

Metamorphic Lavatory

-Accessible aircraft lavatory to enhance comfort for all-





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1. Philosophy and Purpose

While constant efforts have been made to create a barrier-free and inclusive society, air passengers, especially people with disabilities are still required to endure physical and psychological burden during flights due to the confined space and unique environment.

JAXA has undertaken research and development focused on **realizing “universally designed air travel”** in terms of accessible equipment and systems, under the slogan **"Even in air travel, just as usual"**, 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.

Our proposal is a part of achievement of these activities and was developed in collaboration with JAMCO Corporation, a global aircraft lavatory supplier **to solve a challenging problem faced by passengers with reduced mobility (PRMs) regarding in-flight lavatory use.**



Team logo



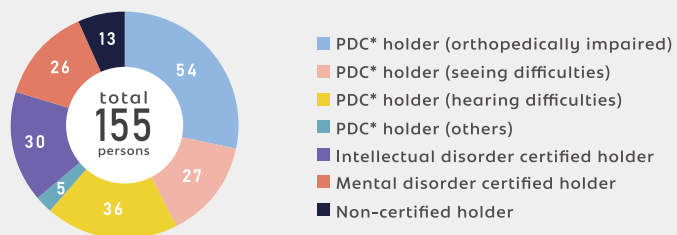
2. Background

JAXA conducted a survey+ (right figures) targeting a wide range of people with disabilities to gather their opinions. As a result, **it reveals that the issue that needed to be improved as a top priority was the lavatory.**

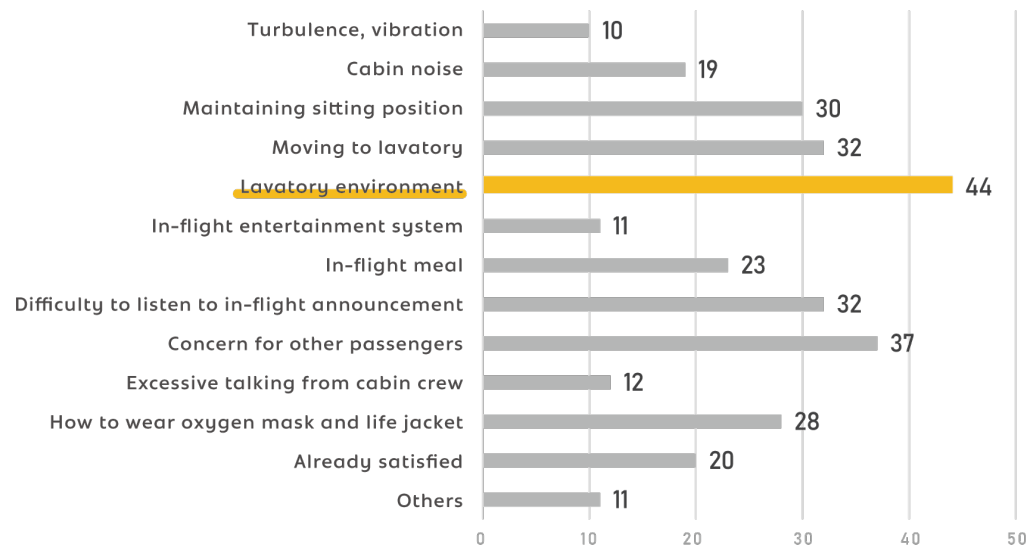
In particular, the PRMs requiring full assistance are often compelled to use diapers in their seats or refrain from using the lavatory throughout the flight due to its confined space. This unsolved situation poses a significant concern in terms of human rights and should be resolved immediately.

