

# AIRCRAFT CABIN EMPATHY



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## BACKGROUND

Single-aisle aircrafts allow only the use of provided onboard wheelchairs to transfer wheelchair users in and out of an aircraft. People who use wheelchairs are not allowed to bring onboard their personal wheelchairs, despite their circumstances. Additionally, there is no federal requirement that forces airlines to provide accessible lavatories on single-aisle aircrafts. The lack of space in lavatories to transfer in and out of a wheelchair and to allow a caretaker to assist in transfers present significant challenges for those who use wheelchairs.

## PROBLEM STATEMENT

People with mobility impairments avoid or cannot travel on airplanes due to wheelchair restrictions and inaccessible lavatories.

## GOAL

Enable people with mobility impairments the use of personal wheelchairs in single aisle aircrafts and aircraft facilities to improve accessibility during air travel.

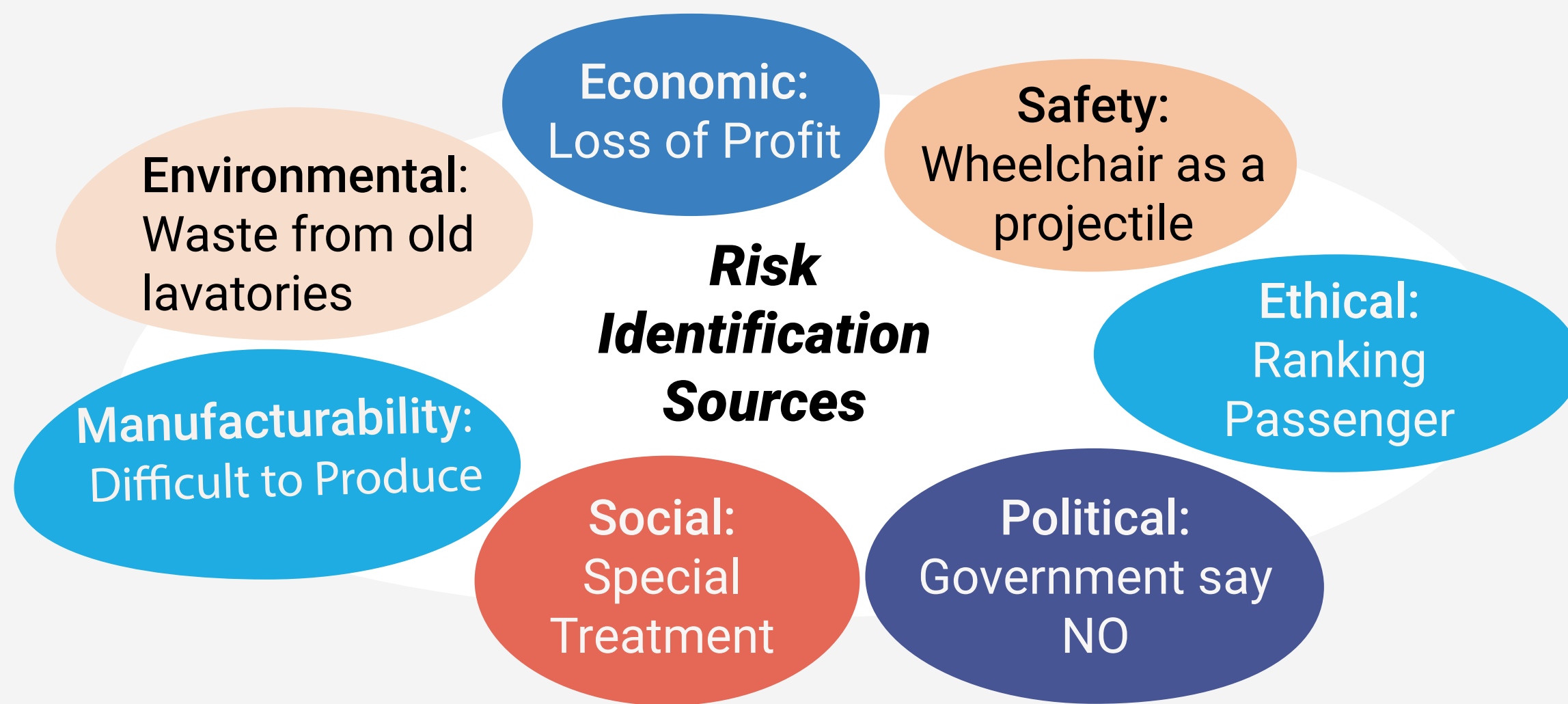
## ASSUMPTIONS

- Design for Airbus A321
- Infinite budget
- Government subsidies and tax deductions offset lost seat(s)

## CONSTRAINTS

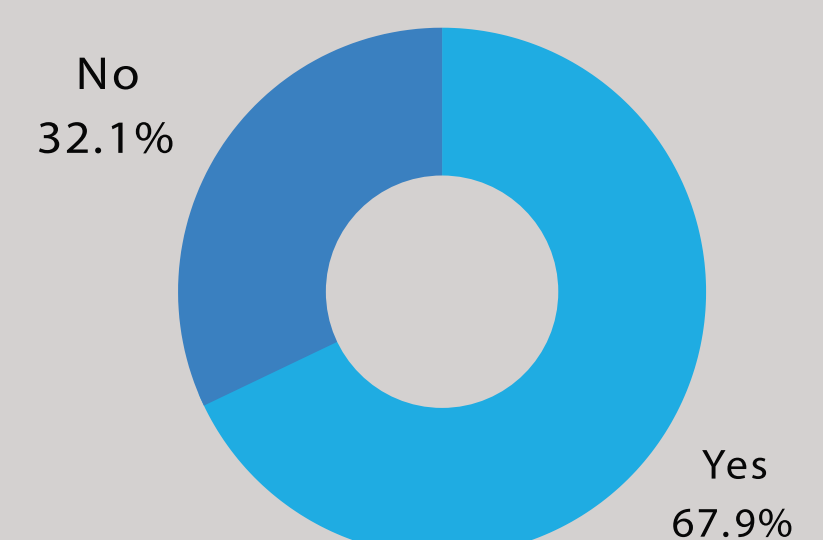
- A 5-year industry project condensed to 5 months
- FAA and Aircraft Carrier Access Act (ACAA) compliance

