refined through cooperation with stakeholders in the aviation industry.

Additionally, we have collaborated with Japanese suppliers of aircraft interiors to develop accessible lavatories and seats, comfortable galleys, and inclusive cabin layouts. These collaborative efforts are not encompassed within the 30 solutions presented in this document.

Most of the conceptual illustrations in this document were crafted by Mr. Naoya Sanuki, and some were provided by Toyota Boshoku Corporation. In addition, numerous individuals within and outside of JAXA offered valuable opinions and assistance during this study. We express our gratitude to all who contributed to this endeavor.

YASUOKA Tetsuo
Leader of Soratabi-UD Team

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Solution Number 01

Database for Carry-On Equipment into Airplane

Everyone can access a reliable database detailing specifications of carry-on equipment into the airplane, such as passenger-owned wheelchairs, medical equipment (e.g., ventilators), and car seats. This enhances the efficiency of flight ticket booking and check-in processes.

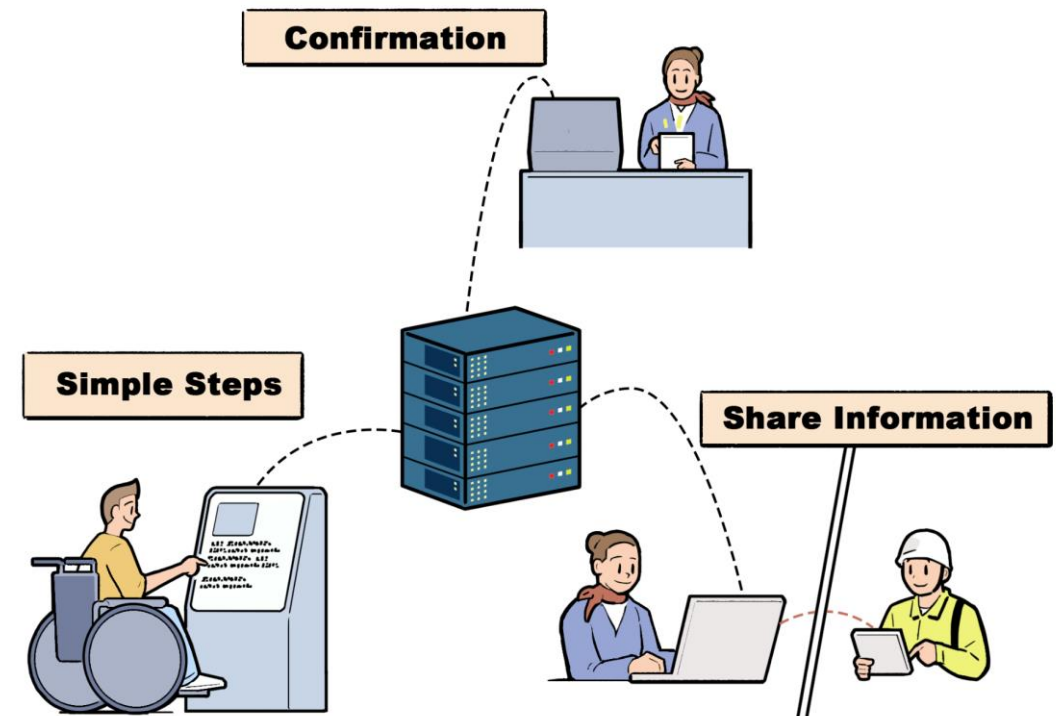
Scope: People using wheelchairs/medical equipment/ car seats

People will no longer need to invest time in scrutinizing detailed information regarding carry-on equipment when booking their flight tickets. This streamlined process will ensure faster and smoother check-in.

Scope: Ground staff

For the check-in staff and ground handling staff, collecting information regarding passenger's carry-on equipment, such as wheelchairs (e.g., size, battery types, handling instructions), will no longer be a time-consuming task.

Category: Ticket reservation and check-in system



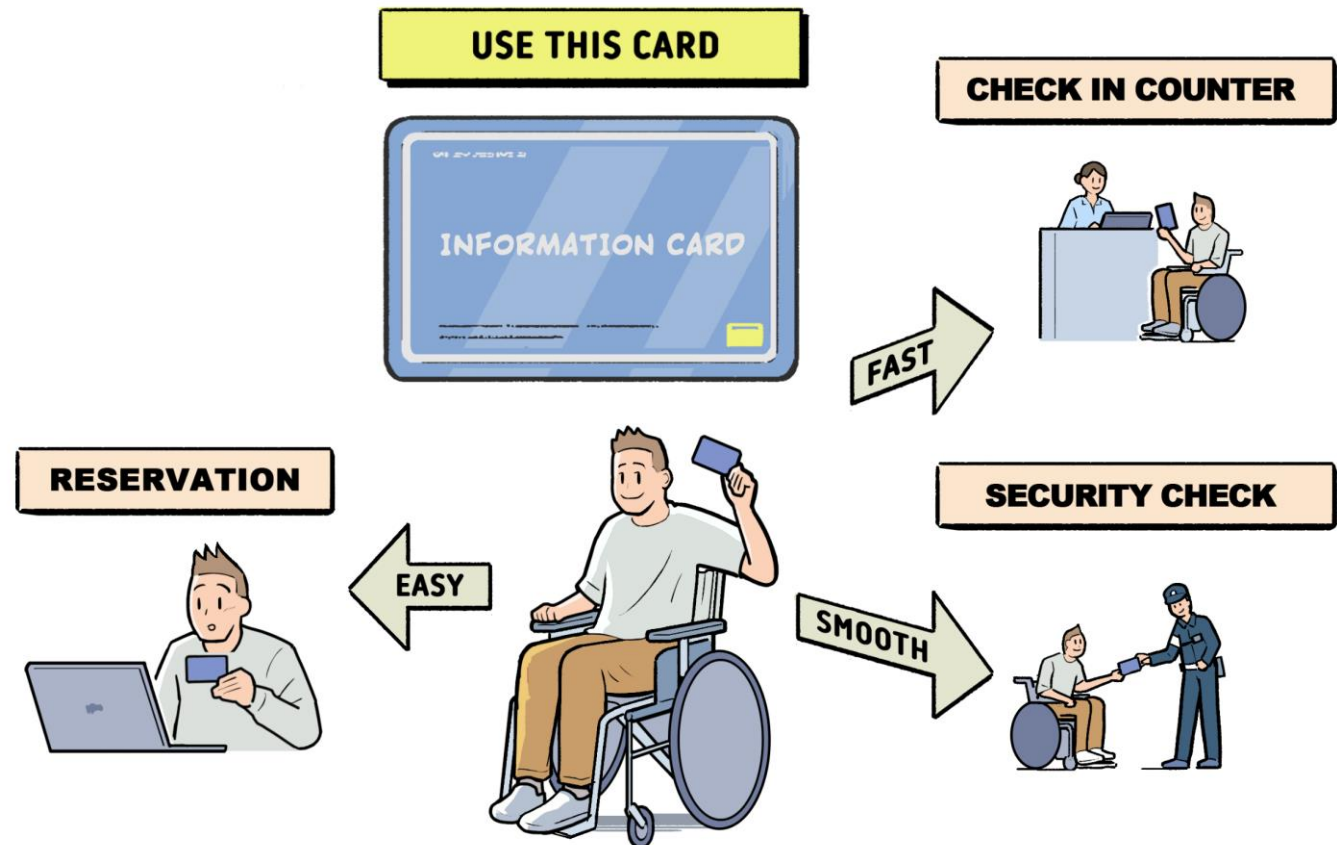
Solution Number 02

Special Assistance Information Card Available Across All Airlines

Passengers can utilize a card containing information related to special assistance request, carry-on equipment (i.e., wheelchair data linked to Solution Number 01), and any additional requests. The card can take the form of a chip card or a mobile phone app and is designed to be available at any airline. The data format of the information on the card is standardized.

Scope: People who need special assistance (particularly wheelchair users)

People who need special assistance will experience smoother and faster processing of booking, check-in, and security check procedures. Furthermore, they will no longer encounter repeated inquiries from ground staff regarding the information already contained in the card.



Category: Ticket reservation and check-in system

Self Baggage Drop System for Dealing with Strollers

This self baggage drop system is designed to deal with not only for regular baggage but also for general strollers and special needs strollers for children with disabilities. The feature of automatic stroller packing into plastic bags is also anticipated.

Scope: People with children using strollers

People will no longer need to wait in line at crowded staffed counters to check strollers in.

Scope: People with children with disabilities

Even if people wish to check their special needs strollers at the timing of check-in, they will no longer need to wait in line at a staffed counter.



