Peter Axelson

Beneficial Designs, Inc.
Minden, NV

Beneficial Design

Designing Beyond the Norm to Meet the Needs of All People

Research
Design
Education

Stanford University
27 February 2014
Peter Axelson

Beneficial Designs' Mission Statement

Beneficial Designs works towards universal access through research, design, and education. We believe all individuals should have access to the physical, intellectual, and spiritual aspects of life.

Beneficial Designs' Mission Statement

We seek to enhance the quality of life for people of all abilities, and work to achieve this aim by developing and marketing technology for daily living, vocational, and leisure activities.

Bill Blythe,
Technical Assistant,

keeps the network and computers running, assists in design work with the projects. When not working he likes to cook, play guitar, work with computers, and lead worship with his wife at church.

Jeremy Vlcan,
Trails Assistant ,

assists with conducting UTAP, development of the HETAP program, and advancement of the Trail Gate barrier project. He also enjoys hiking, photography and playing in the yard.

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

Seanna Kringen,
Research Associate,
has a background in physiological sciences, and assists on the research components of our projects. She enjoys swimming and hiking with her husband and three children.

Carla Shepard,
Bookkeeper,
is in charge of BD finances. When she is not crunching our numbers, she enjoys four-wheeling, exploring old mines, playing piano, singing, and cross-stitching.

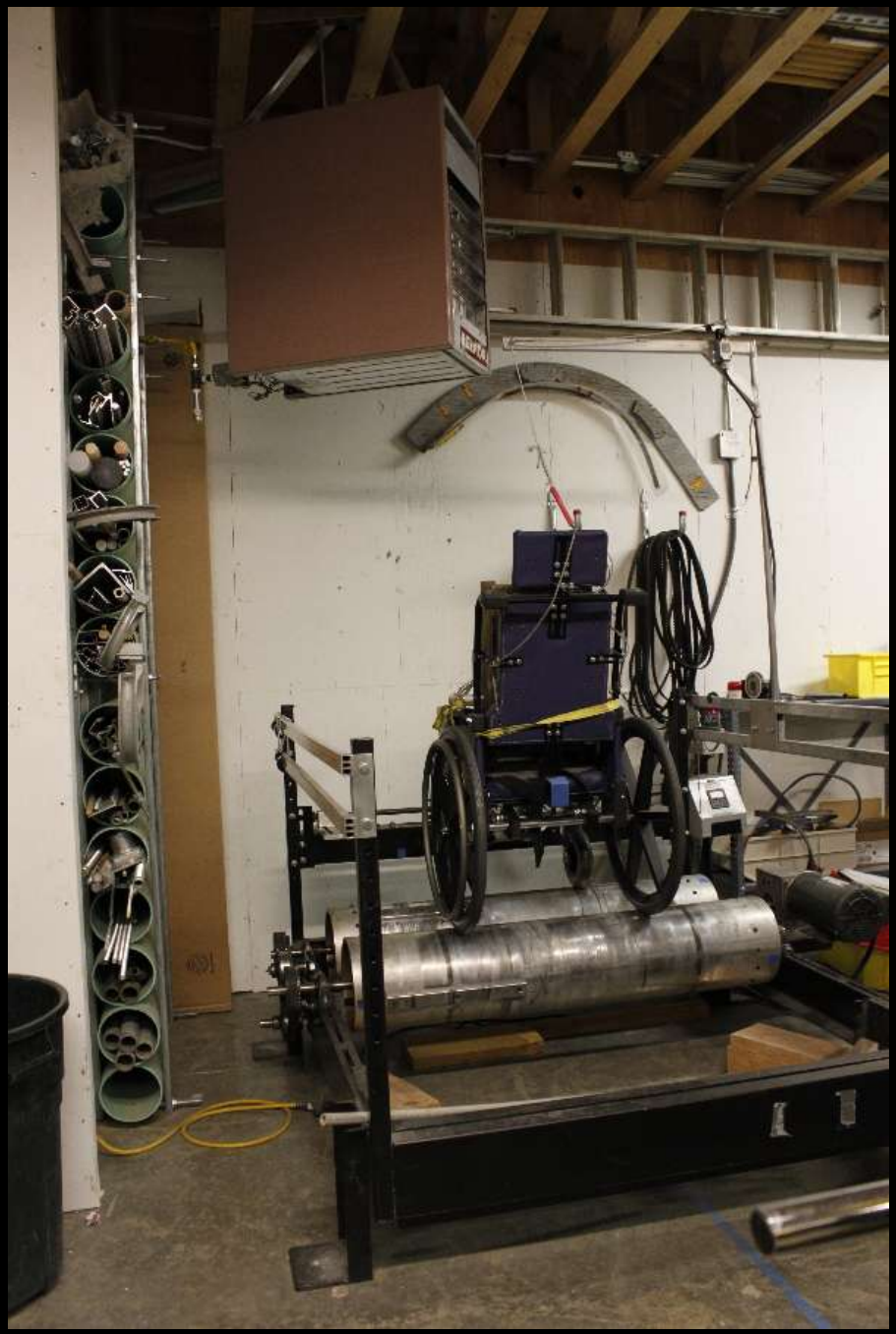
Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

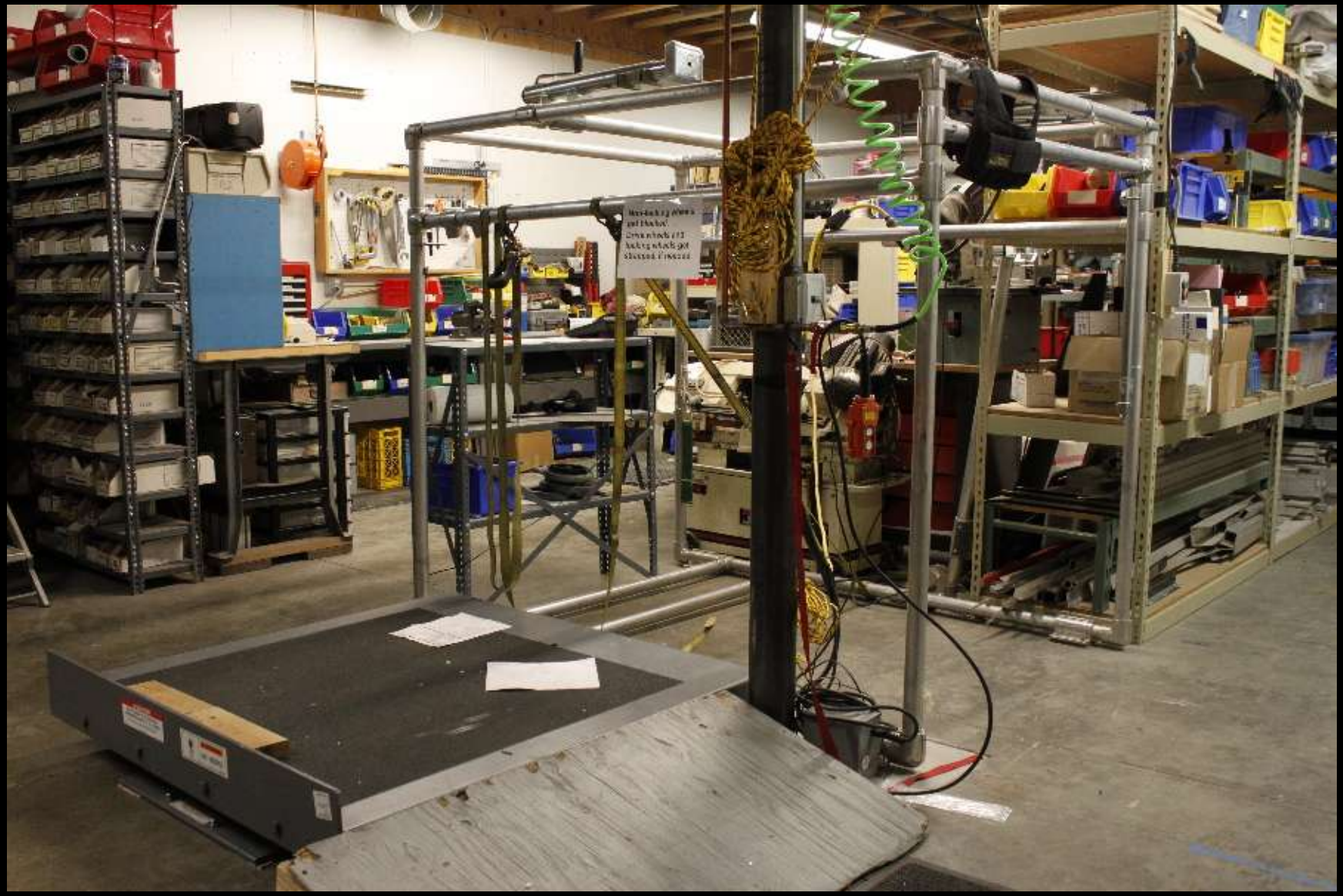
Beneficial Designs

research/design/education

Designing beyond the norm to meet the needs of all people.