Survey respondent breakdown

* Physical disability certificate



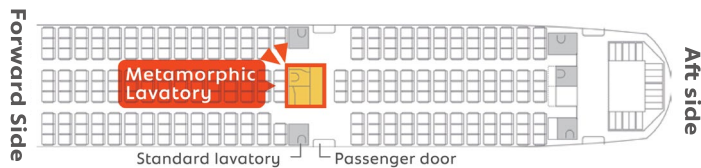
Q.Problems of people with disabilities during the flight



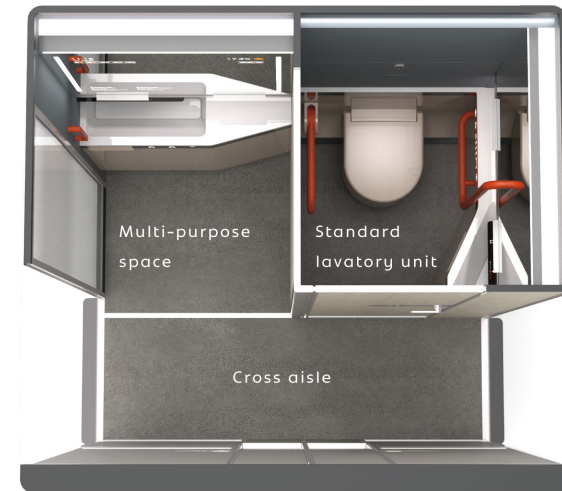
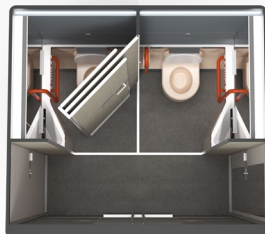
3. Overview

This concept consists of three parts, a standard lavatory unit, a multi-purpose space and a connecting cross aisle. While able-bodied passengers use the standard lavatory unit, **the PRMs can use the spacious and closed lavatory (Type 1) and any passenger can use the closed multi-purpose room (Type 2) created by moving the partitions.** The spacious lavatory has various equipment equivalent to an accessible restroom on the ground.

The concept lavatory is located in front of the passenger door.

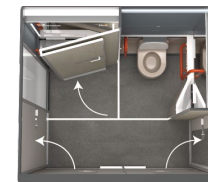


It is also possible to install a toilet in a multipurpose space and propose two closed standard lavatory units. In such a case, it is still possible to create a large space lavatory similar to Type 1.



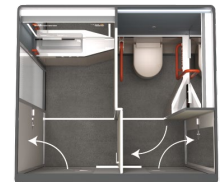
Type 1 Spacious space

The spacious space for two caregivers to assist wheelchair users.



Type 2 Multi-purpose space

This space may be used as a nursing room or a calm-down space.



4. Unique Value

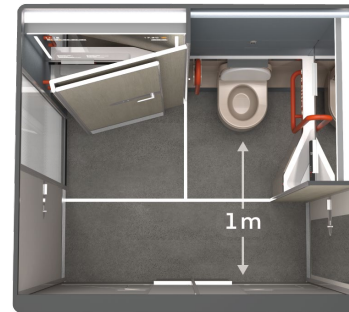
The most innovative and unique value of our concept is that it enables the PRMs requiring full assistance to use the lavatory.

To use the lavatory, the PRMs requiring full assistance needs space for two caregivers to assist them in front and to the side of the toilet seat. If the lavatory simply enlarges, passenger seats will be forced to reduce, thus it is unacceptable for airlines from a profitability point of view. Therefore, we designed the lavatory with two requirements: **to temporarily expand the lavatory without reducing the number of passenger seats, and to make space in front and to the side of the toilet for two caregivers to provide assistance. The lavatory designed with these requirements has never been proposed before.**

Additionally, All people, including ostomates, and passengers with children, other than PRMs, can use the lavatory comfortably, which is another remarkable point of our concept.



Conventional aircraft lavatories have no space for two caregivers to assist PRMs.

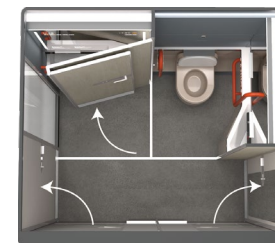


Proposed lavatory has enough space for two caregivers to assist the PRMs. In particular, a space of approximately 1 m is required in front of the toilet seat.