Solution Number 04

Security Screening Equipment Available for Passengers in a Wheelchair

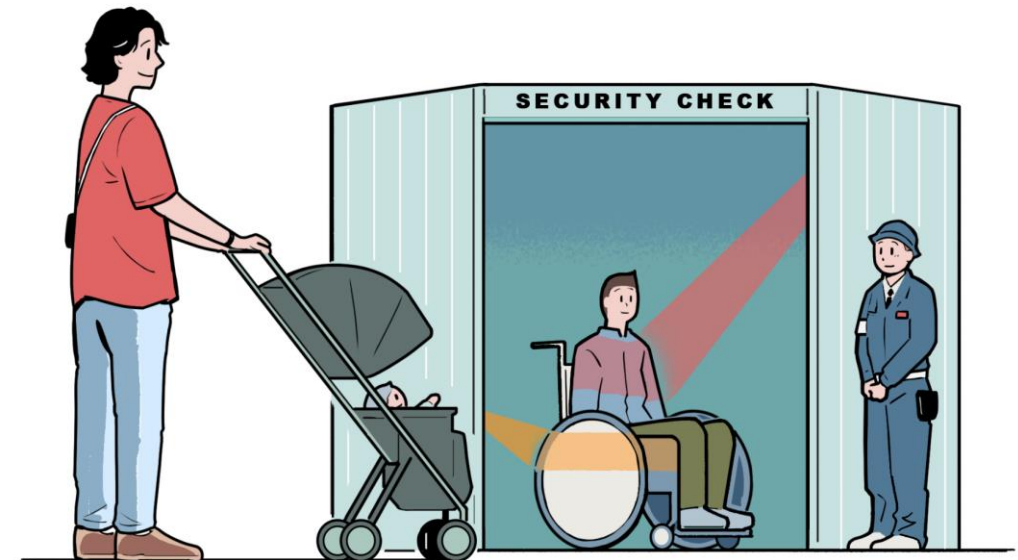
Passengers can pass through security screening while in a wheelchair or a special needs stroller without their bodies being directly touched by inspectors.

Scope: Wheelchair users, and people with children with disabilities

People will undergo a contactless security screening instead of having their body touched directly. This will also result in a faster process.

Scope: People with children using strollers

People will no longer need to fold their strollers during the security screening, leading to a smoother and more efficient process.



Category: Airport facility

Interactive Digital Companion for Airport Guidance

Utilizing artificial intelligence (AI) and augmented reality (AR) technology, a digital companion guides passengers through the airport to boarding. This companion also assists passengers in booking alternative flights in the event of cancellations and engages in interactive conversations with them. Although the AR device is inconspicuous to passersby, airport staff can quickly locate and help passengers using the GPS functionality on the device if necessary.

Scope: People who have concerns about communicating with others (particularly people with intellectual and developmental disabilities, and people with mental disorders)

The companion will alleviate passengers' anxiety, enabling them to navigate the airport independently.

Scope: People with visual impairments

Flight announcements and notifications (e.g., changes in departure time or boarding gate) will be conveyed to people as text messages using an AR view.

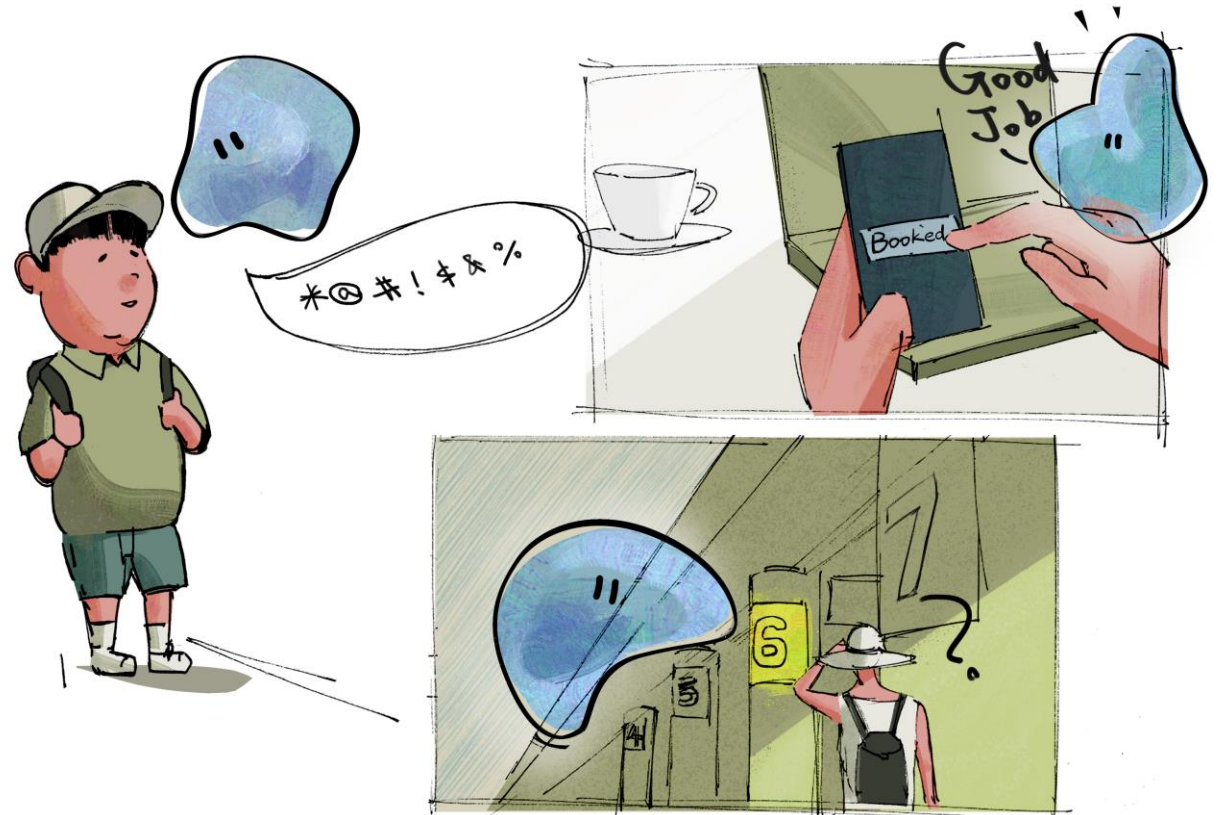
Scope: Wheelchair users

Even when navigating complex routes in the airport, people will reach their destinations independently without confusion.

Scope: All passengers

All passengers will enjoy communicating with the digital companion while moving around the airport. Additionally, they will effortlessly obtain the latest flight information and will have the ability to book alternative flights.

Category: Airport facility



Courtesy of Toyota Boshoku Corporation / Lai Chunwei

Moving Assistance Device in Airport

This device guides passengers from check-in to the boarding gate, avoiding passersby and obstacles on the route. Moving assistance devices are envisioned to have various configurations, including devices shaped like animals (e.g., dogs, cats), robots, and wheelchairs. The device can provide information regarding airport facilities, direct passengers to boarding gates (even if the boarding gate has changed), and interact with passengers. If necessary, airport staff can quickly locate the passenger and provide assistance, using the GPS functionality.

Scope: People with visual impairments

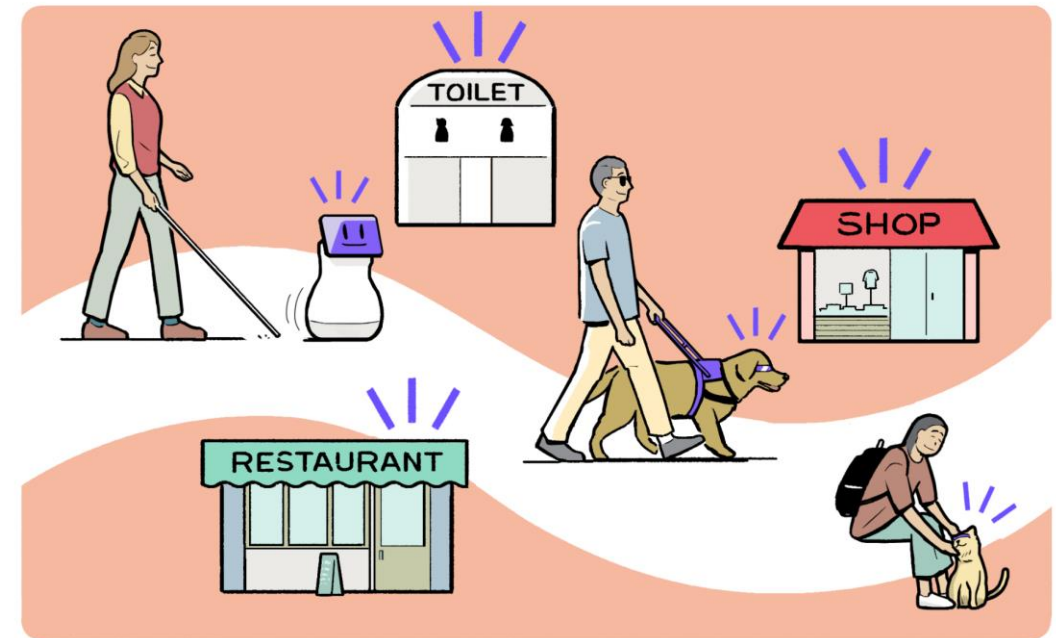
People will be able to move freely in the airport without airport staff assistance.

Scope: People who have concerns about communicating with others (particularly people with intellectual and developmental disabilities, and people with mental disorders)

The device will ease people's anxiety, and enable them to travel independently to their destinations.

Scope: All passengers

All passengers will enjoy interacting with the device while moving around the airport.



Assistance Enabling Passengers to Transfer to the Window Seat Easily

Even within the confines of a cramped economy class seat, passengers requiring total assistance can be easily transferred to the window seat by two caregivers using a slide board and slide seat.