Washoe Lake
State Park
TRAIL USE
North
LEGEND






595
BALLOTIN


DELTA


HAAS


BENCH

Design of Consumer Products

Product Development

Assessment of Products

Universal Design of Products

Product Development

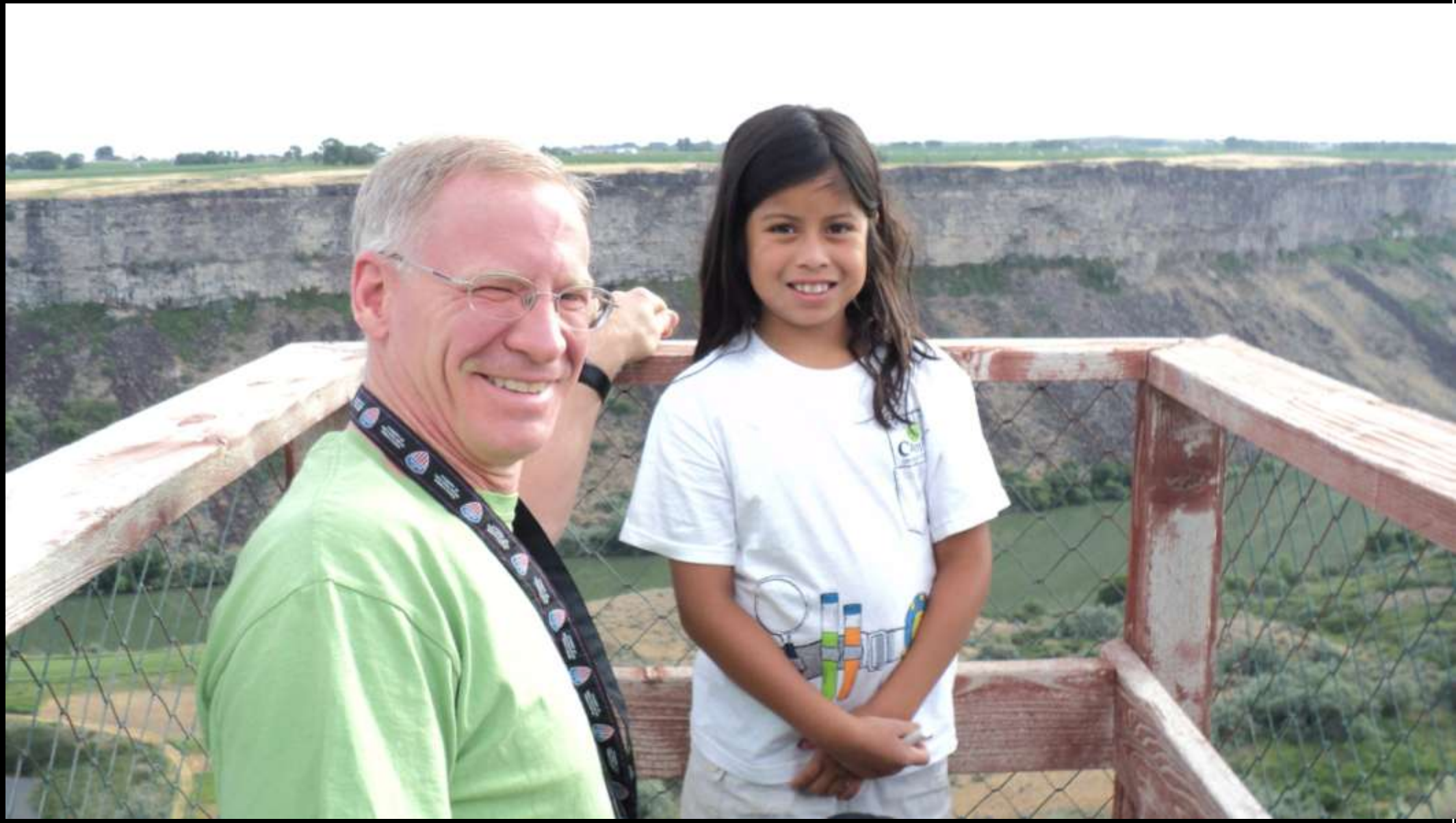
- Mainstream Products
- Opportunity for Universal Design
- Adaptive Products
  - Personal Technologies
  - Activity Specific Technologies

Balance Dimension

Physical

Intellectual

Spiritual




PETZL
PETZL

Sociological Dimension

Dependence

Independence

Interdependence

Personal Technologies
Activity-Specific Technologies
Environmental Technologies

Environmental Technologies

Things that do not move

Activity-Specific Technologies

Arroya Sit Ski

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.


200
205
AMERICAN EXPRESS
When you ne

Mono Ski

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.


WINTER PARK
WEST PORTAL
STATION
HEAD


UNIQUE
HEAD

Dynamic Seating Spring Assist

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

Cross Country Ski

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.


4 12'98


FOX SHOX
4 12 '98

Pax Back

Available from

BES Rehab Ltd

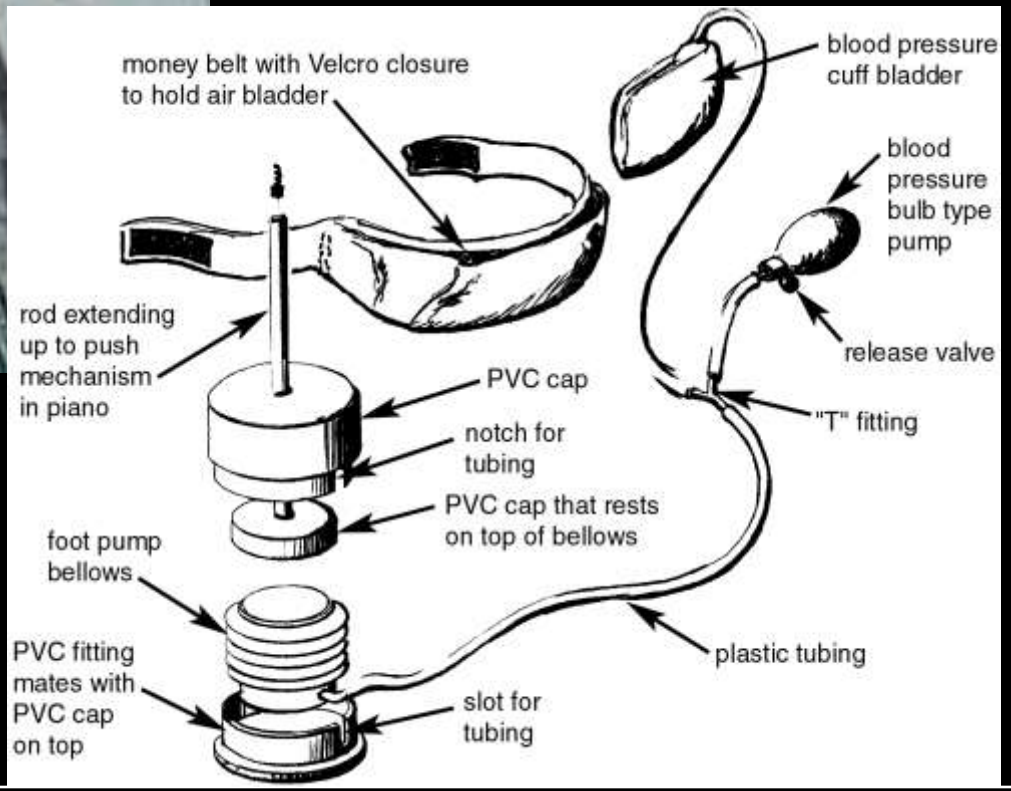
Beneficial Designs

research/design/education

Designing beyond the norm to meet the needs of all people.

Aircraft Aisle Chair

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.


money belt with Velcro closure
to hold air bladder
blood pressure
cuff bladder
blood
pressure
bulb type
pump
rod extending
up to push
mechanism
in piano
release valve
PVC cap
"T" fitting
notch for
tubing
PVC cap that rests
on top of bellows
foot pump
bellows
plastic tubing
PVC fitting
mates with
PVC cap
on top
slot for
tubing

Dynamic Seating

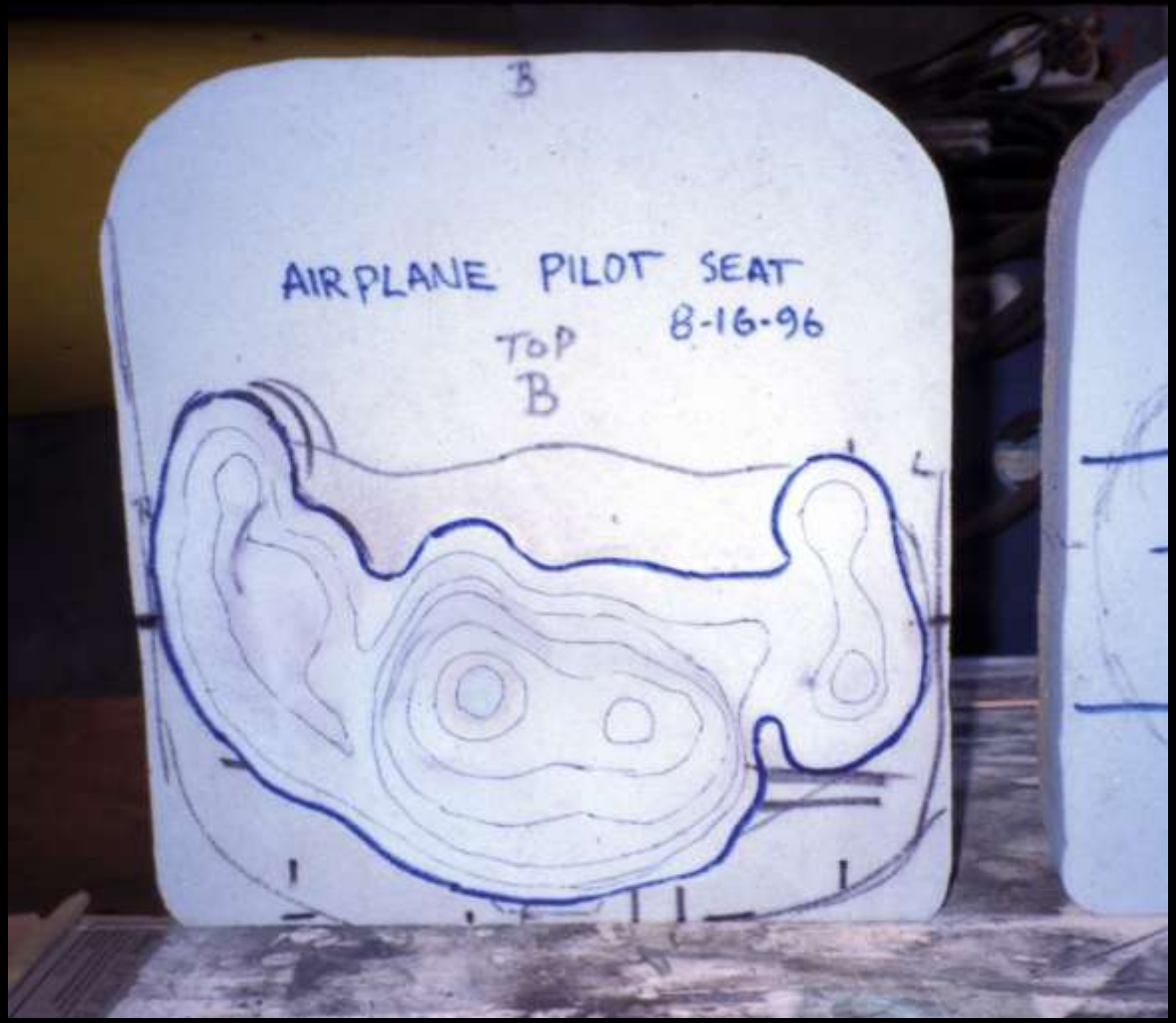
Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