5. Use Case for Wheelchair Users

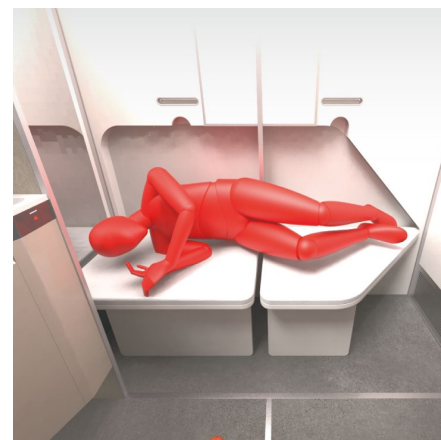
Type 1
spacious space



When the PRMs use the lavatory, cabin crew expands the lavatory (Type 1). To ensure odor containment and user privacy, a partition wall is important, as opposed to a mere curtain. **This expansion creates enough spaces for two caregivers to stand in supportive positions in front and to the side of the PRM, then they can use the lavatory with the same ease as an accessible restroom on the ground.**



Using the lavatory with assistance of two caregivers.



Pull-down bed

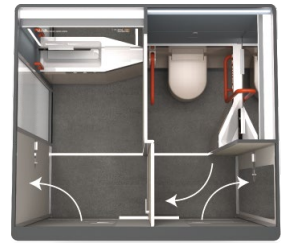


Handrails and backrest

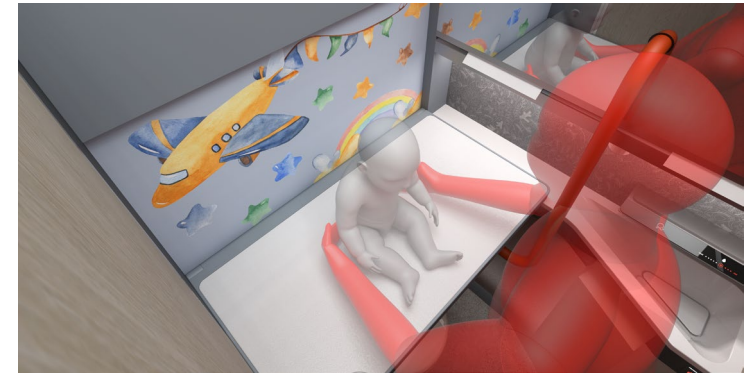
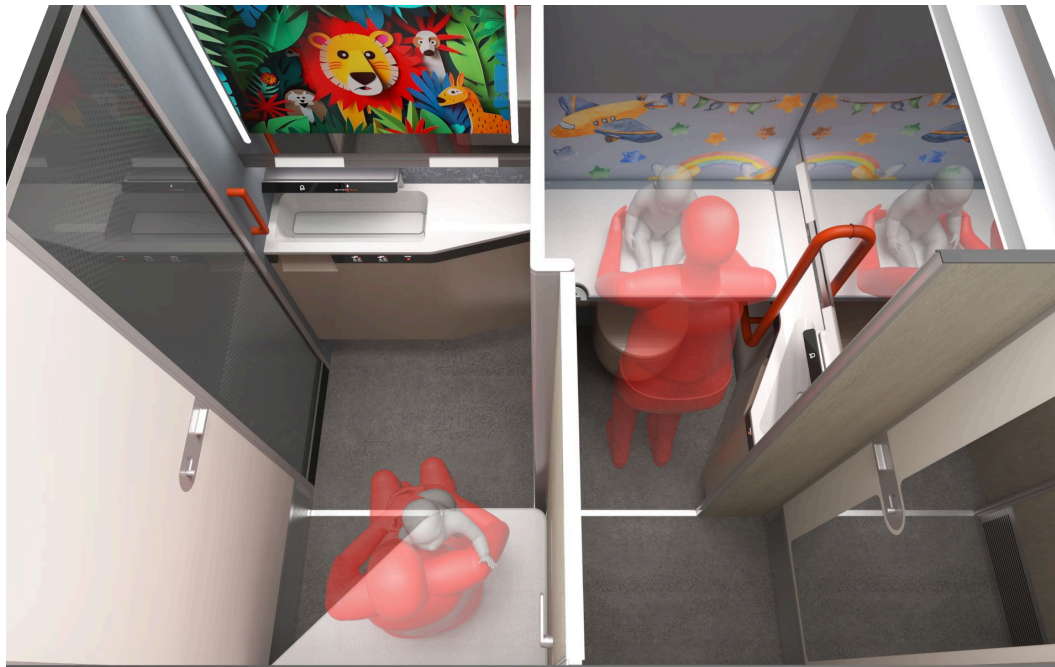
Additionally, the pull-down bed provides a spacious diaper changing station, a dressing room, and a temporary rest area. The handrails on either side of the toilet seat are painted easy-to-recognize color and are L-shaped on the wall side and flip-up on the opposite side, making them easy to use for people who are able to transfer on their own. Furthermore, the backrest can be attached to the toilet seat. That is effective for people who have difficulty maintaining a sitting position using only handrails.