Scope: Caregivers and ground staff

This method will reduce the physical burden associated with transferring passengers who require total assistance to the window seat.

Scope: Wheelchair users

Passengers who use wheelchairs will be able to book and enjoy a window seat without worrying about imposing a burden on caregivers and airlines.



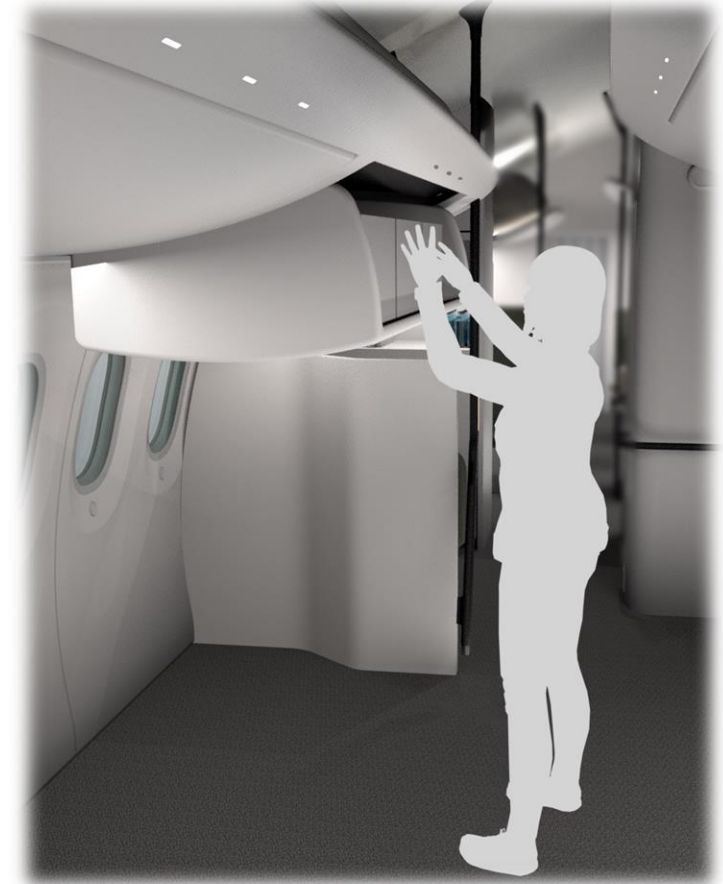
Overhead Stowage Bin Capable of Lifting Up and Down

The overhead stowage bin can be sufficiently lowered for easier stowage as needed, when passengers stow their baggage into it. The stowage bin is designed not to disturb seated passengers and not to intrude into the aisle even when lowered. Additionally, the bin is designed to lift up and down with minimal force.

Scope: All passengers and cabin crew

The physical burden of lifting heavy baggage up and down will be alleviated.

Category: Overhead stowage bin



Courtesy of Toyota Boshoku Corporation

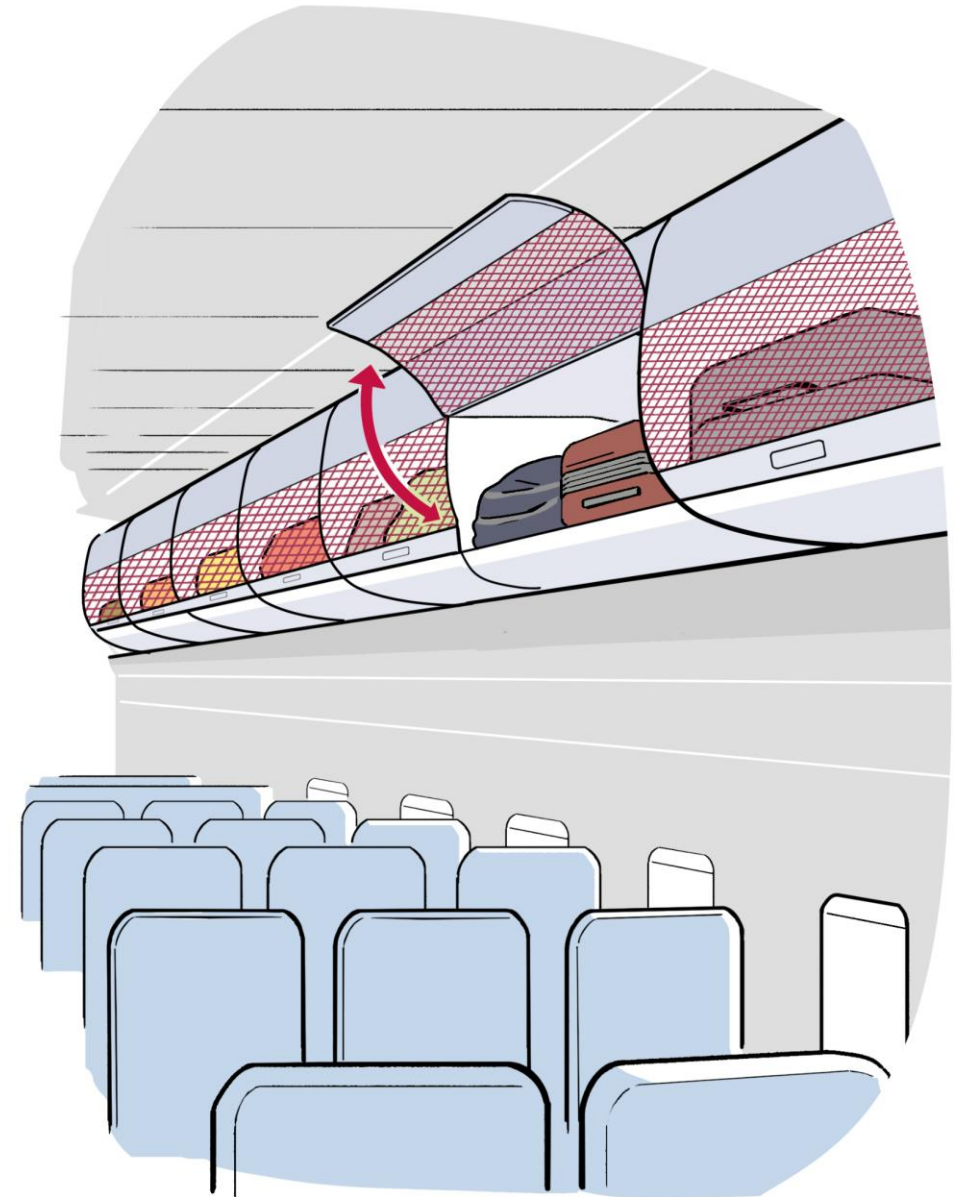
Overhead Stowage Bin with Visible Contents

Part of the overhead stowage bin is transparent or meshed, allowing passengers to see inside without opening it. The design is esthetically considered.

Scope: All passengers and cabin crew

All passengers and cabin crew will easily identify available overhead stowage bins for stowing their baggage without needing to open them. Additionally, the risk of accidentally dislodging contents while retrieving baggage will be reduced.

Category: Overhead stowage bin



Solution Number 10

Indicator Showing Whether the Overhead Stowage Bin is Latched

When the overhead stowage bin is closed and fully latched, an indicator turns on.

Scope: Cabin crew

Cabin crew will conduct quick safety checks on the latches of overhead stowage bins. Additionally, the physical burden of cabin crew using their hands to confirm complete closure of the overhead stowage bins will be reduced.



Courtesy of Toyota Boshoku Corporation

Category: Overhead stowage bin

Solution Number 11

Folding Seats Enable Standing Up in Seat Space

Passengers can stand in their seat space by folding up the seat.

Scope: All passengers

All passengers will be able to stretch and feel refreshed in place. Passengers in window seats will have easier access to the aisle. Additionally, the seat will be utilized to store special large baggage such as musical instruments.

Scope: People with illnesses

Passengers with economy class syndrome and restless legs syndrome will be able to stretch at their seats.

Scope: People with assistance dogs

Assistance dogs will stay comfortable during the flight.