Dynamic Seating

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

Hand Bike

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

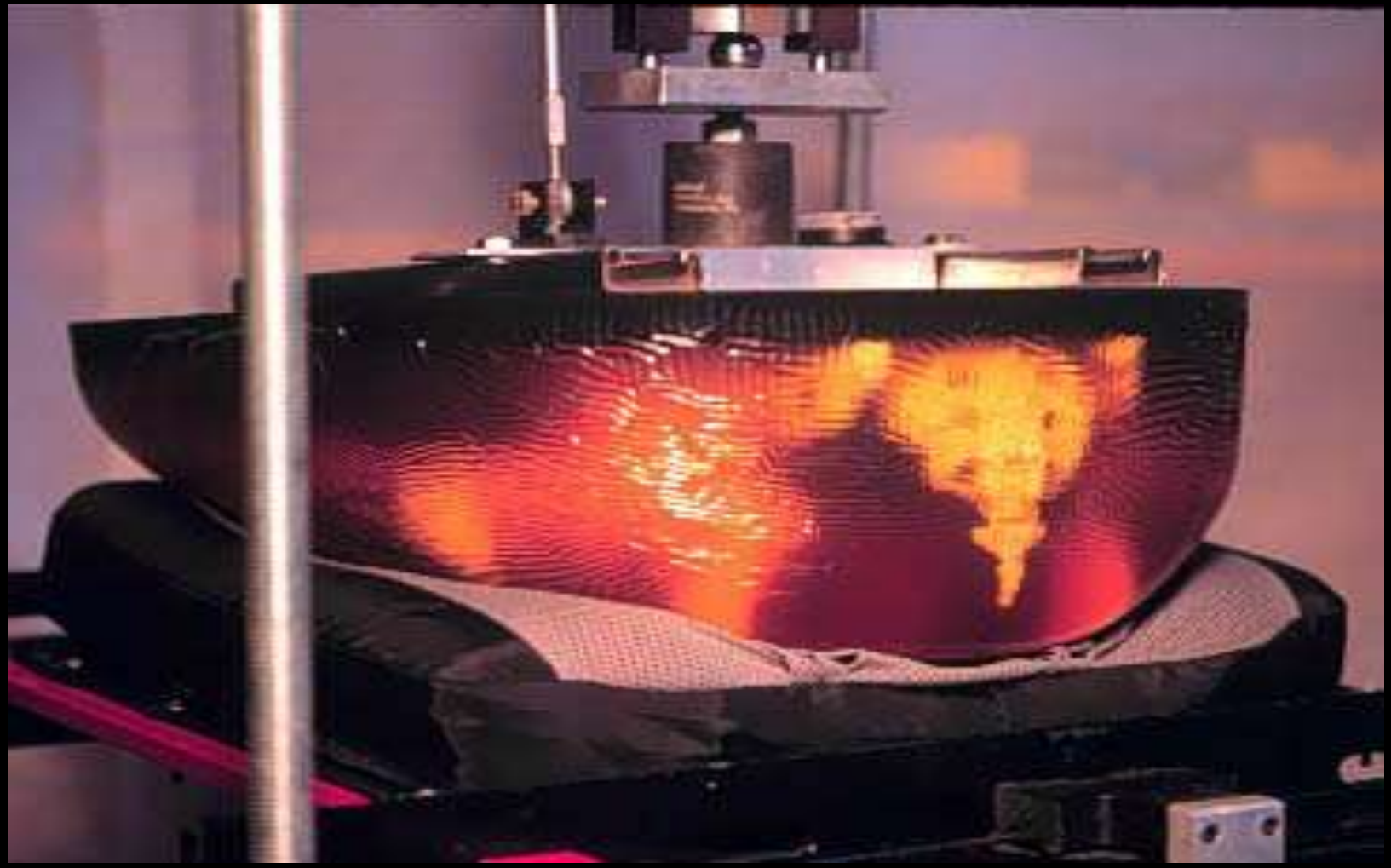


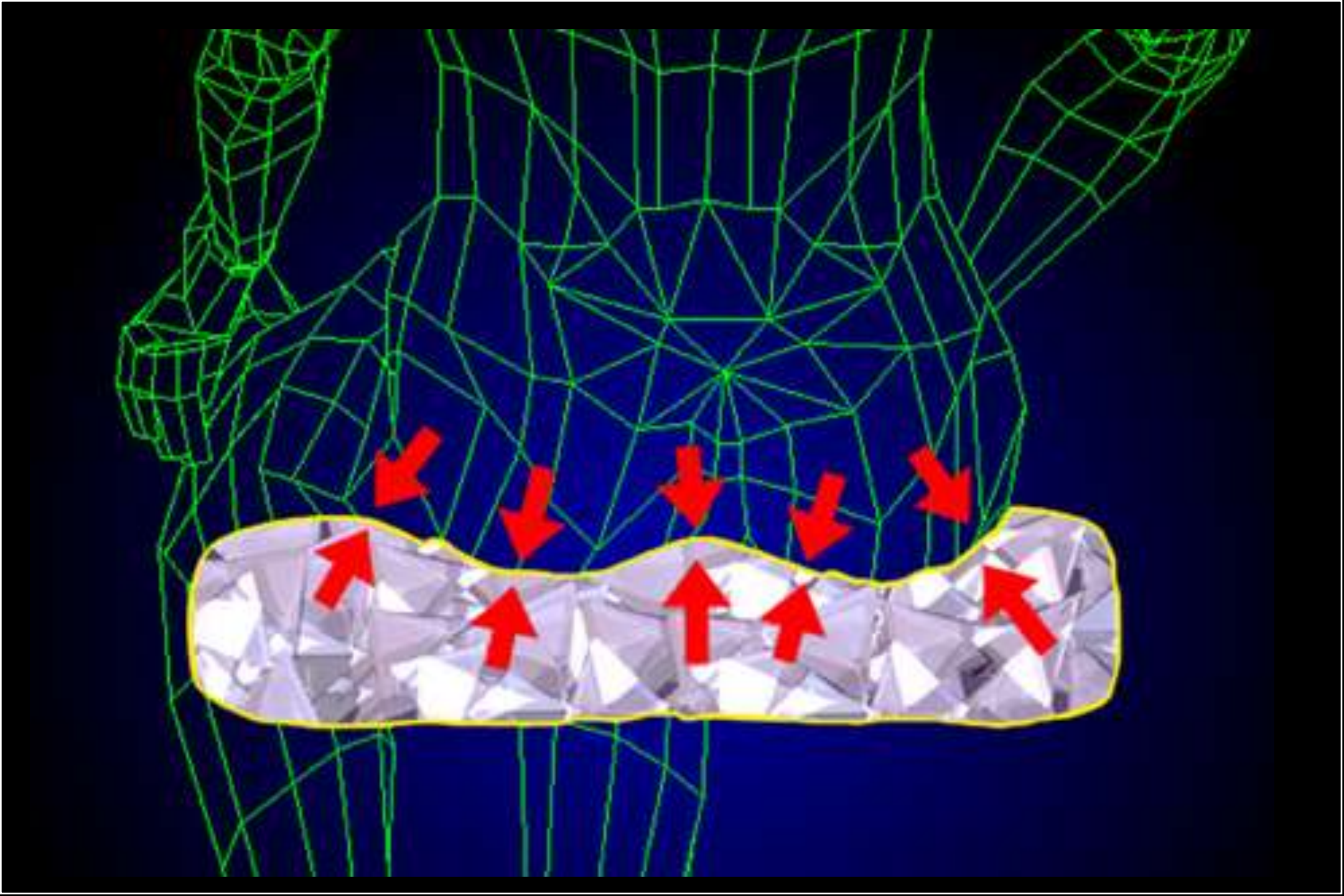
Contoured Seating

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

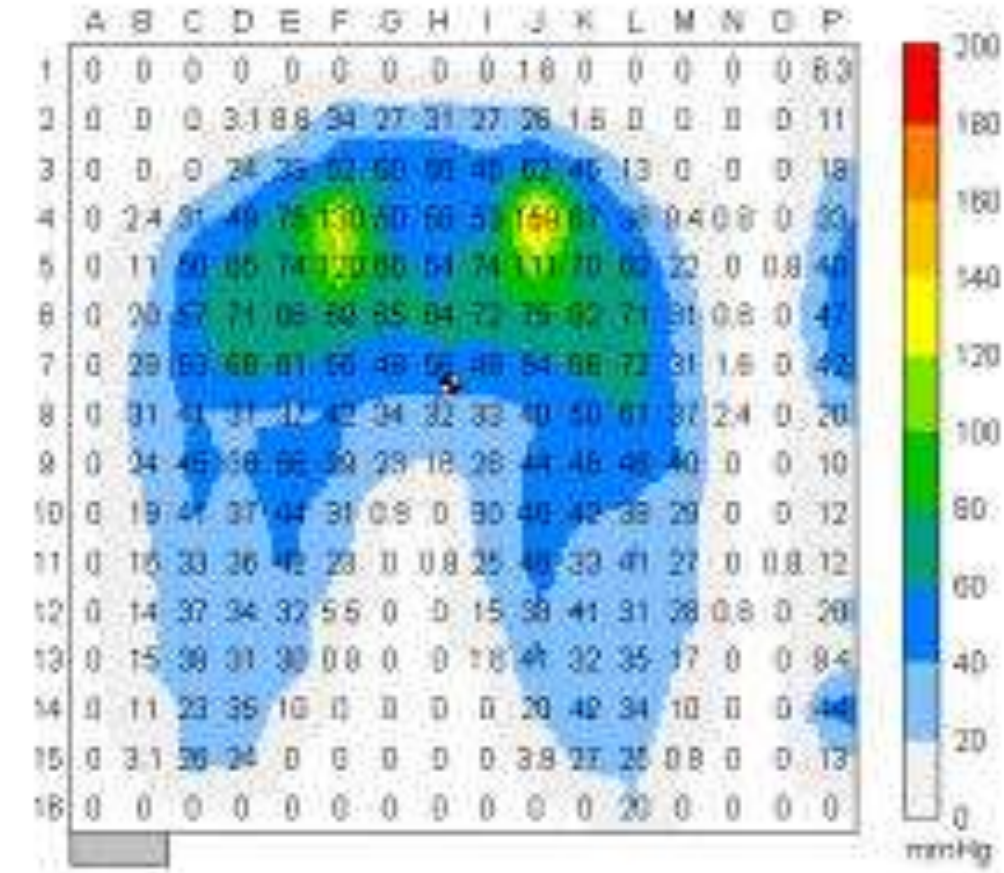
SKELI with Pelvis Model

SKELI from Rear





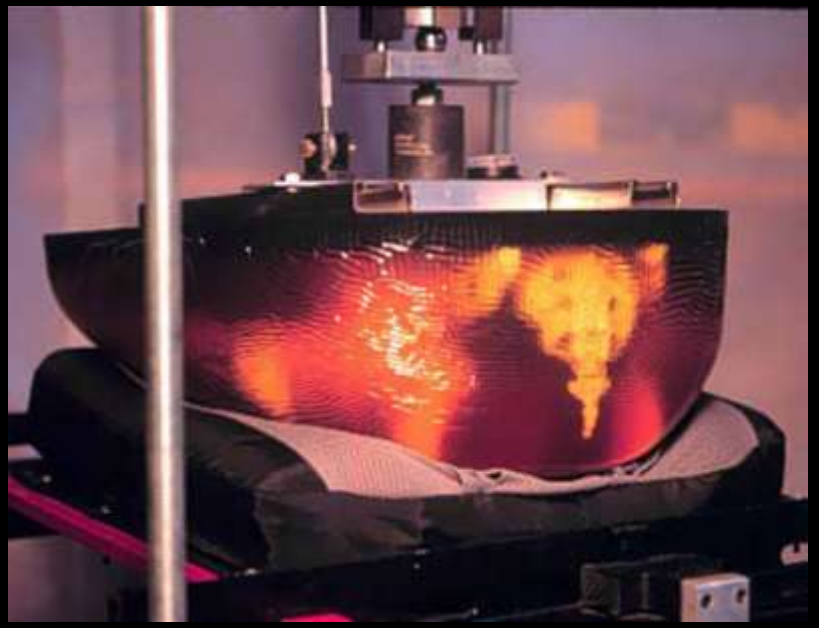
SKELI Used on Foam



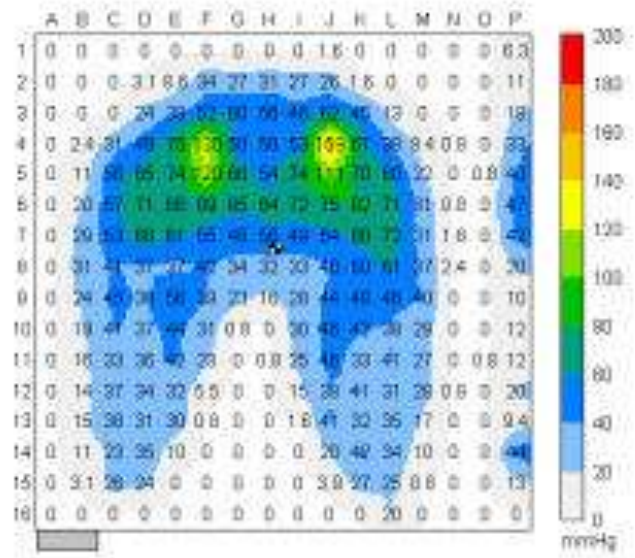
2" HR45 Foam Cushion

Seat Cushion Testing

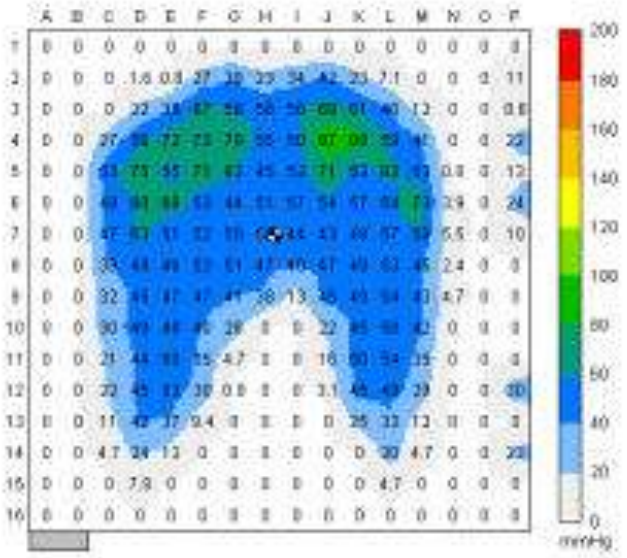