## RISKS

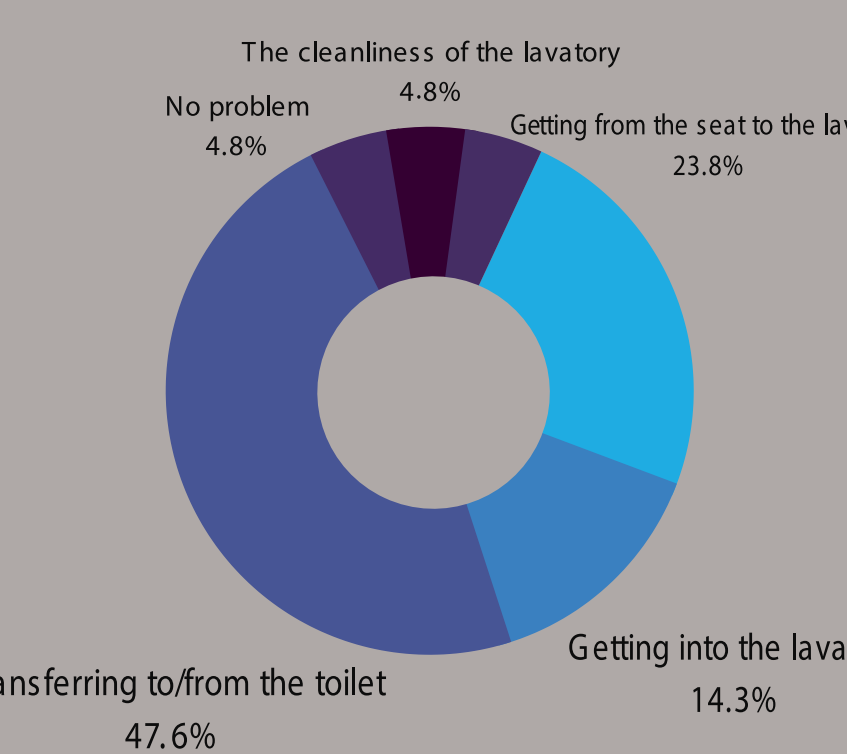


## CURRENT ISSUES

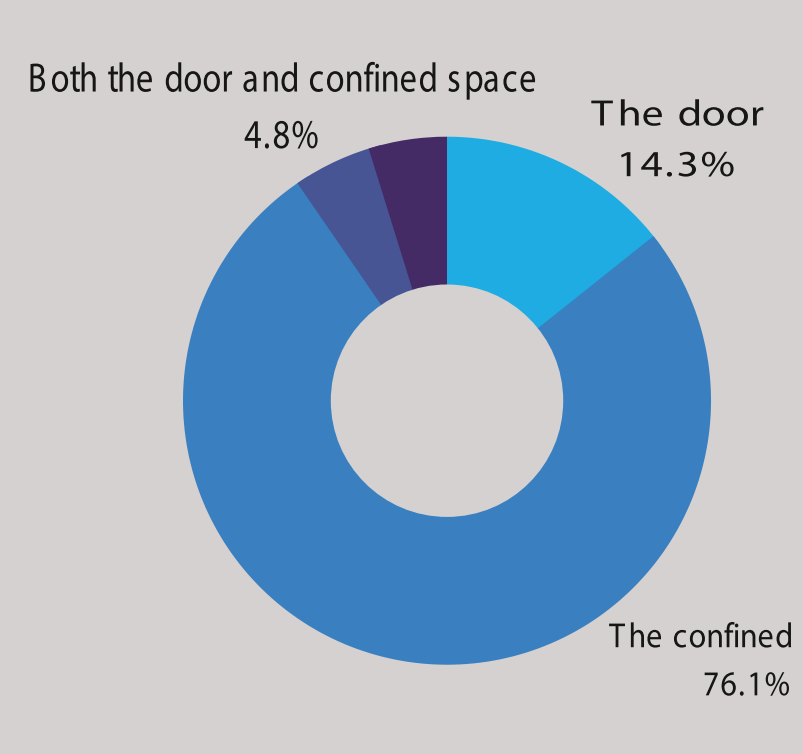
Are you or your family reluctant or unable to fly because of a mobility impairment that requires the use of a wheelchair?



