

## BACKGROUND AND MISSION

Air travel remains difficult for passengers with restricted mobility (**PRMs**). Wheelchair users are forced to transfer to standard seats — a physically demanding and often undignified process. No certified solution currently allows them to stay in their own wheelchairs.

The **Freedom Seat** offers a breakthrough solution enabling PRMs to fly in their own wheelchair with comfort, dignity, and independence while ensuring operational efficiency for airlines, without loss of space or revenue.



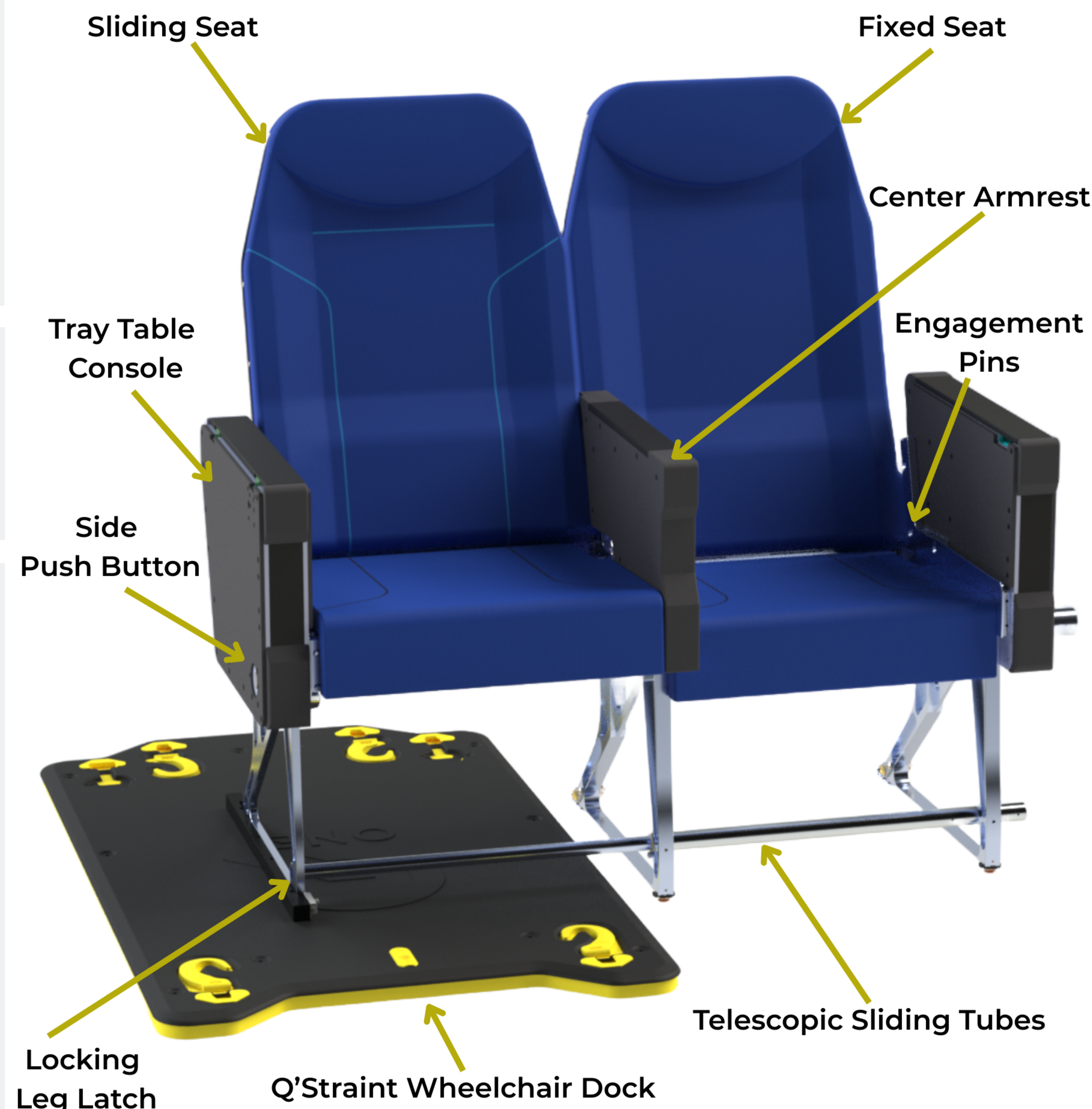
## OBJECTIVE

Design and develop a **FAA-compliant** seating prototype for a **Boeing 737**, featuring a sliding aisle seat that creates space for a wheelchair to be docked. Our goal is to make the Freedom Seat an **accessible solution** for air travel.

## REQUIREMENTS

- ✓ Shall comply with **FAA Regulations and Standards**.
  - **FAA TSO-C127c** - Technical Standard Order
  - **SAE AS8049C** - Performance Standard
  - **ARP 5526D** - Aircraft Seat Design Guidance
- ✓ Shall accommodate wheelchairs up to **30 inches wide**.
- ✓ Aisle seat shall slide laterally to **fully overlap** the adjacent seat.
- ✓ Shall be designed to be **operated by a flight attendant**.
- ✓ Sliding operation shall be completed **within 30 seconds**.
- ✓ Seat **cushion shall remain attached** during sliding operation.
- ✓ Seat shall be designed to be **locked in both configurations**.
- ✓ Seat shall feature an **aisle-side leg** that locks to the floor.
- ✓ Designed for **Q'STRAIT ONE** wheelchair restraint system.
- ✓ Seat shall feature a **stowable tray table** in the armrest.

## MECHANICAL DESIGN



## DESIGN FEATURES

- **Sliding Mechanism:** Telescopic tubes with low-friction liners enable smooth, guided sliding motion.
- **Docking Leg:** Aisle-side leg locks into a custom floor rail when the seat is deployed.
- **In-Armrest Tray Table:** Tray table stows neatly inside the arm console and opens in both seating positions.
- **Push-Button Lock:** Seat locks securely in both positions using a simple button mechanism.