Beneficial Designs has played a key part in the ongoing effort to develop Wheelchair Seating Standards within the ISO. The Skeletal Imbedded Loading Loading Indenter (SKELI) was developed to provide an anatomically based loading indenter for the standard.



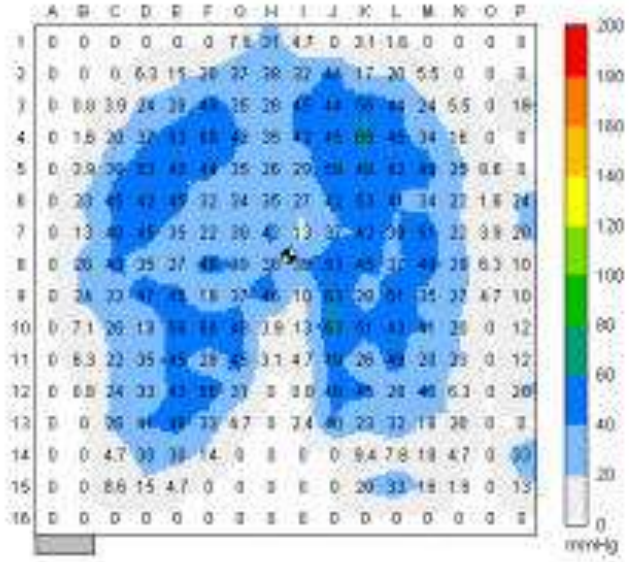
Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.



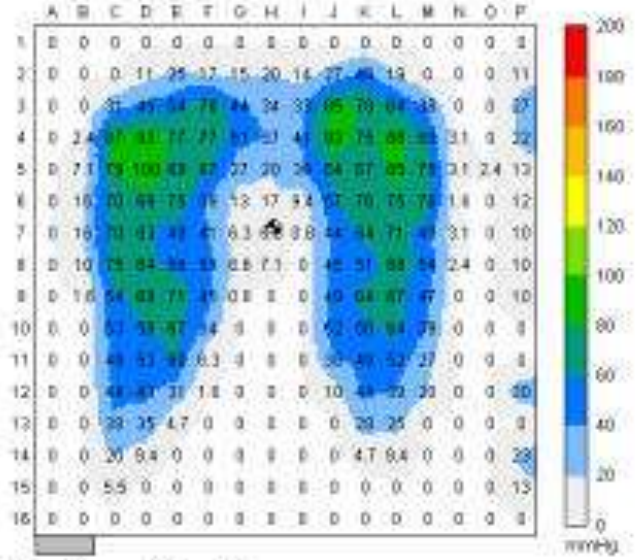
2" HR45 Foam



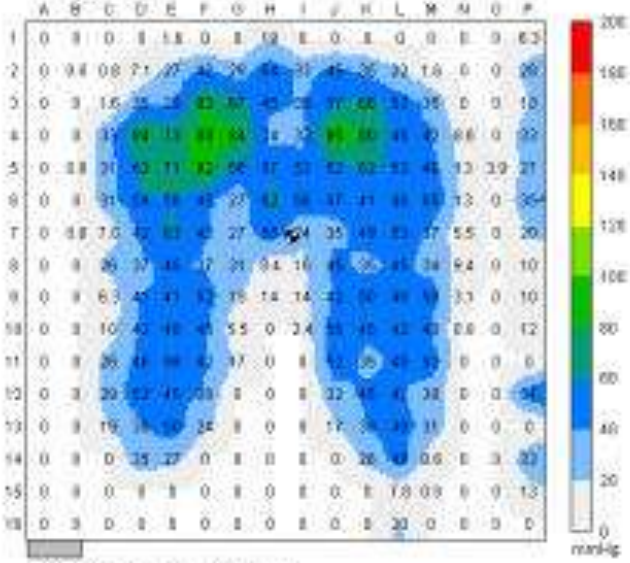
Jay 2 by Sunrise Medical



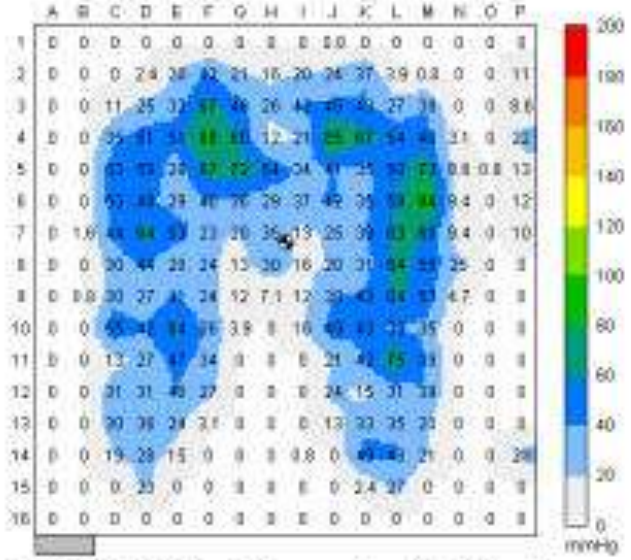
ROHO High Profile by ROHO Inc.