Category: Seat

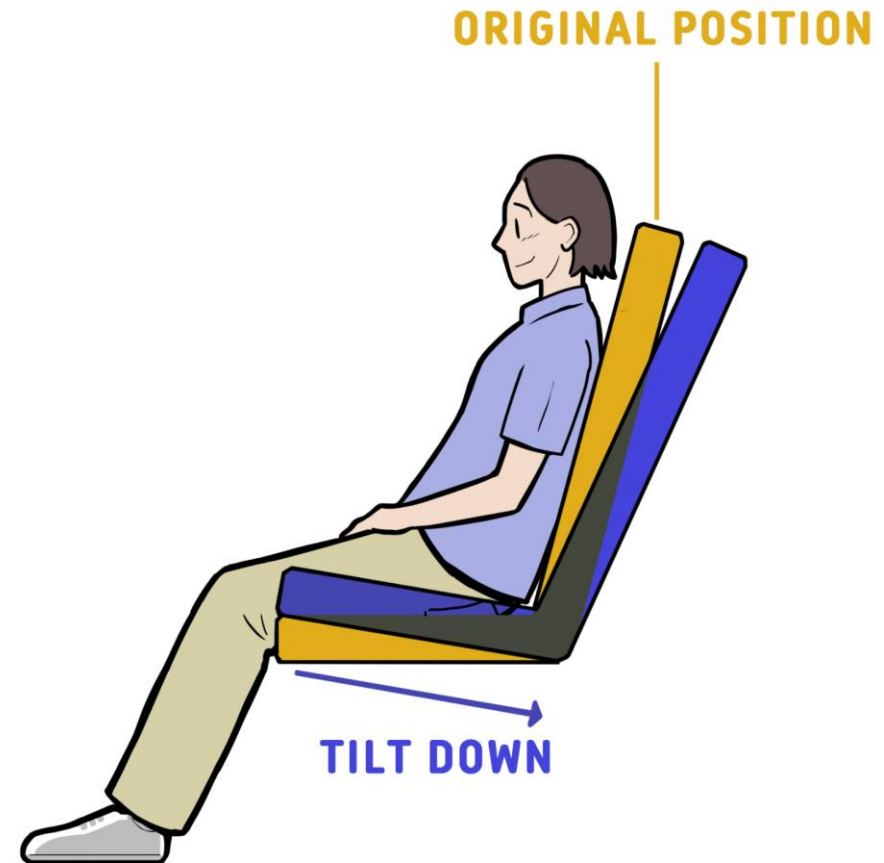
Solution Number 12

Seat Capable of Tilting

This seat features a tilting function, allowing both the seat and backrest to tilt independently or simultaneously. Passengers are not required to return their seats to the original position during takeoff and landing.

Scope: Wheelchair users and all passengers

Wheelchair users and all passengers will find it easier to maintain a stable posture compared with conventional cabin seats, and overall comfort will be enhanced during the flight.



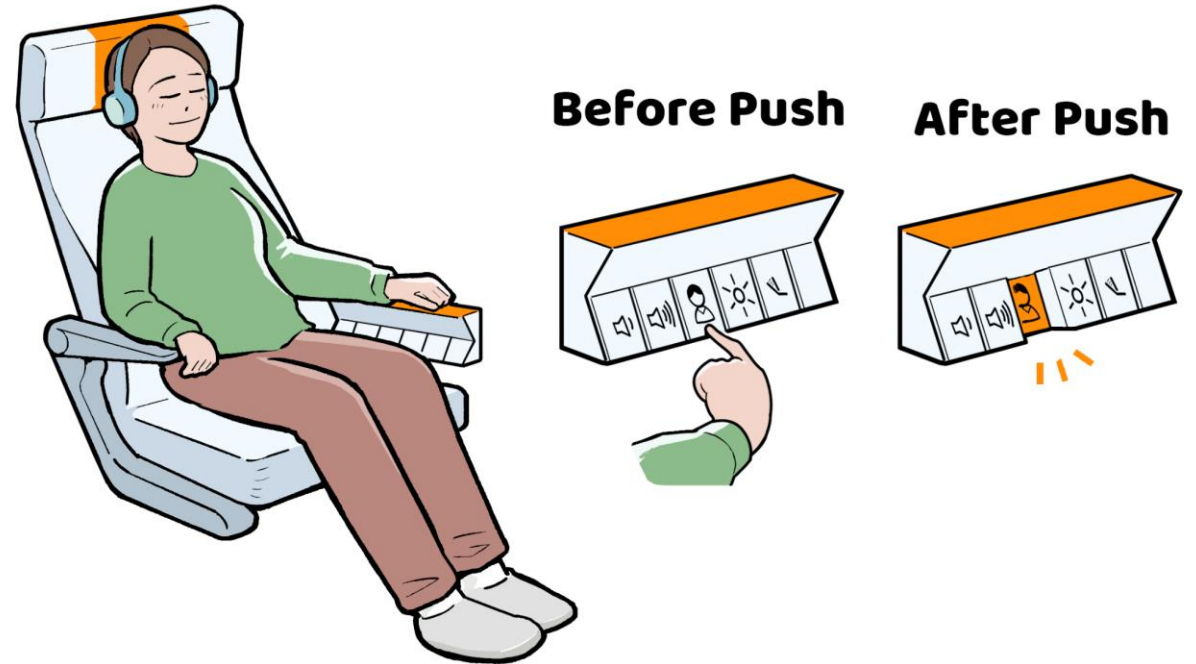
Solution Number 13

Seat Facilities with Color Contrasts and Tactile Features

Each seat facility (e.g., seat pockets, tables, monitors, buttons) is designed with differences in color contrast and tactile features. The button to call cabin crew is not only designed to be easily identifiable, incorporating concave and convex features, but is also designed to clearly identify whether the button has been pressed.

Scope: People with visual impairments

People with visual impairments will easily identify the facilities around their seat.



Solution Number 14

Visually-Distinguished Seat Pockets

Seat pockets are designed with unique colors and numbers for easy identification.

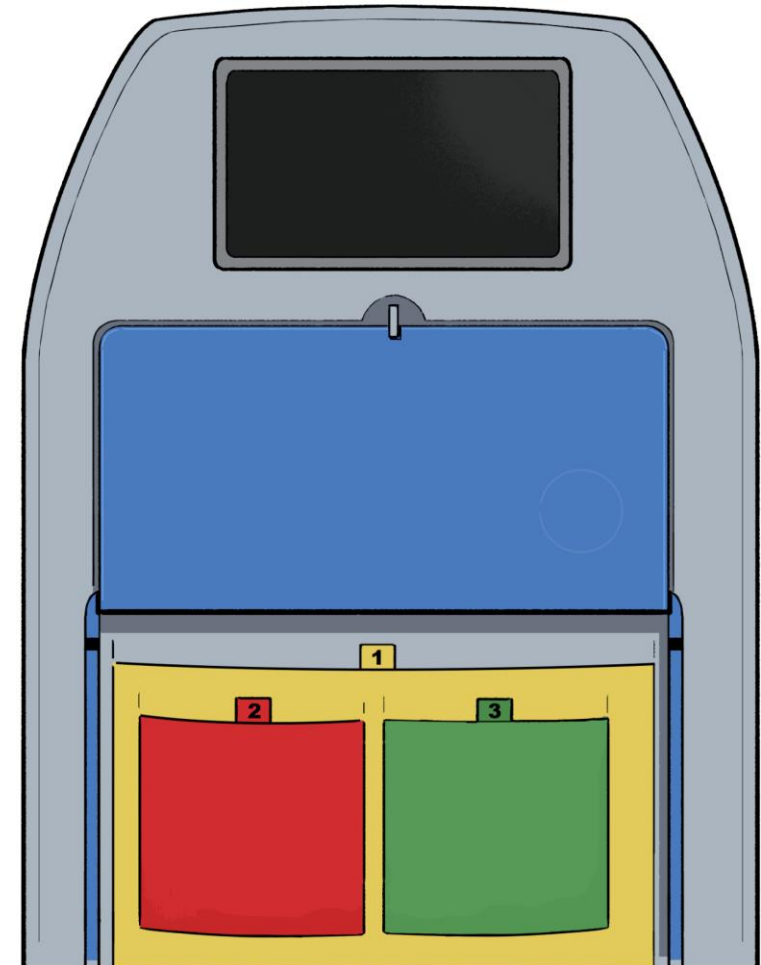
Scope: People with developmental disabilities

The numbered and colored seat pockets will make it simpler for passengers with developmental disabilities to remember the location of their belongings and reduce the likelihood of leaving the airplane with belongings remaining in the seat pockets.

Scope: People with visual impairments

People with visual impairments will distinguish seat pockets easily because of distinct colors and contrasts.

Category: Seat



Indicator Showing Original Position of Economy Class Seat

An indicator turns on when the seat is in the original upright position, allowing passengers and cabin crew to easily determine the seat position.

Scope: Cabin crew

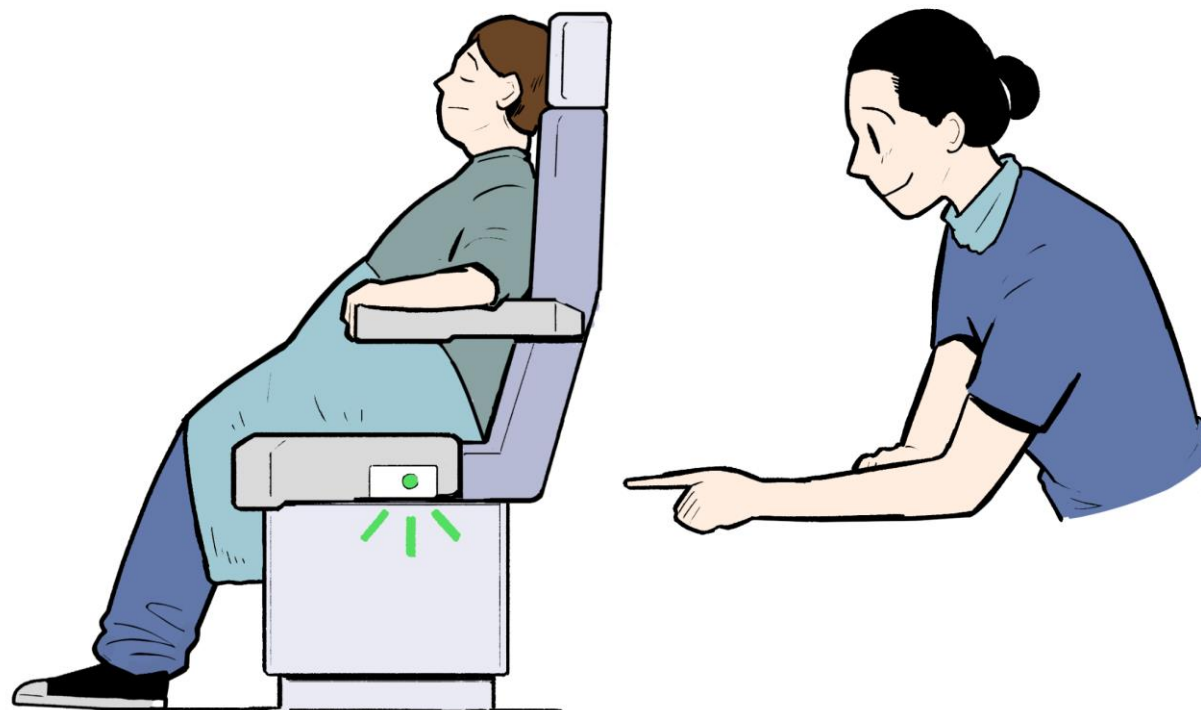
Prior to takeoff and landing, cabin crew will be able to quickly assess the seat position. This will eliminate the need to directly inquire about passengers' seat positions.