6. Other Use Cases

Type 2 Multi-purpose space



The standard lavatory unit and adjacent multi-purpose space can be individually expanded (Type 2). This intermediate expansion renders each space spacious and closed room enough for an adult with a child, serving as a versatile area for nursing activities and a tranquil space for children with developmental disabilities to calm and cool down.



Additionally, there is a large diaper-changing table for babies over the toilet seat. Passengers with baby can use it easily.

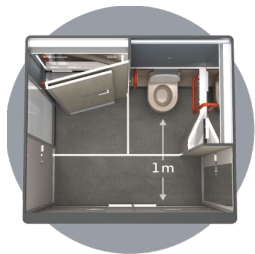


A folding small shelf and mirror are installed above the toilet seat. They are convenient for managing ostomy appliances while ostomates view themselves in the mirror.

7. User Involvement

We have developed the concept with user involvement such as **evaluation of a simple mock-up in cooperation with the disability organizations and participation of the wheelchair user working at JAXA in the research team.**

Through these efforts, for example, the following elements were implemented into the concept.



A space of approx.
1 m for assistance
in front of the toilet seat



A space for assistance
on the side of the toilet seat



A backrest
for maintaining a sitting position



A diaper-changing bed
for adults

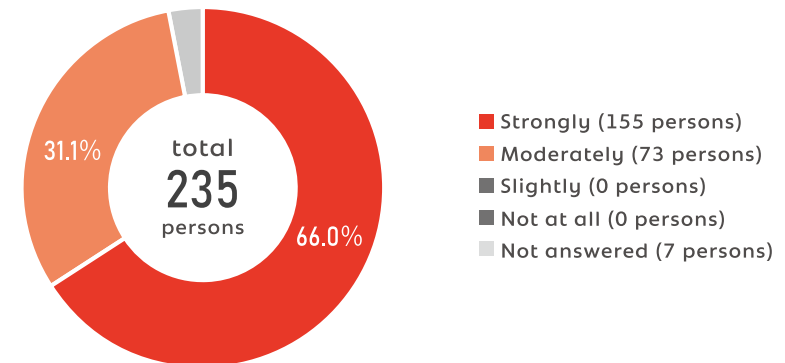


A mirror and small shelf
for stoma care



Easy-to-recognize L-shaped
and flip-up handrails

Q Do you hope that the lavatory exhibited will be introduced into actual airplanes?



To disseminate our concept and gather opinions, a full-scale mock-up was exhibited at the 51st International Home Care & Rehabilitation Exhibition 2024 (H.C.R. 2024) and the Japan International Aerospace Exhibition 2024 (JA2024) in October 2024 in Tokyo.

According to the visitor survey at H.C.R. 2024, **97.1% of the respondents expressed a desire to see this lavatory implemented.**

Mock-up

Photo Gallery