Contoured by Supracor



Model P by Vicair



Model P Deep Immersion by Vicair

ASLI Prototype
ISO Part 2 Shape

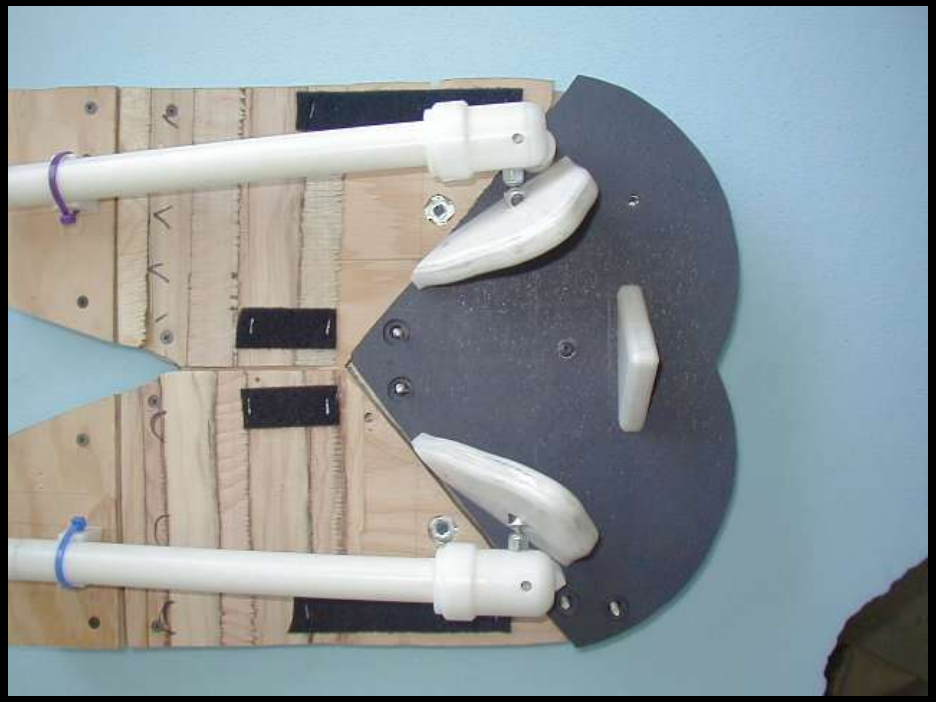
ASLI Prototype V 1.0
with Surrogate Pelvis/Femur
Symmetric loading