Scope: All passengers (particularly people with large physiques)

Situations where the passenger's seat appears to be reclined despite being in its original position will no longer be misrecognized by cabin crew.

Category: Seat

Take Off and Landing



Indicator Showing Whether the Seatbelt is Fastened

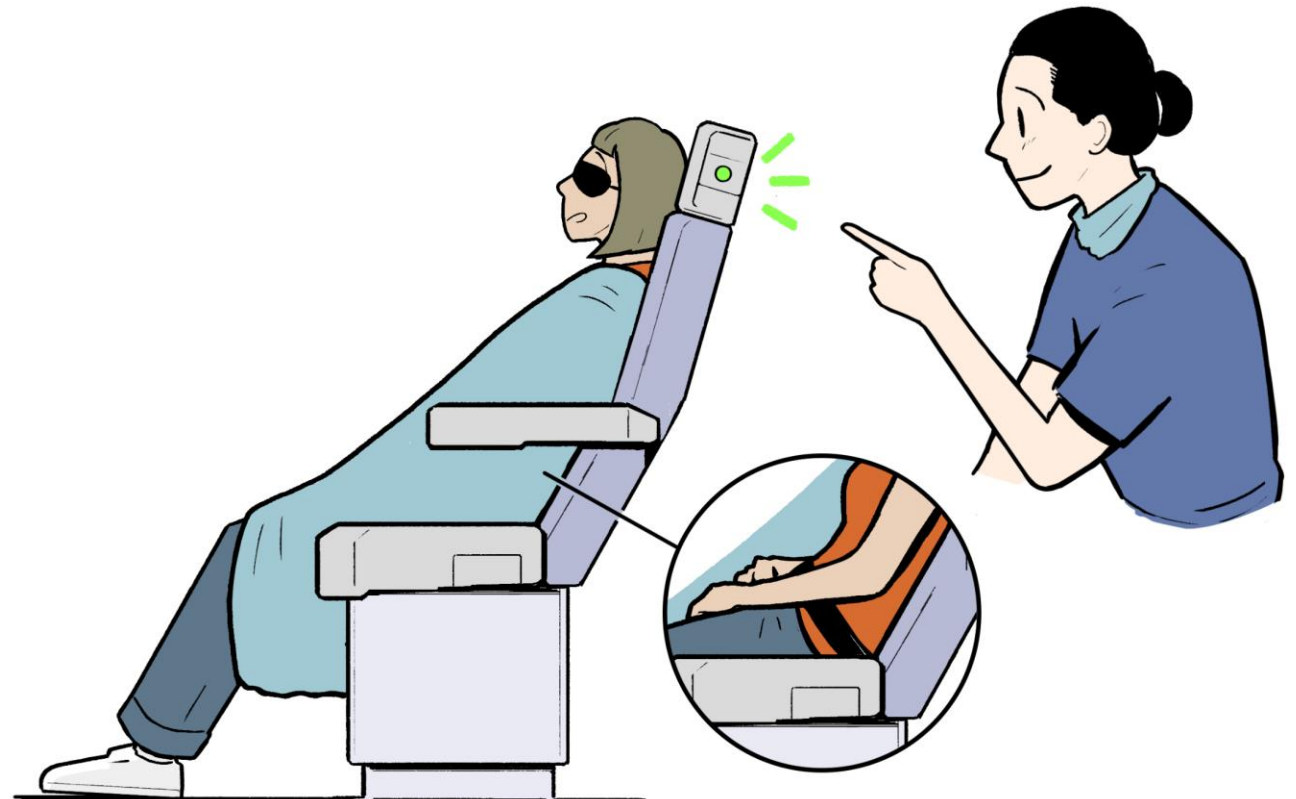
An indicator turns on when the seatbelt is fastened, allowing passengers and cabin crew to identify its status.

Scope: Cabin crew

Cabin crew will conduct safety checks to efficiently ensure that passengers' seatbelts are fastened. This will eliminate the need to directly ask passengers whether their seatbelt is fastened.

Scope: All passengers

When the passenger's seatbelt is fastened, they will no longer be asked about their seatbelt by the cabin crew.



Solution Number 17

In-flight Service Ordering Using the IFE System

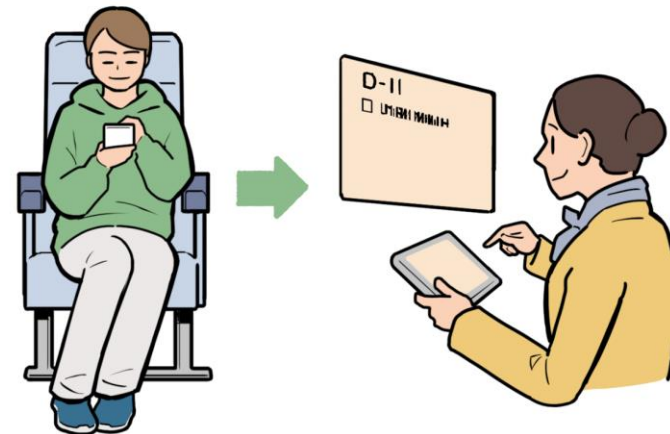
Passengers can directly order in-flight services through the IFE monitor or a mobile phone app, including light meals, beverages, extra blankets and pillows, in-flight sales, and assistance for people with disabilities (e.g., aisle chair use). To make atypical orders, passengers can call the cabin crew and order directly. Consideration of the workload of cabin crew is essential for implementing this system, such as providing information about the number of people waiting to passengers, and limiting service time.

Scope: People with hearing impairments, people with developmental disabilities, and people with mental disorders

These people will be able to order in-flight services without direct communication whenever they want.

Scope: All passengers (particularly window seat passengers)

All passengers will be able to easily order in-flight services.



Category: In-flight entertainment (IFE) system

IFE System Showing Time Schedule of Flight Events

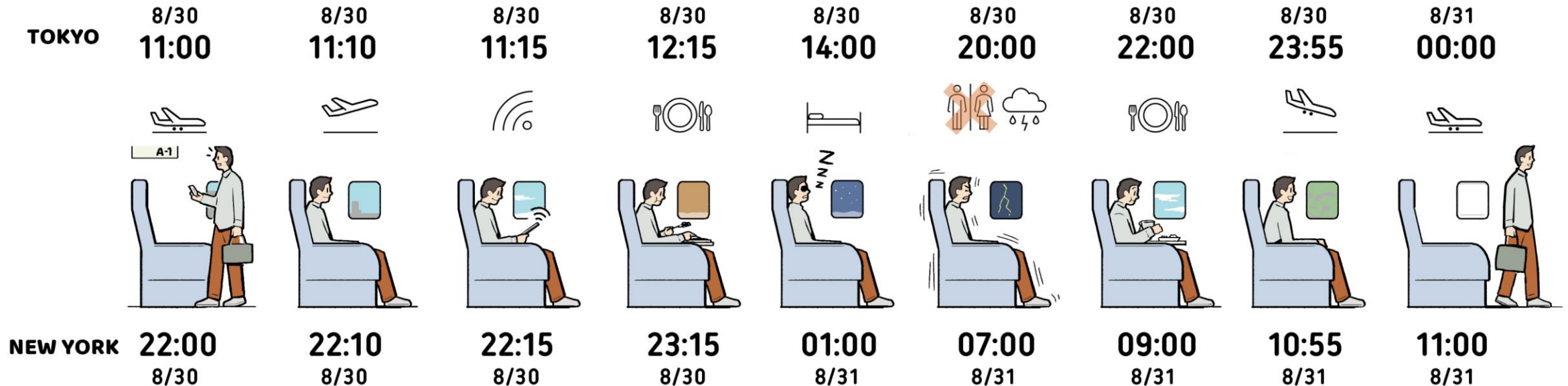
In addition to standard flight information, detailed time schedule of flight events, including meal services, are displayed via IFE monitors. IFE monitors will also provide the latest estimated time of arrival, turbulence forecasts, information on irregular situations such as runway traffic jams and landing timing.