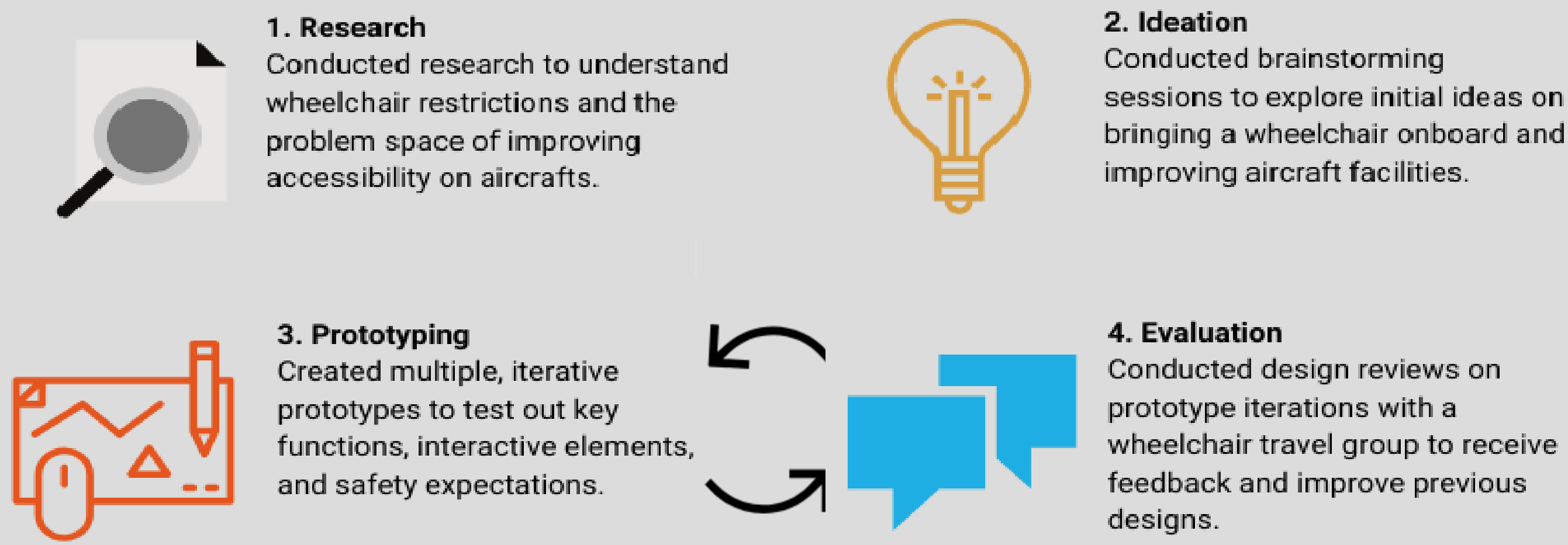
What is the most difficult part about using an aircraft lavatory?



What makes the current lavatories the least accessible?