ASLI Prototype
10 Pelvic Obliquity

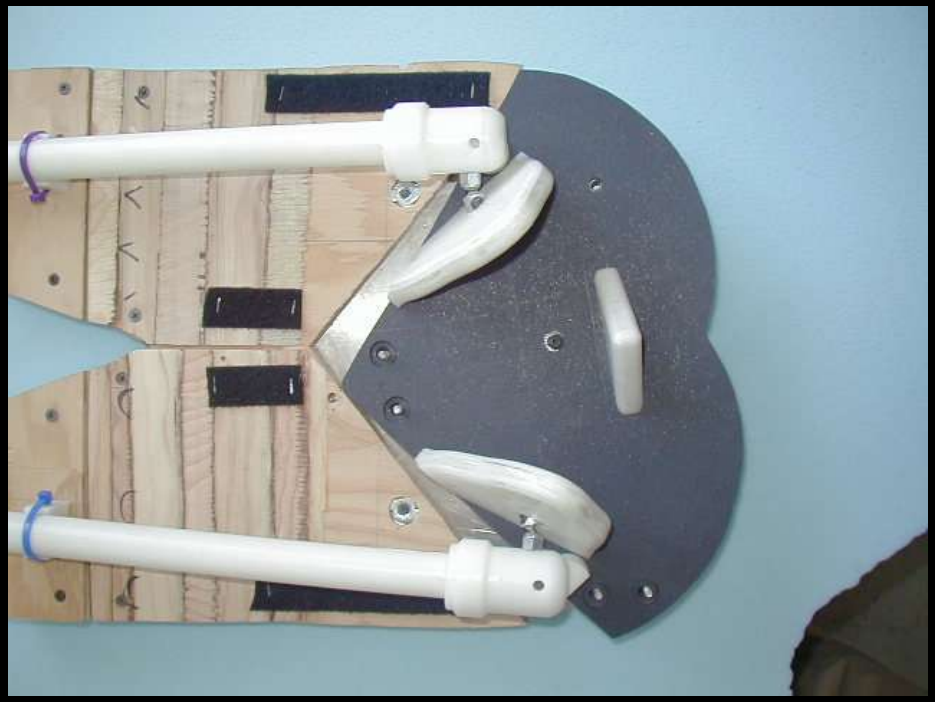
ASLI Prototype
15 Posterior Pelvic Tilt

ASLI Prototype

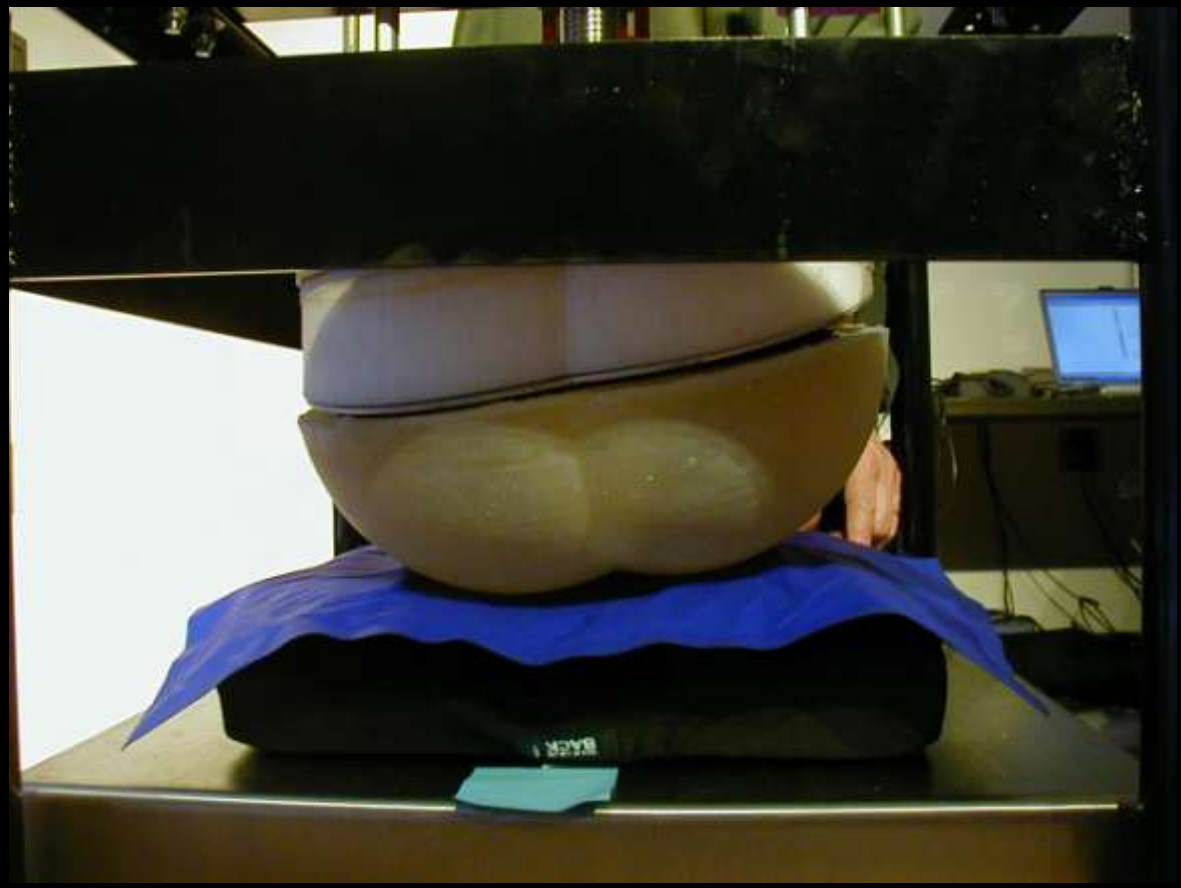
Symmetric loading



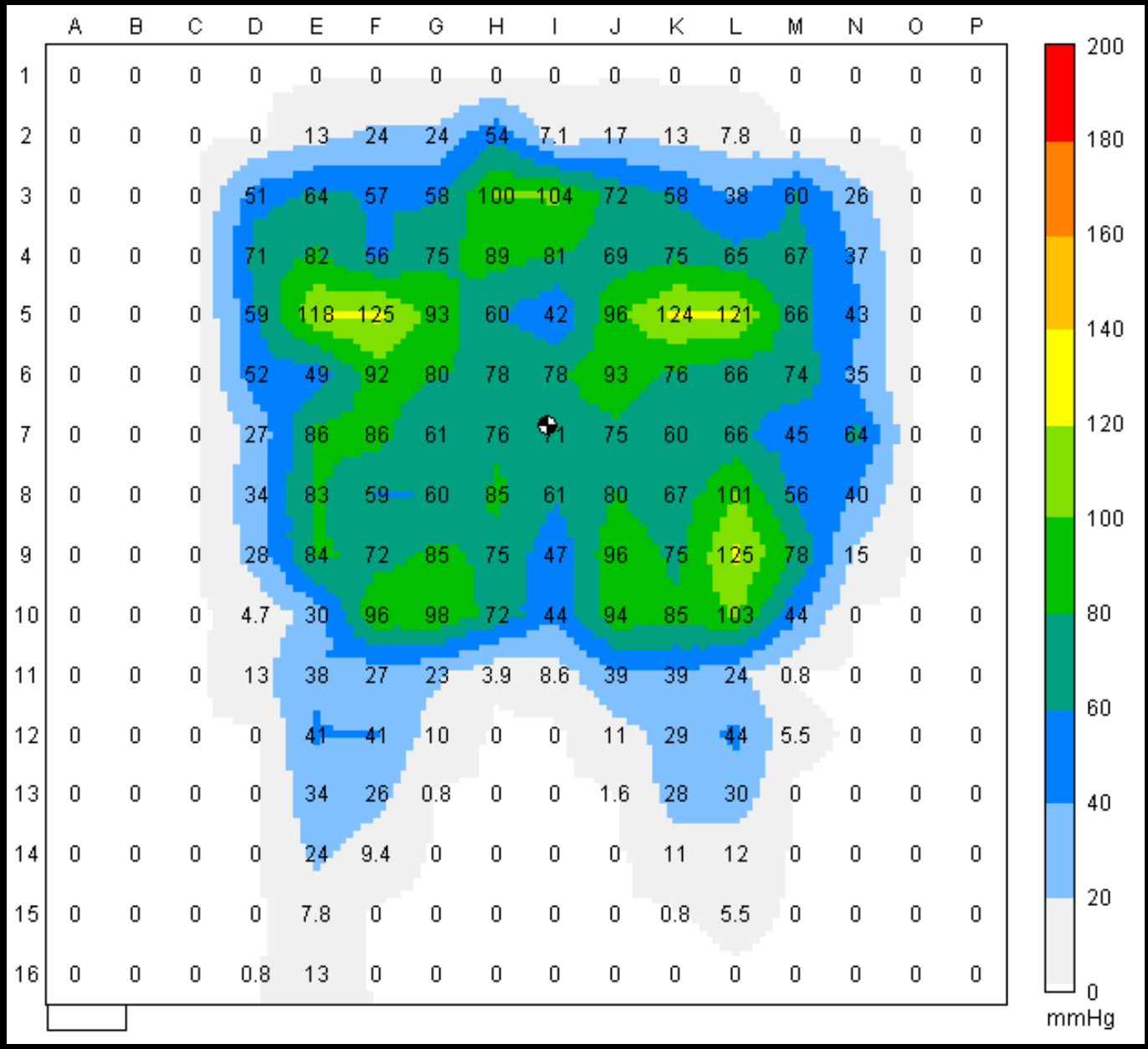
10 Rotation



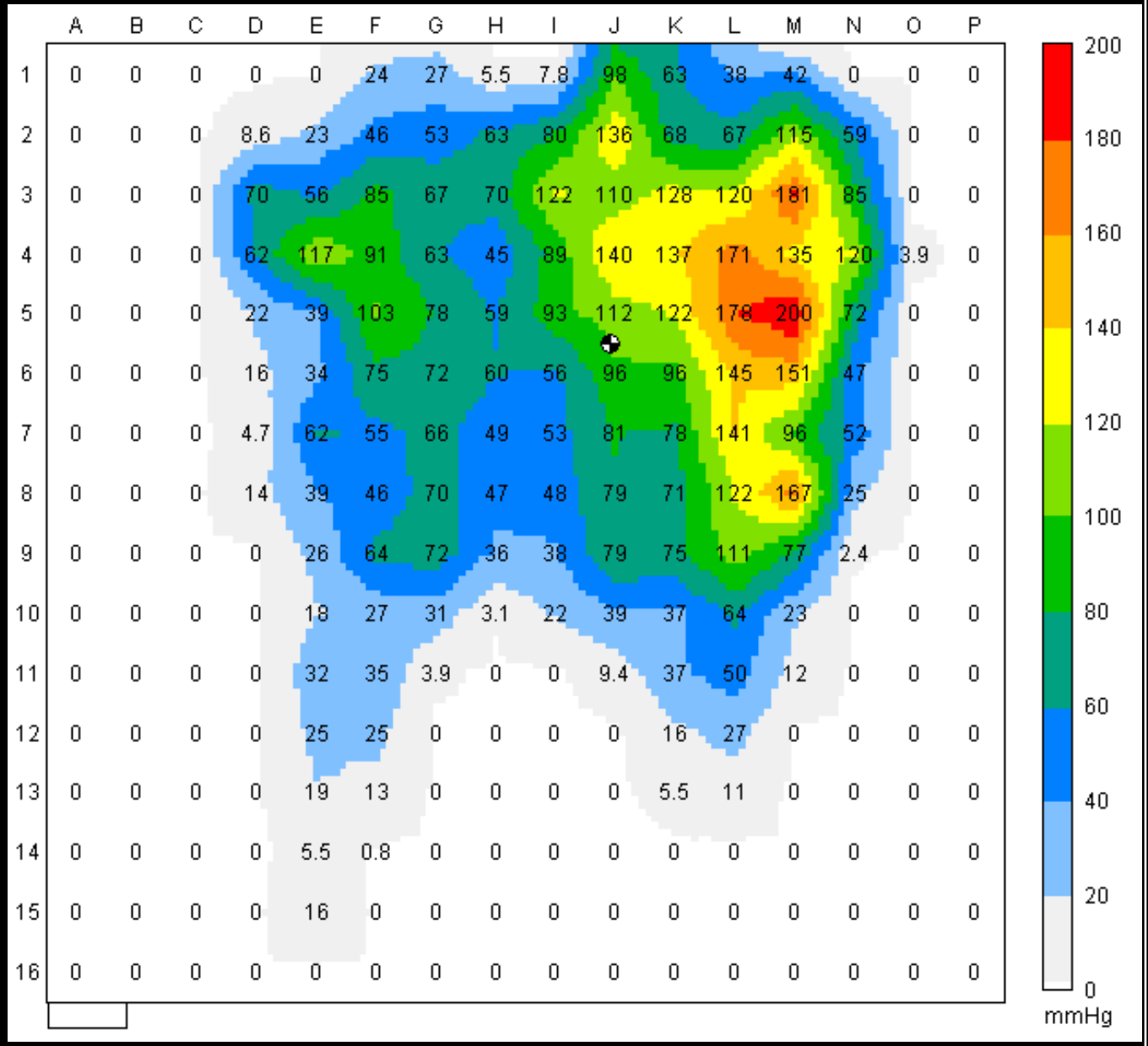
ASLI Prototype V 2.0
with Gel Soft Tissue
10 Pelvic Obliquity and
15 Posterior Pelvic Tilt



