

Secondary Airline Mobility Device Design Specifications (PDS)

Project Design Description | September 21st , 2018

Client: Mr. Dan Dorszynski

Advisor: Dr. Aaron J. Suminski

Team Name: airline_mobility_device

Team Members: James Tang (Team Leader)
Hannah Fjellman (Communicator)
Eric Arndt (BPAG/BSAC)
Noah Trapp (BWIG)

Lab Section: 312

1. Function:

- a. Traveling with a disability can be a difficult process. Electric wheelchairs are not allowed on flights. A person with a disability that requires the use of an electric wheelchair must transfer to a manual wheelchair, assisted onto the airplane, and then removed again from the wheelchair and placed onto a seat on the airplane. This may cause a great deal of unnecessary distress to the individual. A secondary mobility device would theoretically attach to the client's normal wheelchair. The client would then be able to travel through the airport on their own wheelchair, along with the secondary attachment. When it comes time for boarding, the client would simply detach the secondary device from the electric wheelchair and use it to board the airplane. Once boarded on the airplane, the secondary device should be foldable so that it can either fit under the client's seat, or in the carry-on luggage section.

2. Client requirements:

- a. The device must be original, easy to use, and fit over the client's wheelchair. It should minimize transfers and need for assistance

3. Design requirements:

- a. Must be compact, hopefully fitting under the seat of an airplane

4. Physical and Operational Characteristics

a. Performance requirements:

- i. The device should be easily manipulated by the flight attendants and they should be able to transfer the client without any difficulties with the device.

b. Safety:

- i. The product must be able to consistently support 250 pounds (113.4 kg) without any risk of bending or breaking, which could result in injury for the client. Safety straps will also keep the client secure on the device.

c. Accuracy and Reliability:

- i. The device should be 100% reliable within the shelf life and the operating environment specified below.

d. Shelf Life:

- i. The device is expected to last a minimum of ten years. It should be able to work consistently if the client is using it frequently within a short period of time, but should also be able to maintain its usability if it is in storage.

e. Operating Environment:

- i. The device should be able to withstand multiple, consecutive uses under drastic climate and temperature changes. It should be functional in 0-100% humidity, and temperatures from -50 to 55 degrees Celsius. This accounts for temperatures in a car trunk and temperature in the cargo hold of an airplane. In addition, most uses of the device are in the airports with flat platform, so we do not need to account for rocky terrain.

f. Ergonomics:

- i. Client should be comfortable when sitting in the chair for a 2 hours if needed. The chair should also not be taller than his wheelchair and adjustable if needed. The seat should be less than 2 in. thick (5 cm).

g. Size:

- i. The device must fit on an airplane (Approximately 20 in. (50.8 cm) wide) and be able to fit under the seat of an airplane once it is done being used (8 in. tall x 14 in wide x 18 in. long (20.32 cm tall x 35.56 cm wide x 45.74 cm long)). [5]
- ii. The device should be lower than the airplane seat.

h. Weight:

- i. The device should be easily carried and stowed by an adult with average strength. The group estimates that the product should weigh no more than 30 lbs. (13.6 kg).

i. Materials:

- i. The material should be strong enough hold the client (about 113.4 kg) and hold steady during the client transitions. It should also be lightweight, with a maximum weight of the device at 13.6 kg. The material must withstand varying pressure, altitude, and temperature changes.

j. Aesthetics, Appearance, and Finish:

- i. The client places priority in the functionality of the device, however the group has determined that a smooth seat without sharp corners will ensure both safety and some aesthetic appeal.

5. Production Characteristics

a. Quantity:

- i. Only one unit is needed for the client.

b. Target Product Cost:

- i. The client would prefer a budget of \$500 or less, however said he is open to some flexibility if impressed with our design.

6. Miscellaneous

a. Standards and Specifications:

- i. The device must comply with all airline carry-on restrictions and guidelines.

b. Customer:

- i. The most important characteristic for the customer is the chair is easy to use, and is shorter and less bulky than the previous designs. He wants a compact design that is easy for flight attendants to assist with. "Thinking outside the box" is highly encouraged, since he wants an original, creative design.

c. Patient-related concerns:

- i. This section is not applicable for this project.

d. Competition:

- i. Our client has reached out to engineering student in the past for the same device. The students created two quite similar designs. The second design was 14" wide

and 18” tall. A couple key features of this design were that the hind legs were foldable so that the chair could fit onto the client’s electric wheelchair and it had 4” diameter caster wheels, making it easy to transport the client.

- ii. The Karman Healthcare Airplane Aisle Chair sells for around \$2,000. It is designed with wheels that are 61 cm in diameter. When these wheels are detached, the width of the chair decreases to 35.5 cm. Smaller wheels attached to bottom of wheelchair are utilized when larger wheels are detached [3].
- iii. The Columbia Medical AisleMaster Unfoldable Boarding Chair costs around \$2,500. It has a width of 33 cm and features padded seat, backrest and headrest, as well as flip-up armrests for ease of transfer [1].
- iv. The Columbia Medical AisleMaster TransportMate Compact Wheelchair was originally designed for an on-flight wheelchair under the 1986 Air Carrier Access Act. It collapses compactly to a height of 18 cm from an unfolded height of 85 cm. It has a width of 41 cm including the wheels [2].

7. References

[1](2017). Columbia Medical AisleMaster Unfoldable Boarding Chair. [Online] Available: <http://www.1800wheelchair.com/product/aislemaster-unfoldable-boarding-wheelchair/>

[2](2017). Columbia Medical AisleMaster TransportMate Compact Chair. [Online]. Available: <http://www.1800wheelchair.com/product/aislemaster-transportmate-compact-wheelchair/>

[3](2017). Karman Healthcare Airplane Aisle Chair [Online]. Available: <https://www.activeforever.com/karman-healthcare-airplane-aisle-chair>

[4](2017). Secondary Mobility Device for Airline Travel [Online]. Available: http://bmedesign.engr.wisc.edu/projects/fl7/airline_mobility_device/

[5](2017). Here’s How Much Space You Get Under the Seat in Front of You on Every Airline [Online]. Available: <https://www.travelandleisure.com/airlines-airports/airplane-under-seat-storage-space>