AISLE CHAIR DESIGN PROPOSAL INFORMED BY FOCUS GROUP OF OPERATORS: *EXECUTIVE SUMMARY*

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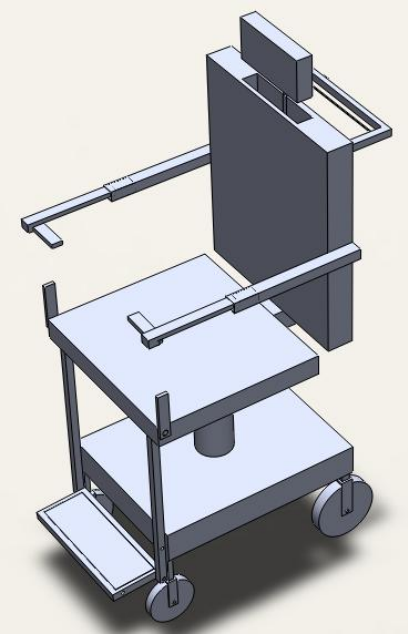
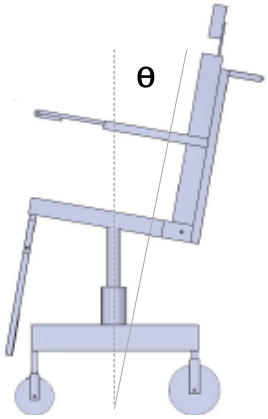
Human-Centered Design with Dr. Sprigle – Spring 2013 – Georgia Tech



Revised Layout for Aisle Buddy

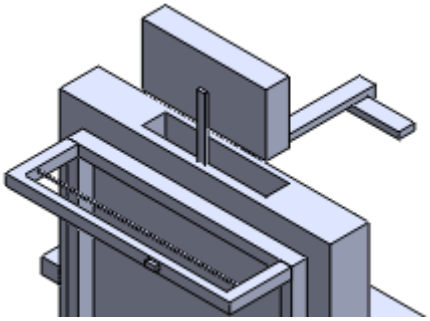
The revised layout design of aisle chair is shown on the left. The model below and throughout this document highlights the improved design features. It is a simple model that does not reflect the final design with respect to aesthetics or finalized mechanical aspects. Descriptions of the major design revisions follow.

An adjustable headrest was designed to allow the aisle chair to provide more comfort and postural stability for users. It allows users to stabilize their head and neck more easily when the chair is in motion or encountering bumps. Also, when the seat is tilted backwards greater than 10 degrees, it will provide support for the user's head. The headrest can slide down behind the seat for unimpeded transfers when the chair operators are transferring the users into and out of airplane chairs. There is padding on the headrest to provide more comfort to the users. This feature was added as a result of the feedback from the operators and the occupants. The operators suggested that the headrest got in the way during transfers, while the occupants desired more head support.



When the chair is being moved, the seat angle can be adjusted, allowing gravity to enhance postural stability for users. The angle (θ) can be adjusted from 0 to 17.5 degrees, and the related parts of the chair are tilted accordingly, which includes headrest, armrest, seat, seat back and foot step. Transfers in and out of the aisle chair can be performed at a 0 degree tilt, but when the chair is moving the user gains increased stability with an inclined seat.

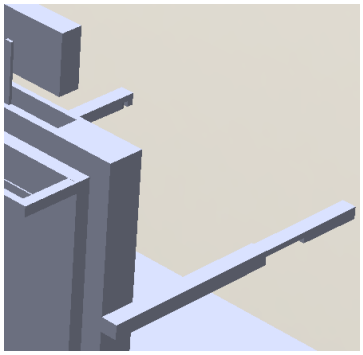
The handlebar design was improved by adding brake control and wheel lock control. By moving the controls to the handlebar, chair operators no longer need to squat to the ground to lock or unlock the swivel wheels. For brake control, chair operators need to grip a parallel bar to release the brake, just like many designs for airport trolleys. Existing designs have separate brake controls on back wheels, which is inconvenient for chair operators. The brakes automatically activate when the parallel bar is released, making transfers easier and faster. For the wheel locking controls, operators can press a button on the handlebar to control whether the front wheels are free to swivel or fixed straight. The button must be activated to lock the wheels. This is useful when the aisle chair must go over the transition from the jet way onto or off of the plane. The operators can easily lock the wheels to go over the bump and release the button to return to a swivel wheel for the transition between first class and coach.



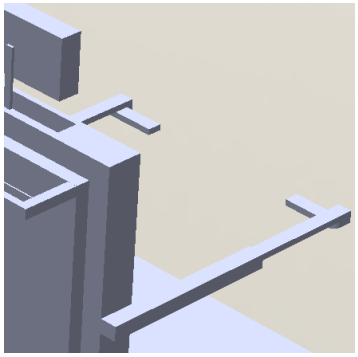
This feature was added based on the feedback from the chair operators. The majority of them preferred having a caster wheel that swivels but commented that it compromised safety going over large bumps like that between the plane and jetway. They did not like having to bend down to individually lock or unlock each front wheel and often left it free to swivel.