Scope: All passengers (particularly people who need special assistance)

All passengers will be able to plan how they spend time on the plane, such as restroom use. Additionally, passengers will more easily understand situations such as landing timing and irregular events.

Scope: People with developmental disabilities

People with developmental disabilities will be calmed during flights by knowing the order and timing of in-flight services.



IFE System Controllable on Personal Mobile Devices

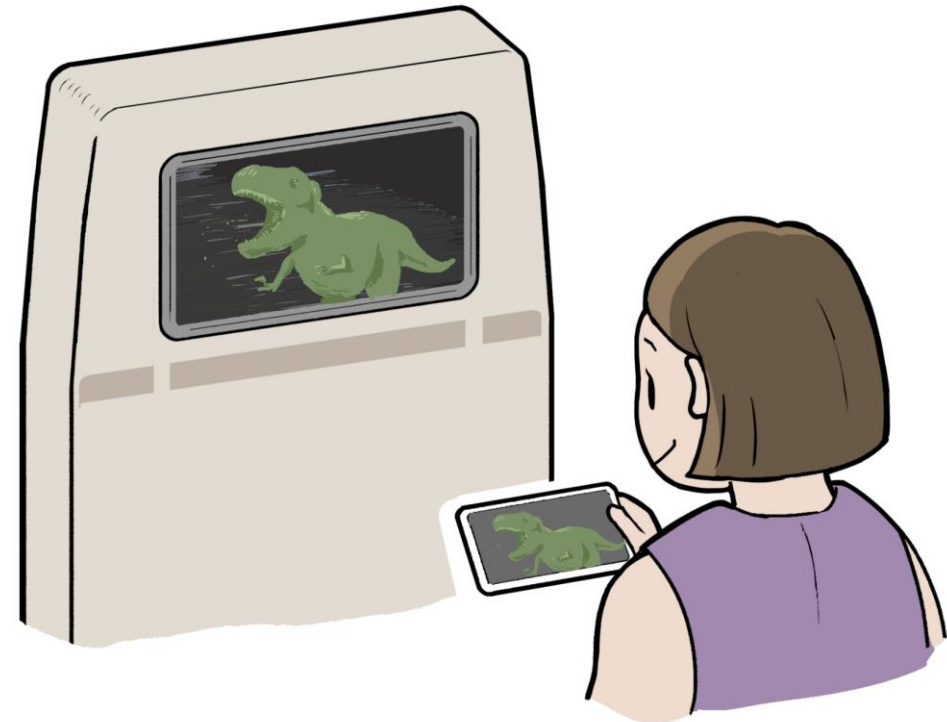
Passengers can operate the IFE system using their personal mobile devices such as mobile phones and tablets. In the IFE system, not only entertainment contents and flight information, but also in-flight service ordering are included.

Scope: People with visual impairments

People with visual impairments will be able to operate the IFE system using their familiar personal devices.

Scope: Passengers whose hands cannot reach the IFE monitor

Passengers will be able to enjoy IFE content without direct operation of the IFE monitor.

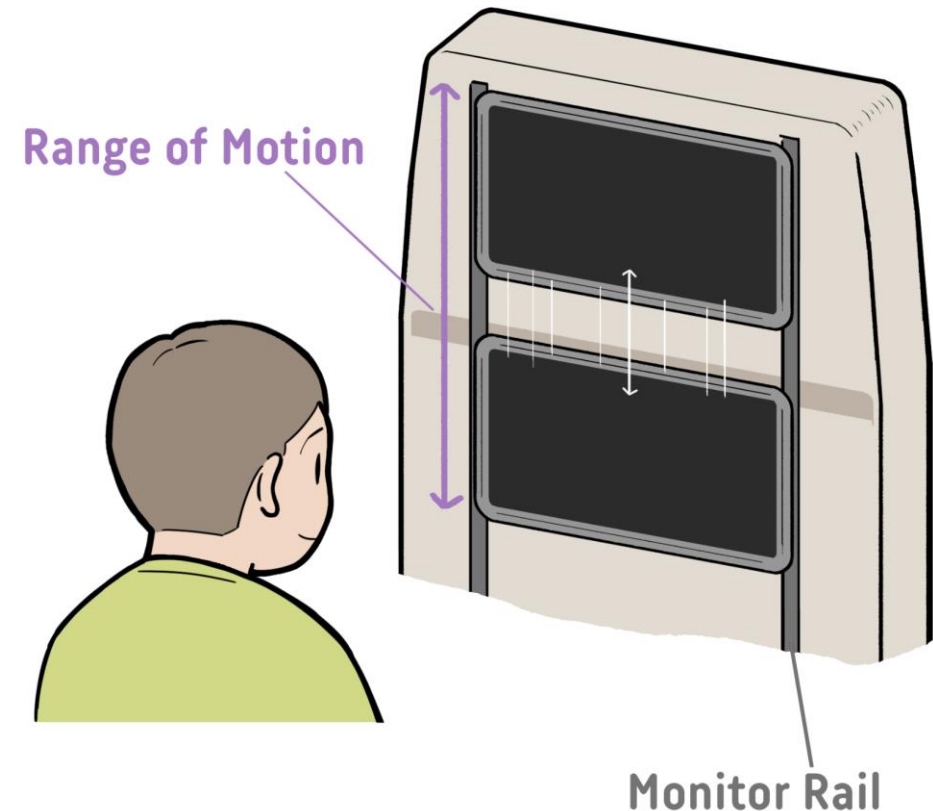


Movable/Detachable IFE Monitor

The IFE monitor, including the type extending from the armrest, can be moved or detached, making it easier for children to watch compared with conventional monitors positioned at adult eye level.

Scope: Children, and passengers who have difficulty watching IFE with conventional monitors

These passengers will enjoy IFE content comfortably.



Solution Number 21

Subtitle Display for In-flight Announcements

Subtitles for in-flight passenger announcements are displayed on IFE or cabin monitors.

Scope: People with hearing impairments

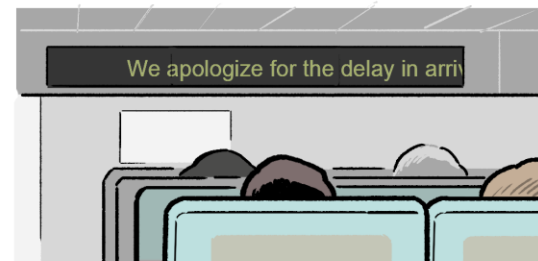
People with hearing impairments will receive in-flight passenger announcements in real-time as text messages.

Category: In-flight entertainment (IFE) system

Approach ①



Approach ②



Approach ③



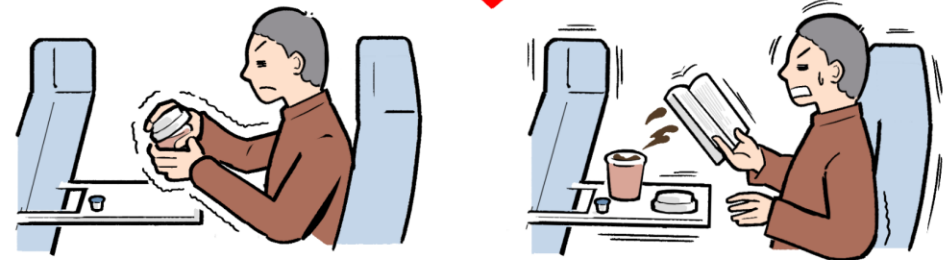
Solution Number 22

Paper Cup Lid with Sophisticated Features

A paper cup lid with an opening for easily adding milk or sugar and convenient drinking is used for in-flight drink service. In addition, the opening is equipped with a feature to prevent the contents from spilling.

Scope: All passengers

The lid will prevent hot drinks from spilling as a result of turbulence, avoiding dirtying tables and clothes, and causing burns.



Category: Tableware

Solution Number 23

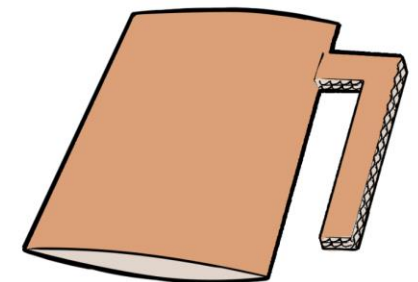
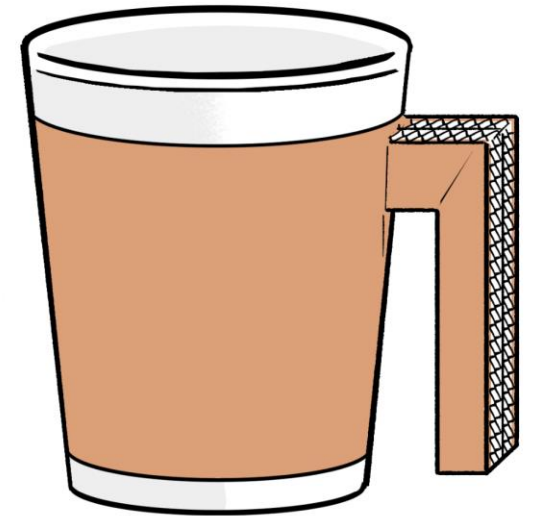
Paper Cup Sleeve with Easy-to-Grasp Handle

A paper cup sleeve featuring an easy-to-grasp handle is used for in-flight drink service. This sleeve is made of cardboard, can be stored compactly before use, and provides an insulating effect.