## DESIGN PROCESS



## RECOMMENDATIONS

### ACE Wheelchair Reservation

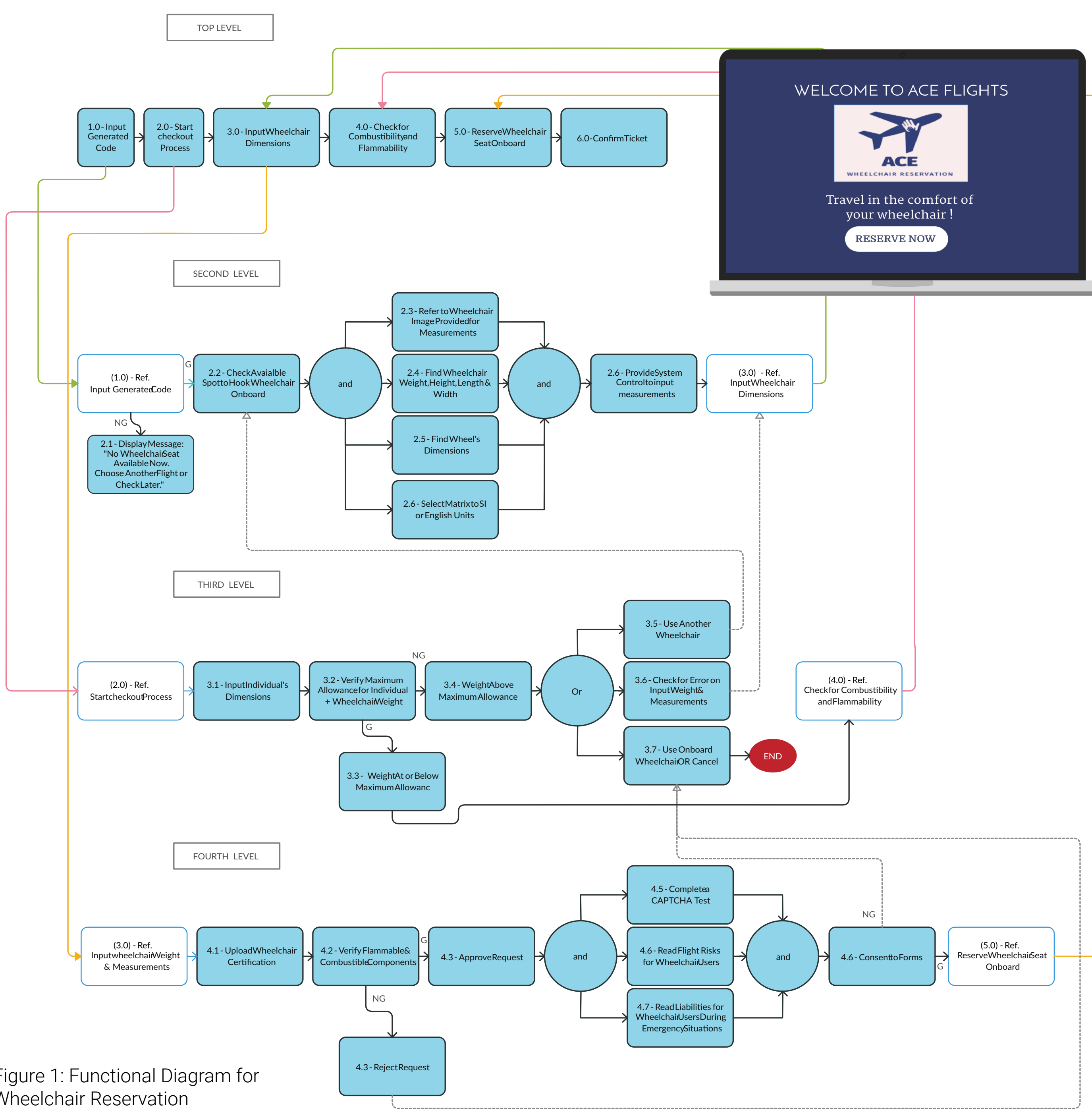


Figure 1: Functional Diagram for Wheelchair Reservation

### Wheelchair Accessible Seat

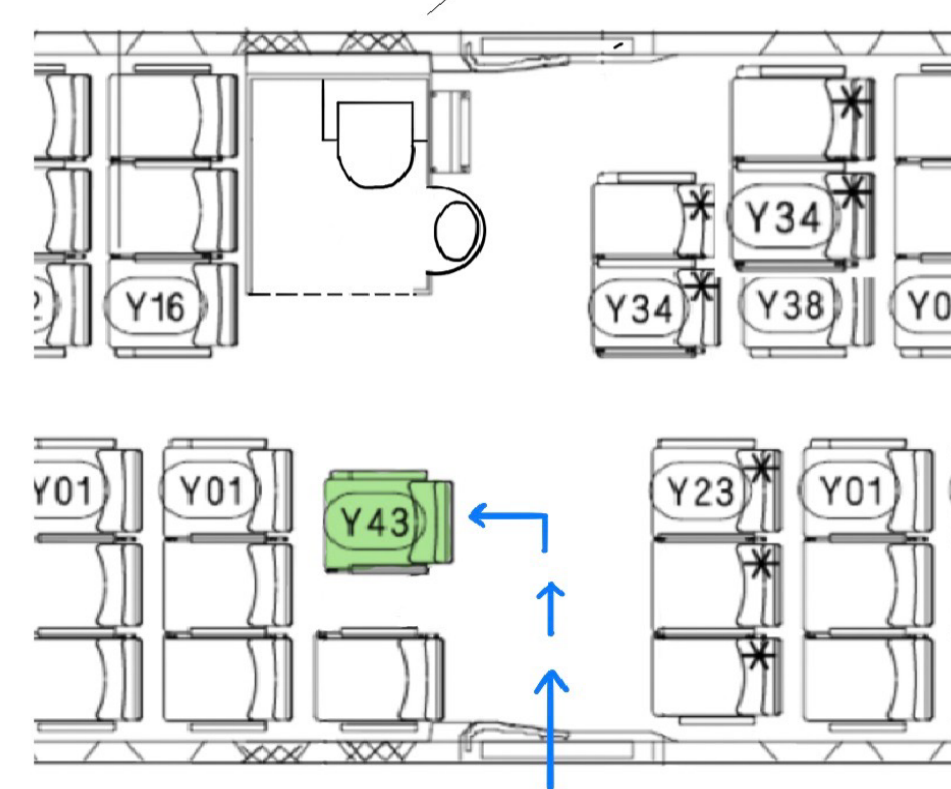


Figure 2: Recommended Plane Layout



Figure 3: ADAPTS Portable Transfer Sling, <https://www.adapts.org/>

### Steps to attach a personal wheelchair in the aircraft:

1. Detach aisle and middle seats in front of lavatory by Door 3
2. Store removed seats in cargo compartment of the plane
3. Passenger using a wheelchair boards with first priority & enters aircraft on an airport crane system through Door 3
4. Wheelchair is attached on spot Y43 using Q'STRAIN's QRT MAX straps that are attached onto the existing L-track anchorage aircraft system.
5. Wheelchair Accessible Seat passengers are given an emergency sling such as ADAPTS Portable Transfer Sling and further emergency protocols.

## Acknowledgements

Dr. Patricia Buchanan - University of Washington  
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## Lavatory Design