- **Lock Engagement Pins:** Structural pins reduce compliance and maintain seat stability.
- **Wheelchair Dock Integration:** Compatible with industry-standard Q'STRAIT ONE docking system.

## USER TESTING

- **6 participants** acted as **flight attendants** to operate seat
- Participants **average age** was **40**, reflecting typical flight attendant age (IATA, 2023).
- **All participants** with demonstration and a user manual slid the seat in **under 30 seconds**
- **90%** of participants encountered **difficulty** with engagement **pin alignment**, requiring multiple attempts
- **High physical demand** scores were due to **sliding friction**
- **All participants** rated **low on mental demand**
- Overall System Usability Score: **4.1 / 5**, indicating ease of use

## IMPACT

For passengers who have avoided air travel due to discomfort or inaccessibility, the Freedom Seat enables new opportunities, independence, and connection with the world.

With advocacy from **All Wheels Up** and the innovation of **Molon Labe Aircraft Seating**, this vision is gaining visibility and momentum for inclusive air travel.



## OPERATIONAL SEQUENCE

**1. Unlock the Seat** - Press the button and release the latch

**2. Slide the Seat** - Push the seat laterally over the adjacent seat

**3. Lock in Place** - Ensure the seat clicks and aligns flush on the far side

**4. Dock the Wheelchair** - Secure the wheelchair using the restraint system



## FUTURE WORK

- Conduct **digital dynamic testing** in partnership with NIAR (National Institute for Aviation Research)
- Design a retractable screen behind the wheelchair for **Head Injury Criterion (HIC) compliance**
- Establish the new locking leg's structural requirements and crash load criteria in consultation with the FAA.
- Develop and integrate seat **reclining functionality**.
- Develop a stowable **in-flight entertainment (IFE)** system.
- Perform **lifecycle analysis**: 7 years and 40,000 cycles
- Expand **user testing** with flight attendants and PRMs