Scope: People with weak hand grip and people whose hands are sensitive to heat

People with weak hand grip will find it easier to drink comfortably and safely. Additionally, those whose hands are sensitive to heat will enjoy hot drinks comfortably and safely.

Category: Tableware



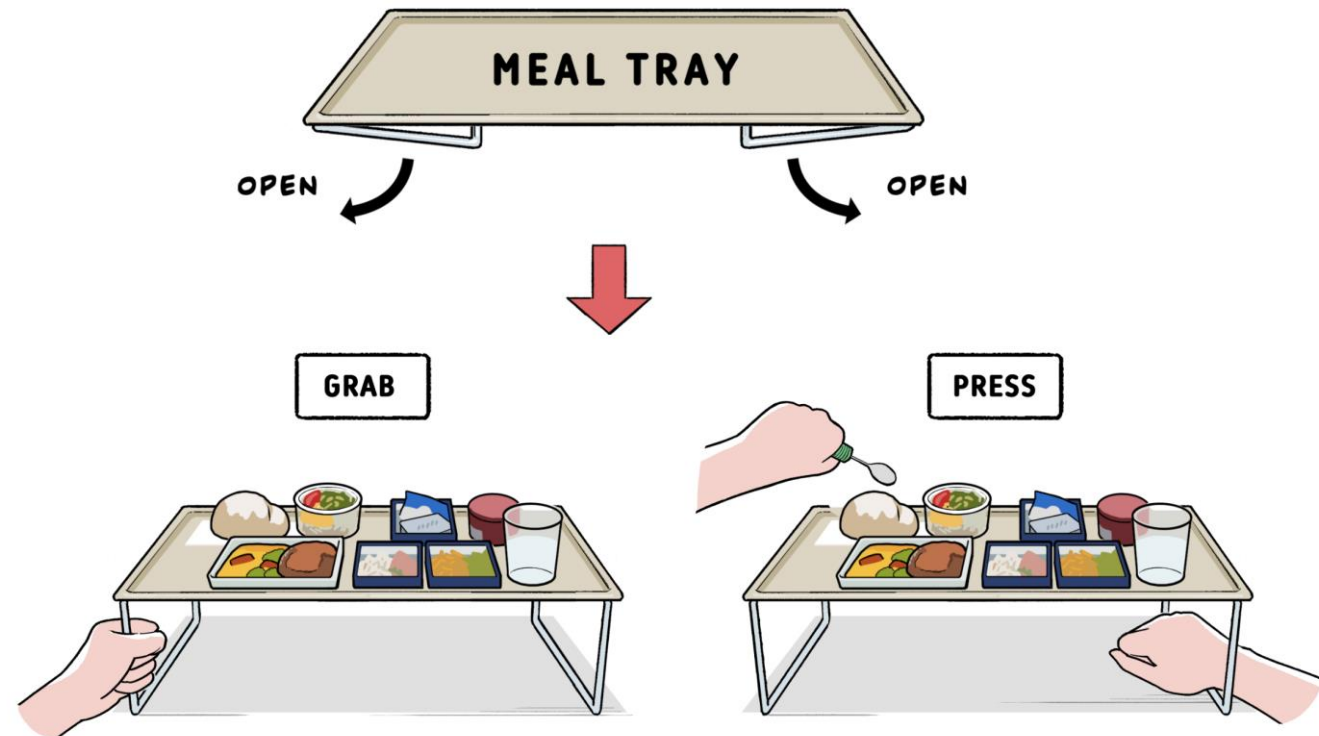
Solution Number 24

In-flight Tableware for Eating with One Hand

This tableware (trays, dishes, and cutlery) is designed for easy hold and grip in terms of one-handed use, and ensuring it does not slip. The shape of the dish is designed to facilitate scooping of food with a spoon. Additionally, the height of the meal tray is adjustable for enhanced ease of use.

Scope: People with reduced mobility and older people

People will find it easier to independently enjoy their in-flight meals, even with just one hand.



Category: Tableware

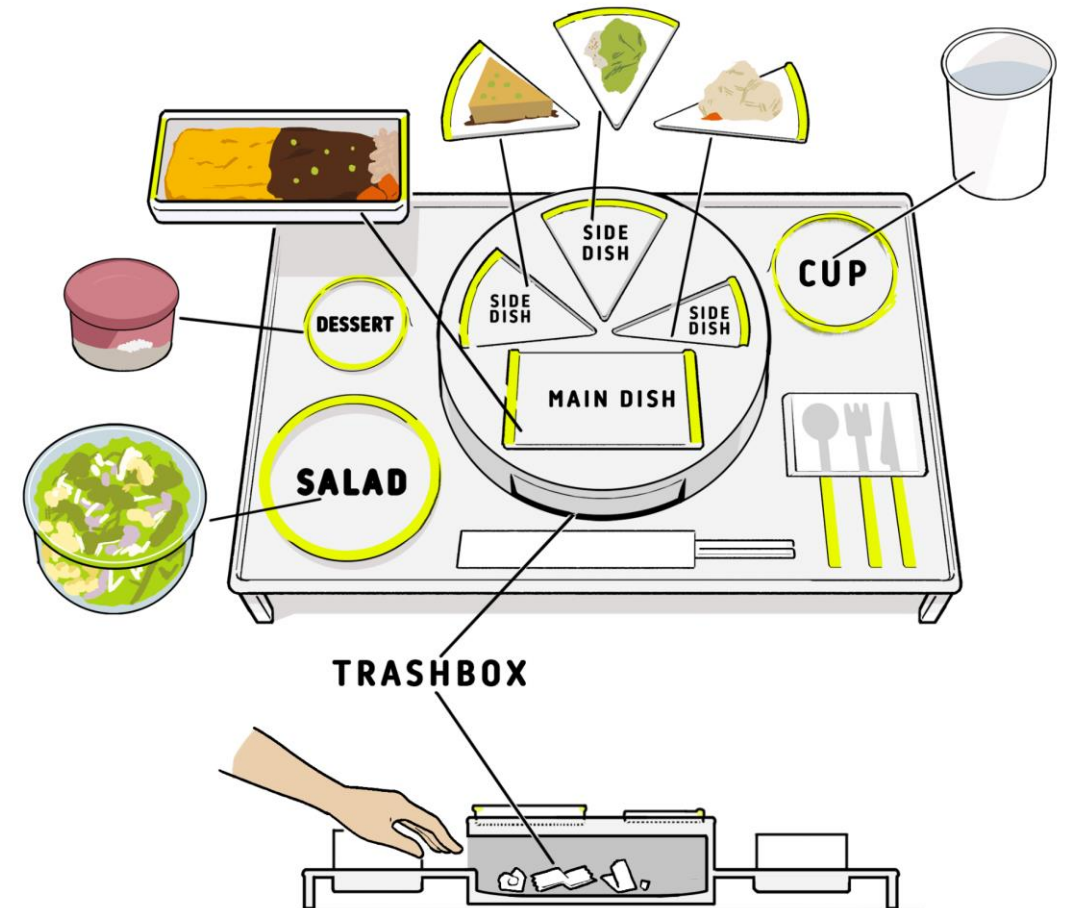
Solution Number 25

In-flight Tableware for People with Visual Impairments

The placement and colors of plates and trays for in-flight meal service are carefully designed for people with visual impairments. For instance, main and side dishes are arranged along the clock positions, trays feature a concave and convex surface for easy identification, and one of the trays includes a trash box.

Scope: People with visual impairments

People with visual impairments will find it easier to take in-flight meals.



Solution Number 26

Multi-Purpose Space Available While Airplane is Cruising

Spaces around passenger entry doors and service doors are utilized as temporary multi-purpose spaces, or the space created by space-saving is designated as permanent multi-purpose areas.

Scope: People with children

People will use the space as a nursing room, or as a convenient space for comforting their babies or children.

Scope: People with developmental disabilities

People with developmental disabilities will use the space as a calm-down or cool-down area.