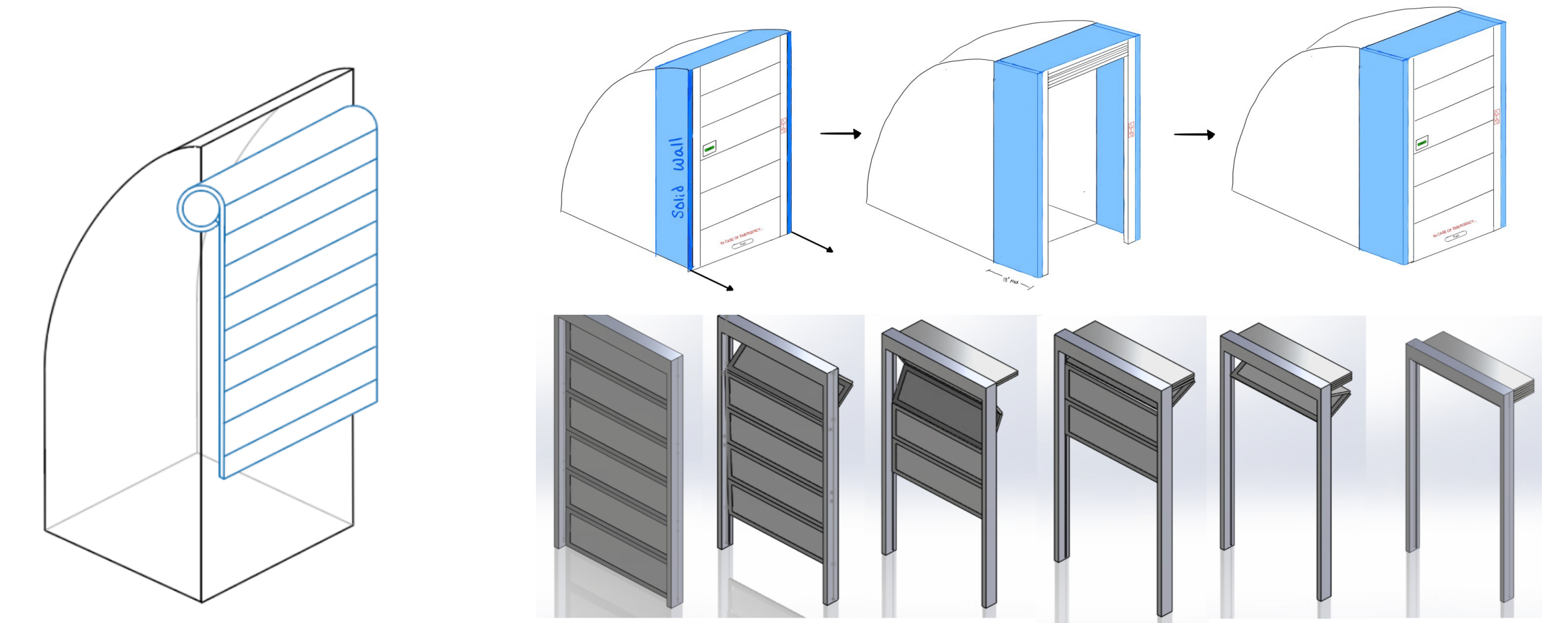


Figure 4: First Iteration Lavatory Door

Figure 5: Final Design Lavatory Door

Problems with First Iteration	Solutions to Problems in Final Design
No room for mirror on inside of lavatory or posters on outside	Foldable panels which would allow for mirrors or posters to be incorporated
No privacy when entering or exiting the lavatory	Extendable wall to act as a curtain to allow for more privacy and room when transferring onto/off of the toilet
No way to manually open or close door	Security handle which will pop out of one of the panels and act as a handle to manually open or close the door
No way to lock or unlock door	Locking mechanism incorporated into the panel which will allow for flight attendant to unlock door from the outside if necessary

### HOW TO USE THE LAVATORY

1. Push button to automatically slide out wall (Optional for those who need the space)
2. Push button to automatically raise door
3. Enter the lavatory
4. Push button to automatically lower door  
Slide the locking mechanism to lock door

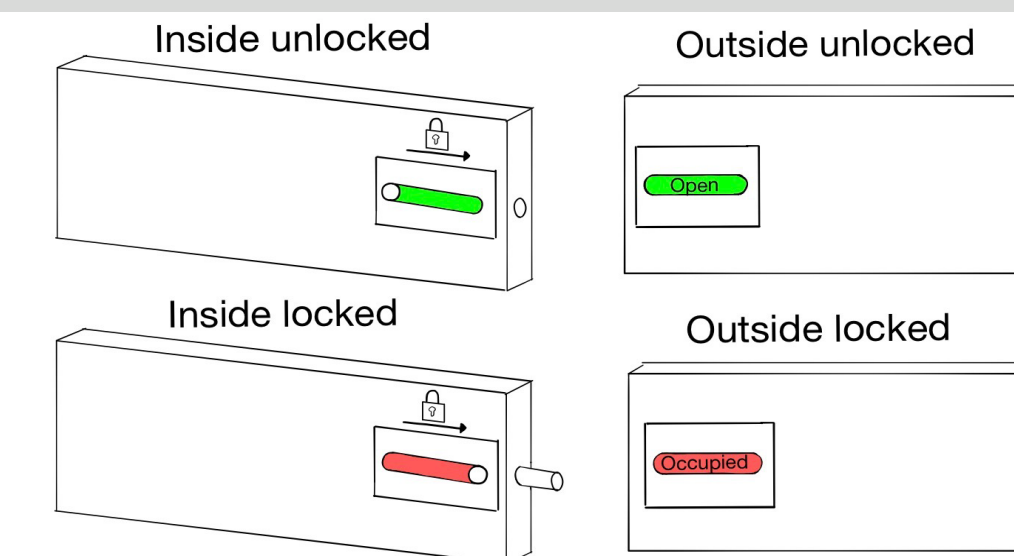


Figure 6: Door Lock Mechanism

### IN CASE OF EMERGENCY

1. Flight attendant unlocks lavatory door from the outside by sliding the lock over
2. Push the button to bring out the emergency handle and manually lift up door