Left, the chair's handlebar

Adjustable armrests were implemented for the aisle chair. The current aisle chair designs have short armrest. The longer the armrest the easier it is for a person to push themselves up out of a chair. Also the operators commented that because the users do not have anything to grip onto they sometimes reach out and try to grab the airplane seat as they go down the aisle. This not only slows down the transfer process but is unsafe. Therefore, we decided to use adjustable armrests with a pivoting grip at the end. The armrest can be extended to accommodate the entire length of the occupants arm. The hand grips at the end give the user something to hold as they move down the aisle. This helps keep their arms inside the chair and gives them something to hold should things get rough. When the use is getting out of the chair by holding the armrest, he can rotate the grip handle inward when standing or sitting into the chair. There would be increased padding on the inside of the armrests and on the grips to make them more comfortable for users.

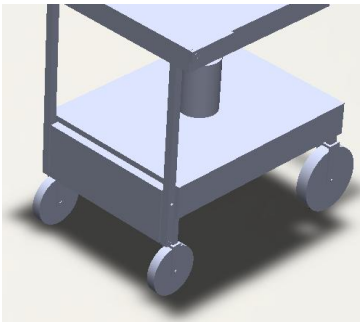


Hand grips retracted

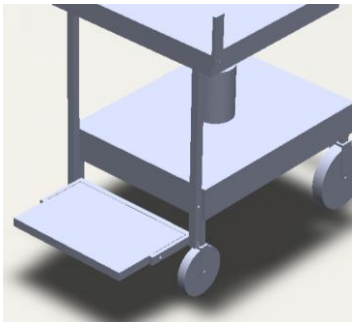


Hand grips rotated inward

The foldable footrest was made to accommodate various foot sizes and to provide support for the body. A lip extends from the back of the footrest to keep the user's feet from sliding off of the back of the foot rest. Both the occupants and the operators complained that the user's feet often slid off the footrest, getting trapped or caught while moving. Especially, for very tall or long-legged persons, the footrest can serve as a way to increase leg space. They can place their foot a little farther forward on the footrest. Also, the footrest gives the user a sense of security and stability, instead of hanging there. The chair can also be lowered so that the footrest can lay on the ground to making getting in and out of the chair easier. It can also be flipped up.