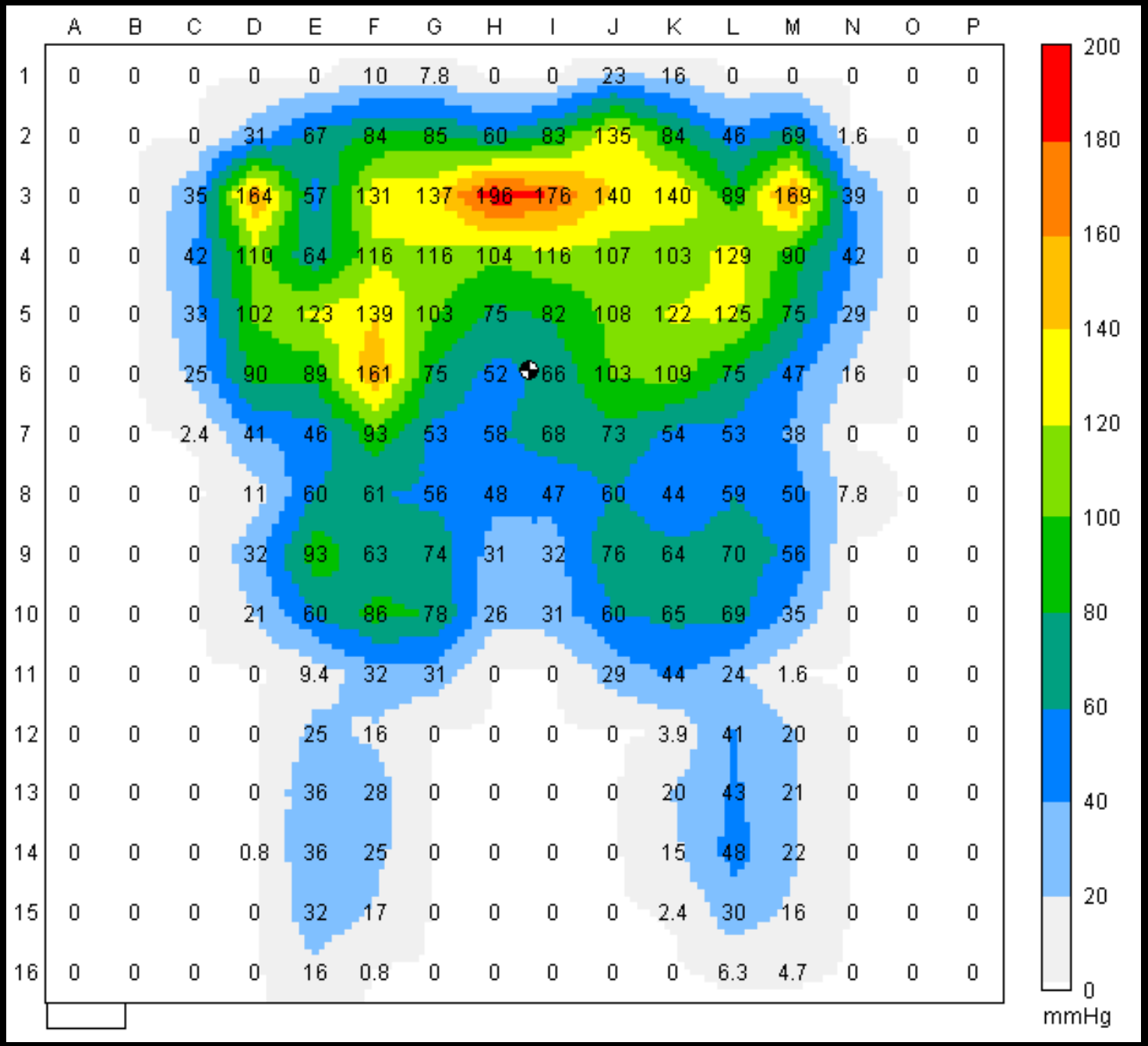
Pressure Measurements Symmetric



Pressure Measurements 10 Pelvic Obliquity



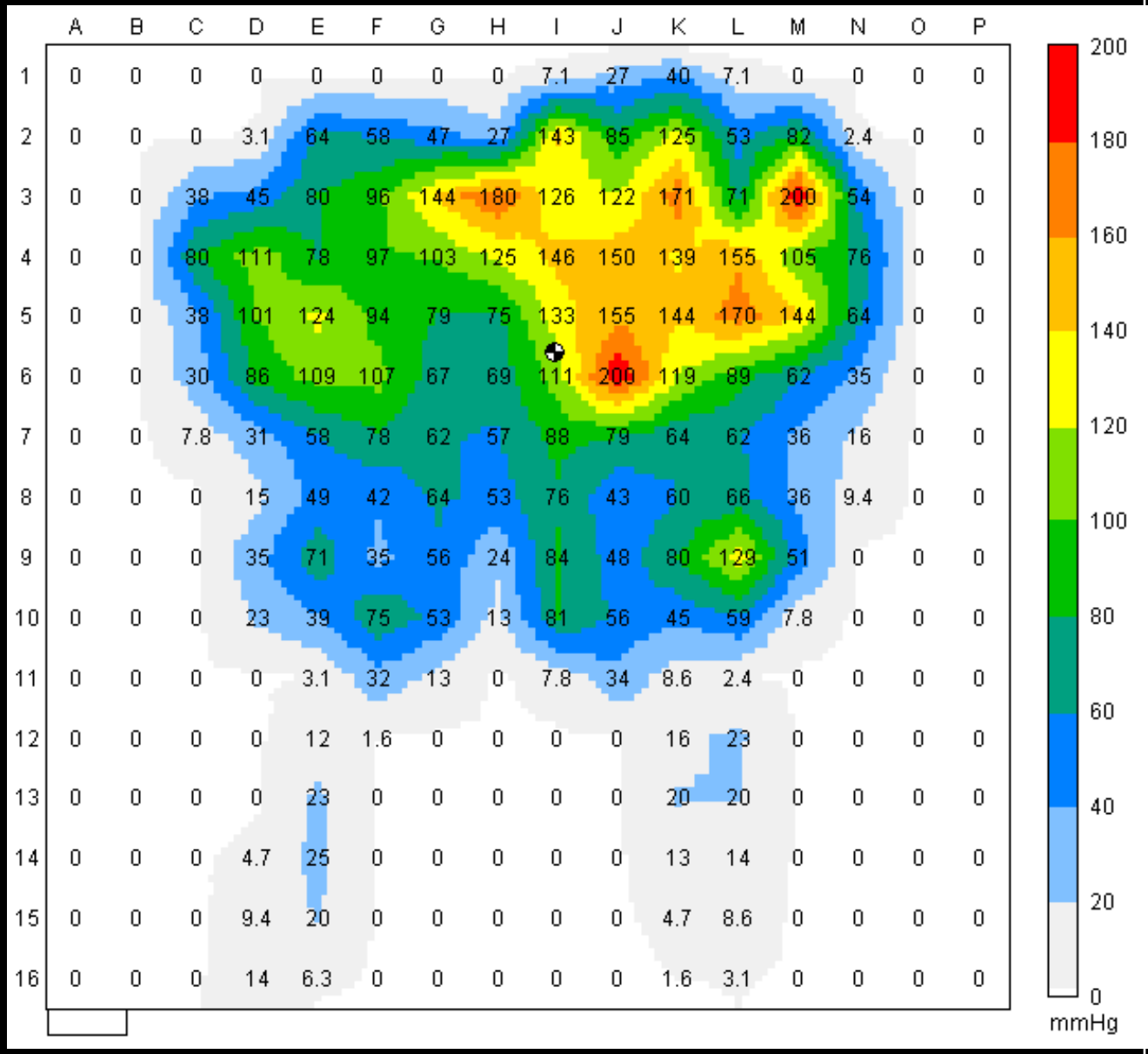
Pressure Measurements 15 Posterior Pelvic Tilt