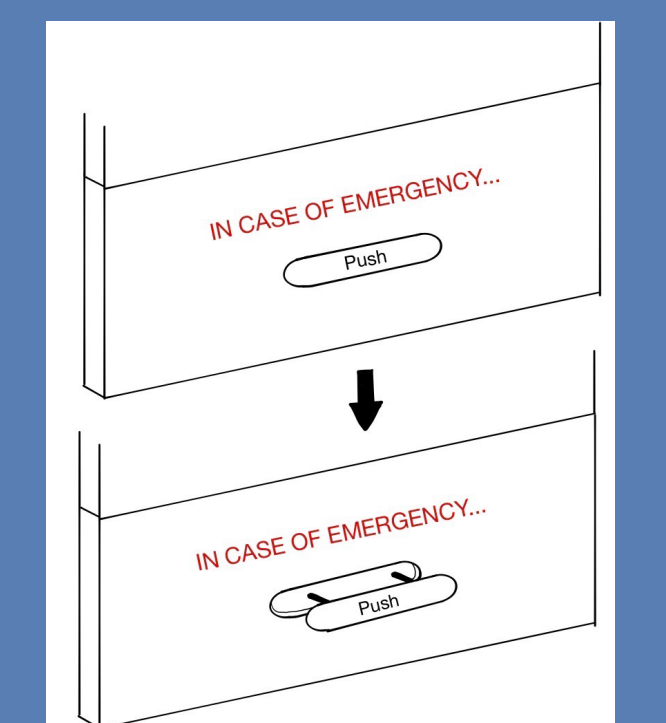


Figure 7: Safety Opening Mechanism

## Lavatory Layout

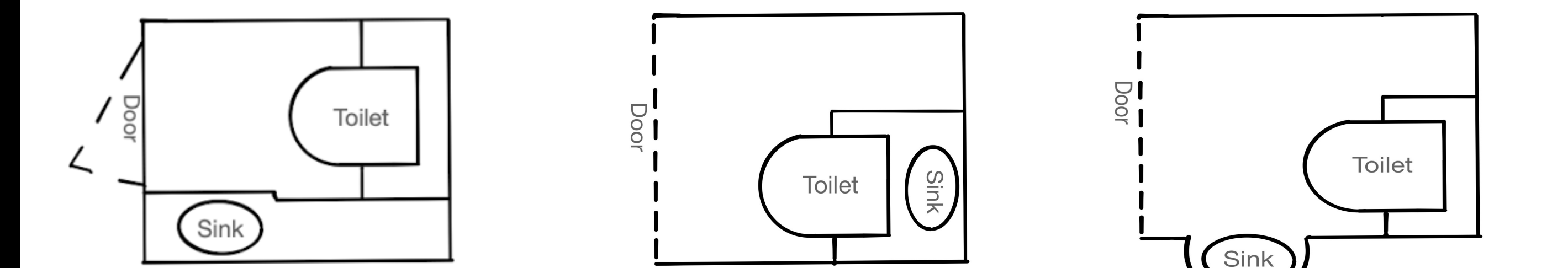


Figure 8: Original Lavatory Layout

Figure 9: First Iteration Lavatory Layout

Figure 10: Final Lavatory Layout

Problems with Original Layout	Problems with First Iteration	Solutions in Final Design
<ul style="list-style-type: none"> <li>• No room for wheelchair and assistant</li> <li>• No space to transfer</li> </ul>	<ul style="list-style-type: none"> <li>• Minimal room to maneuver in front of toilet</li> <li>• Hard to reach sink for people with back issues or mobility impairments</li> <li>• Sink will splash water on toilet seat</li> </ul>	<ul style="list-style-type: none"> <li>• Place sink in front of the toilet and in a pop out that extends outward to maximize space inside the lavatory</li> </ul>

## IMPACT

Five major U.S. airlines have **262** A321 models in service. Assuming **50%** of airlines implement the accessible seat, government subsidies and tax deductions can reward airlines who implement accessible seats therefore enabling fair ticket pricing that keeps the average domestic flight cost of **\$359**. With a conservative estimate, an A321 does **2** flights/day, **365** days/year, the opportunity cost of the accessible seat is:  $(131 \text{ planes} \times 2 \text{ flights/day}) \times 365 \text{ days/year} \times \$359/\text{ticket} = \mathbf{\$34,331,170/\text{year}}$

When an organization reaches out to diverse customers, their connection to diversity and inclusion will tie into their brand and business performance.