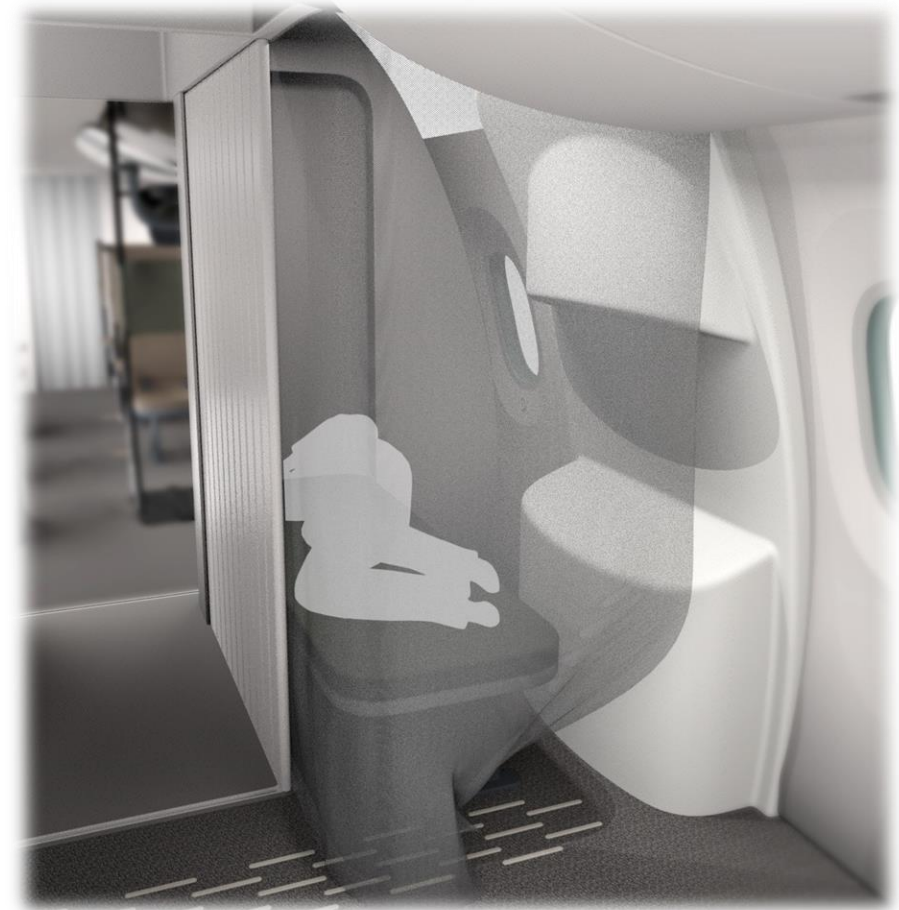
Scope: People with illnesses

Passengers with economy class syndrome and restless legs syndrome will use the space for stretching.

Scope: All passengers

This space will be used for various purposes. If a bed can be deployed in the area, unwell passengers will have the option to lie down and rest.

Category: Cabin facility



Flight Experience Attractions

This attraction offers a comprehensive experience of the entire air travel process, covering activities such as check-in, security check, boarding, takeoff, the cabin environment during the flight (e.g., turbulence and noise), in-flight services (e.g., meals, drinks and sales), landing, and disembarkation. This attraction is situated in commercial facilities, among other locations. As a more simplified option, an online digest video is available, summarizing the air travel process, cabin environment, potential risks during flights, and the enjoyment of air travel.

Scope: People with disabilities who have never experienced air travel

By intuitively understanding the flow of air travel and being informed about potential risks and its countermeasures in advance, the anxiety of people with disabilities who have never experienced air travel will be alleviated.

Category: Ground facility

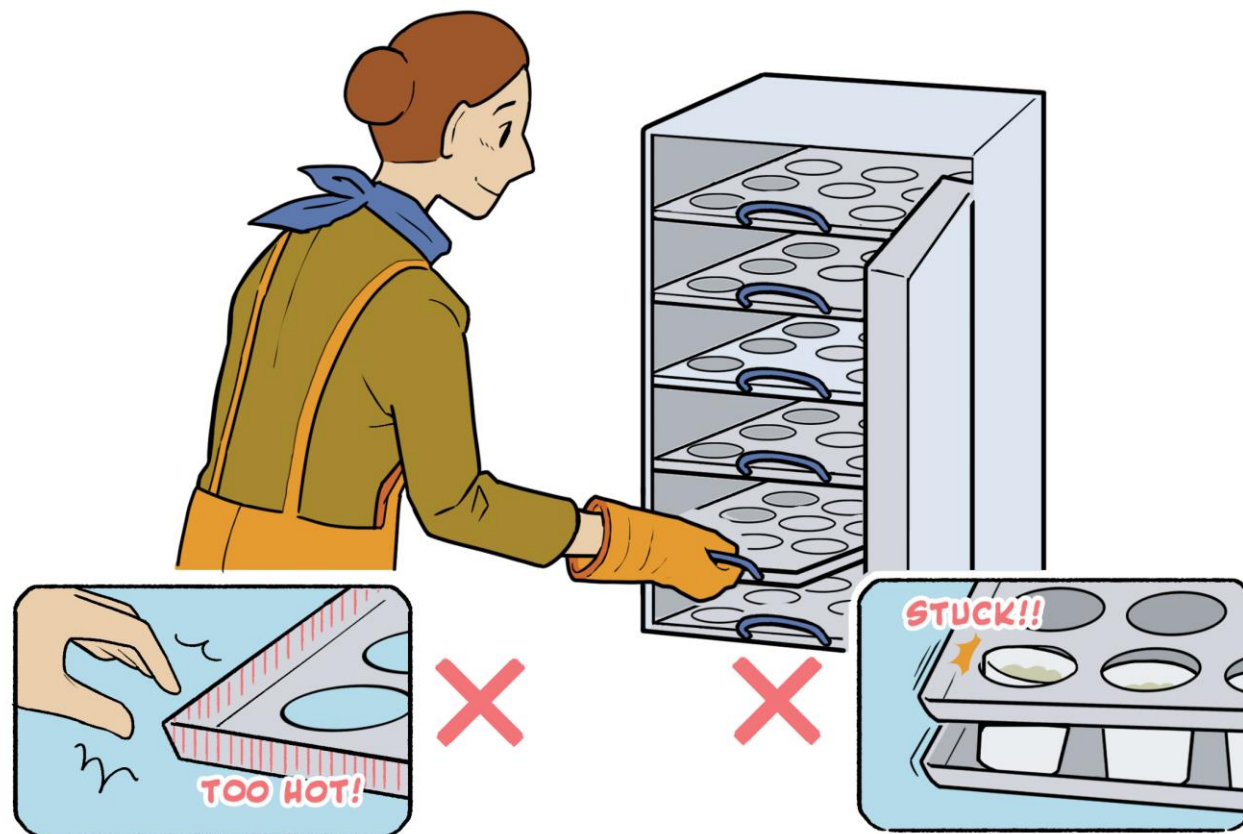


Steam Oven for Easy Removal of Contents

When cabin crew extract an oven pan from this oven, the pan does not get stuck. Additionally, the oven pan can be attached an easy-to-grasp handle, eliminating direct contact with the pan.

Scope: Cabin crew

Cabin crew will carry out their tasks smoothly and safely while avoiding burns.



Easy-to-Operate and Quiet Latches in Galley Compartment

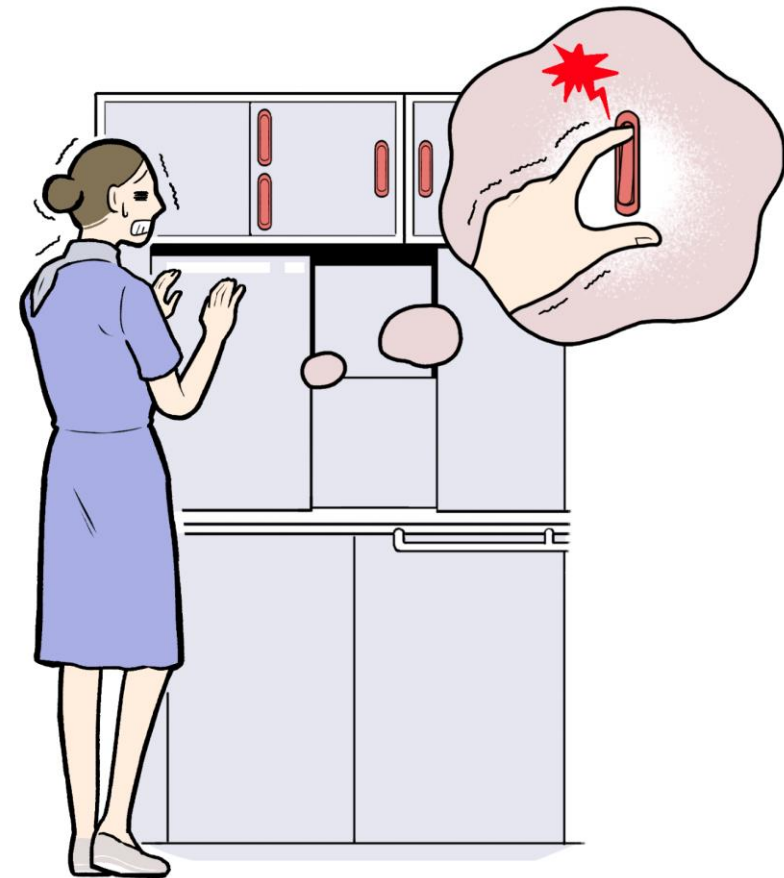
When this latch is pushed or pinched with fingertips, it ensures that fingers and nails are not injured. Additionally, the latch is designed to operate quietly.

Scope: Cabin crew

Cabin crew will no longer injure their fingers and nails when they operate latches.

Scope: All passengers

The passengers seated close to the galley will enjoy a more comfortable flight as a result of a quieter galley environment.



Solution Number 30

Attendant Seat Reducing Impact upon Landing

The attendant seat has improved cushioning and comfort.

Scope: Cabin crew

The physical burden of the cabin crew will be reduced because the attendant seat will absorb more of the landing impact.



Category: Attendant seat