Footrest and support retracted

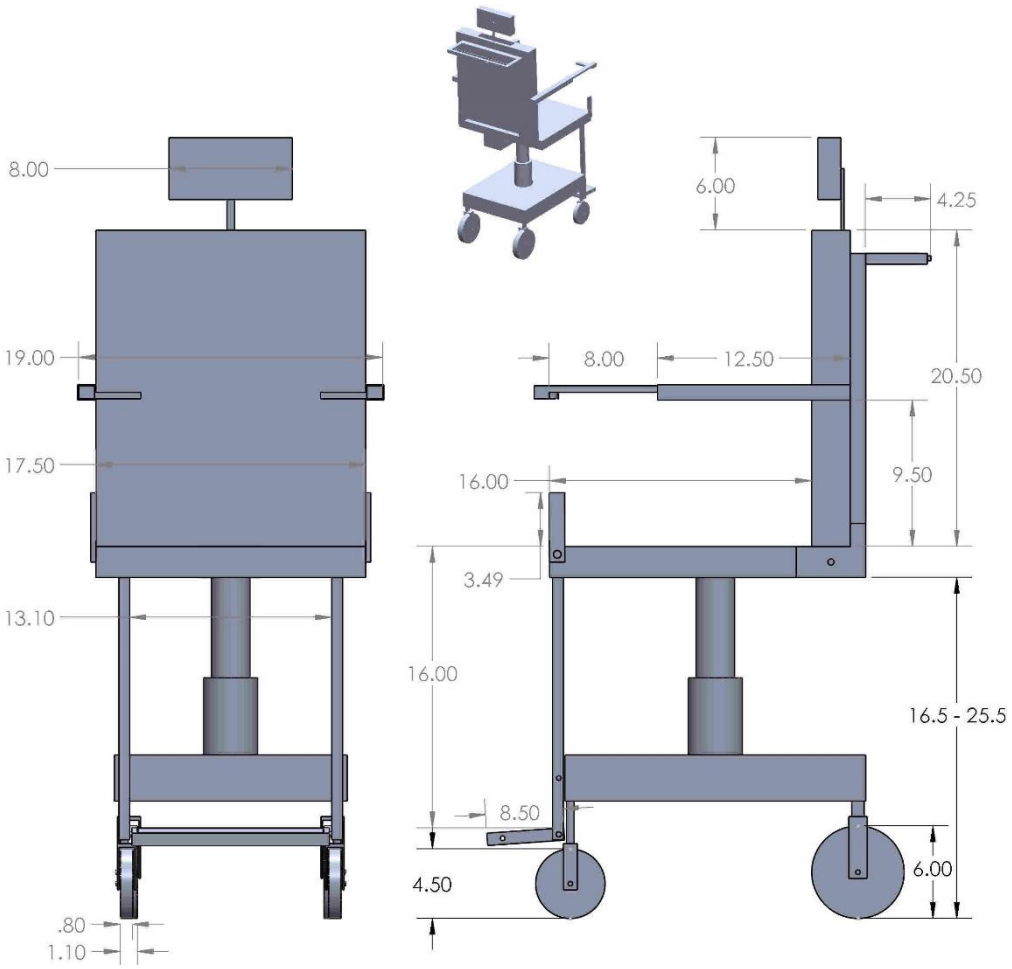


Footrest and support protracted

Both the occupants and the operators commented that the occupant's legs tended to splay open while moving. Their legs would hit the seats while moving down the aisle. The occupants however complained about the amount of time it took to get them fully strapped into the seat. To keep the user's legs from splaying knee support bars are mounted to the front edge of the seat. They can be rotated vertically to prevent the occupant's legs from splaying out and hitting the airline seats.

For seat belt designs, a crossing seat belt design that some of the other aisle chairs have already adopted was envisioned. The operator's focus group suggested that some occupants panic and even resort to grabbing surrounding items for stability. Two crossing seat belts at the upper body would address this. The design of armrests with integrated handles is also aimed at improving the perception of stability.

A motorized lift system would lift the seat to facilitate transfer the users. When the aisle chair is in its lowest position, it is easier for the users to sit in the chair. The low position has a low center of gravity, which makes it more stable when getting in or out of the chair. But the chair can be raised above the height of the armrest on the plane. The weight of the motor and the location of seat in relation to the wheels guarantees that the center of gravity remains inside the chairs footprint even when raised, meaning that even in the lifted state the chair will remain stable. Because the seat can be raised, the overall width of the chair could be increase to accommodate more occupants.



Major dimensions of revised Aisle Buddy design

The Aisle Buddy ES model was the main chair that was referenced for its basic dimensions and functional layout. Its technical Specifications, shown next, were determined using anthropometric data as well as information from the FAA about airplane aisle dimensions:

Specifications

DIMENSIONS	ELEVATING SEAT	NON ELEVATING SEAT
Seat Width:	13"	13"
Seat Depth:	17.5"	16"
Seat to Floor:	21" (min), 28.5"(max)	Front 22"/Rear 21"
Chair Height: (w/o Headrest)	36" (min), 43.5: (max)	37: (min)
Chair Width:	14.5"	14.5"
Front Wheels: (swivel)	8"x2" (poly filled)	8"x2"(poly filled)
Rear Wheels:	12"x2.25" (poly filled)	12"x2.25"(poly filled)
Turning Radius:	35"	33"
Adjustable Head rest:	up to 16"	up to 16"
Passenger Weight Capacity:	350 lbs.	400 lbs.
Chair Weight:	111 lbs.	65 lbs.

The team chose to design for planes that have a seating capacity of 20 passengers or more. Furthermore, the seat can lift to ride down the aisle over the armrest on the plane. This function allows the seat to be wider than the existing aisle chairs. The base of the chair must still fit the 15 inch regulation, as it remains below the 25 inches. The motor is placed at the bottom of the seat to help lower the center of gravity and keep it within the footprint of the base, maintaining stability when the seat is raised and tilted.

The postural stability specifications were based off of anthropometric data. When possible the dimensions were optimized to fit 1% to 99% individual. Many of the dimensions were limited by the width of the aisle. Allowing the footrest to rest on the floor at the lowest height makes getting in and out of the aisle chair easier. Users don't have to pick up their feet as high to step on or off the foot rest. Finally, the anticipated load capacity of the revised chair is 400lb.

A few compromises had to be made. The footrest was not designed such that it is adjustable vertically, which means that the distance between seat and the footrest would remain constant. This decision was taken based on the results that came out of the focused group with occupants as participants. The occupants mentioned that they would like to get into the chair with the least amounts of adjustments possible and the vertical adjustment of the footrest seemed unnecessary.

In the revised design, the width of the armrest is not appropriate for an adult's forearm. It's also narrower than what it needs to be, due to having to work within the limits of the aisle width. Therefore it cannot be increased on either the outer or inner side, as it will reduce critical seating space.

Seat width is another dimension that is driven by aisle width. Seat width has to be such that the aisle chair can easily move within the aisle without hitting the airplane seats. The chair's dimensions are based on the FAA regulation for planes with a capacity of 20 or more passengers. Smaller planes with less than a 20 capacity limit have narrower aisle width regulations.