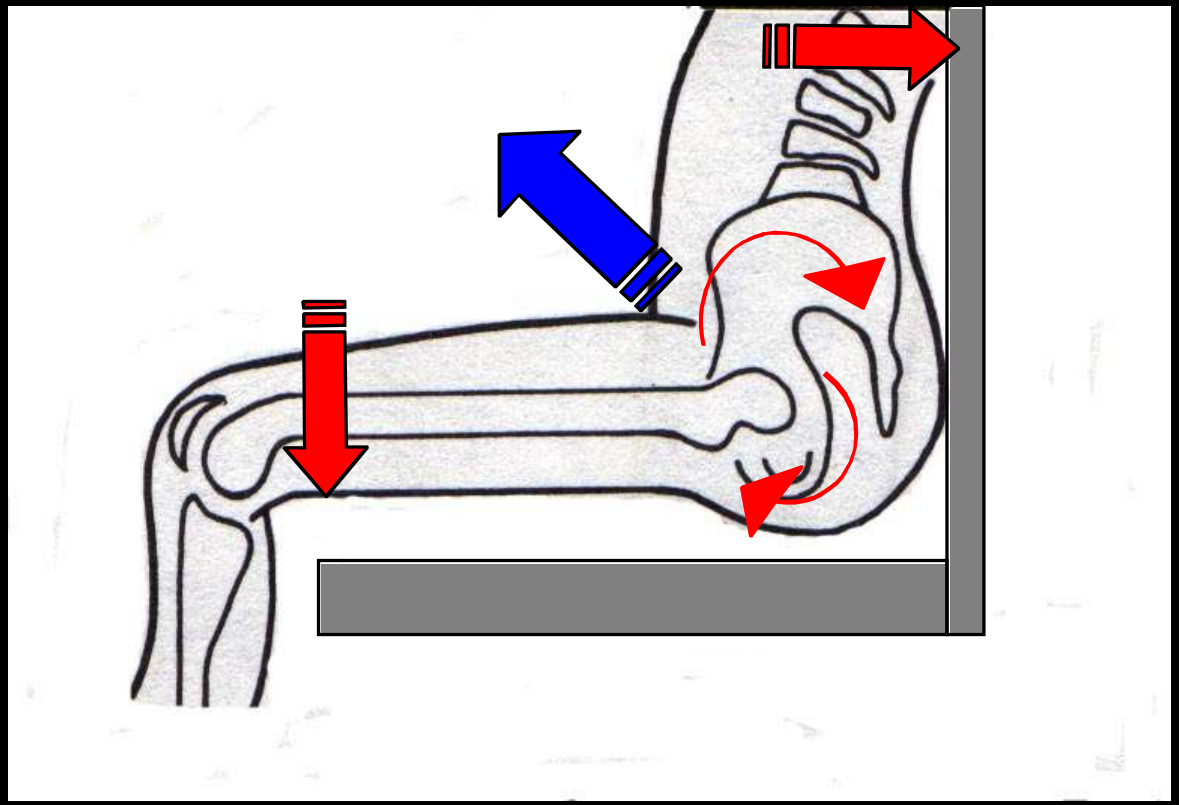
Pressure Measurements

10 Pelvic Obliquity

15 Posterior Pelvic Tilt



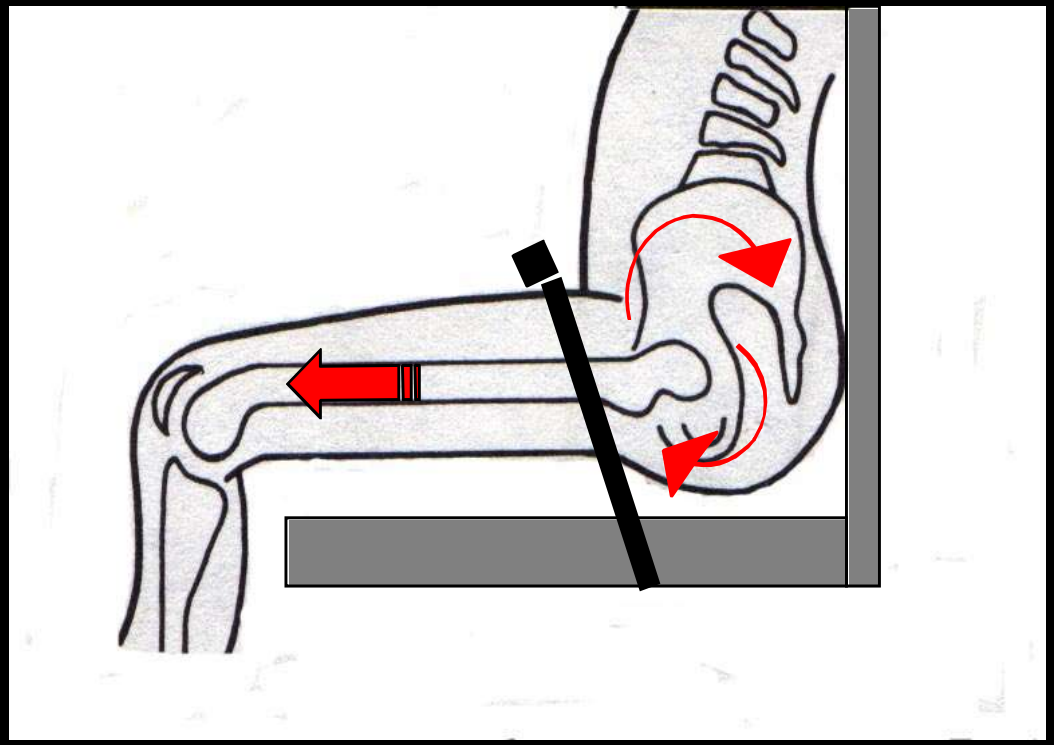
Pelvis Movement During Extensor Thrust Activity



Force at Thigh and Backrest During Extension

Pelvis Moves Up, Out and Rotates

Variations of Belt Angle

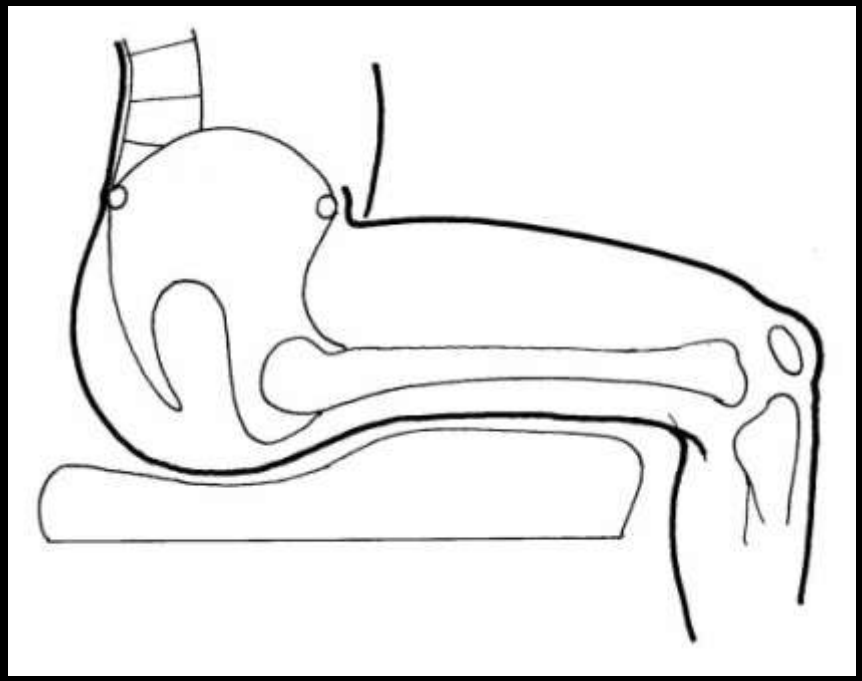


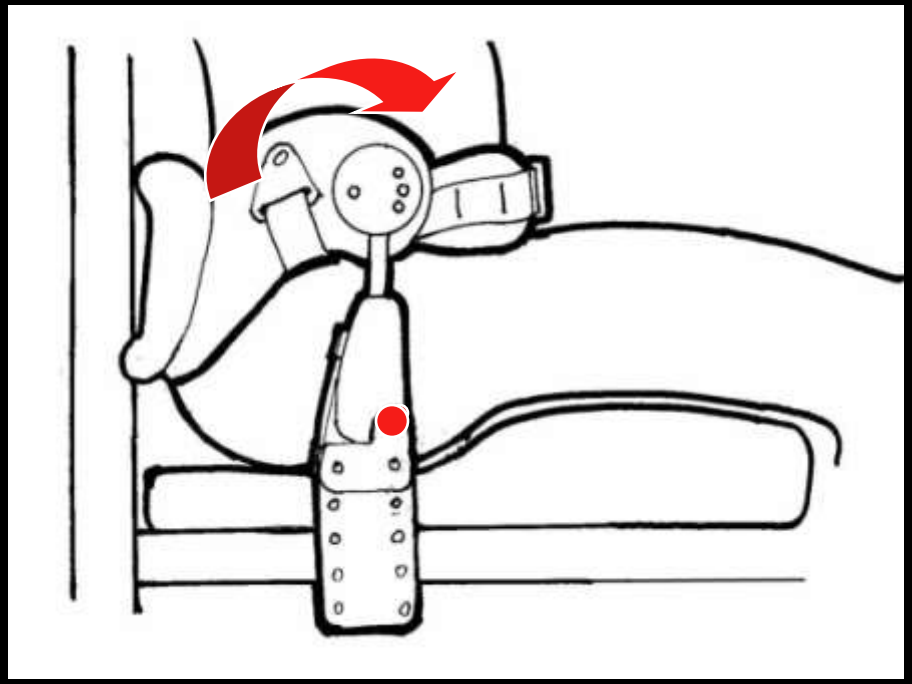
Downward Pull Limits Upward Movement

Allows Posterior Pelvic Rotation

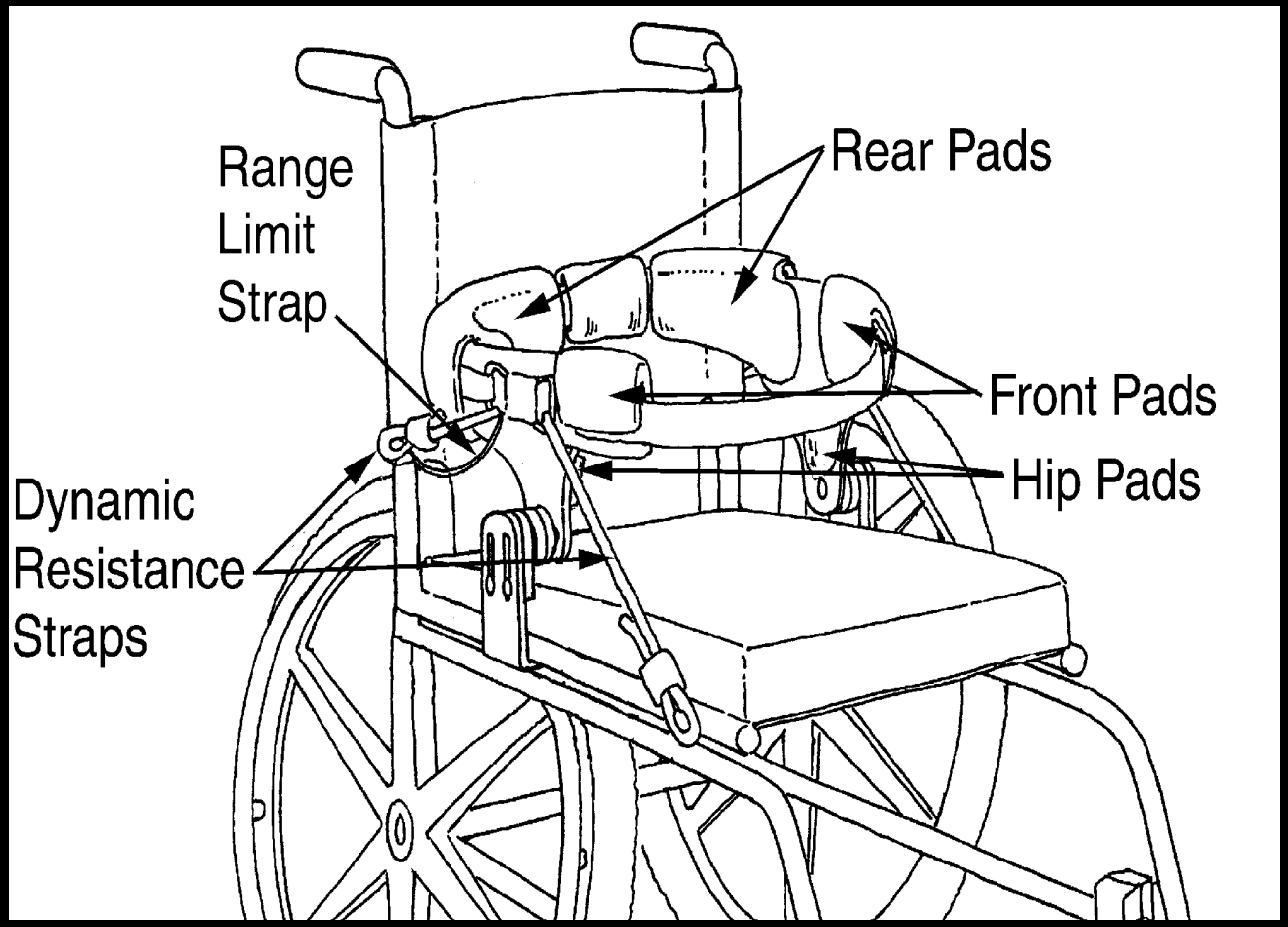
Limits Full Anterior ROM

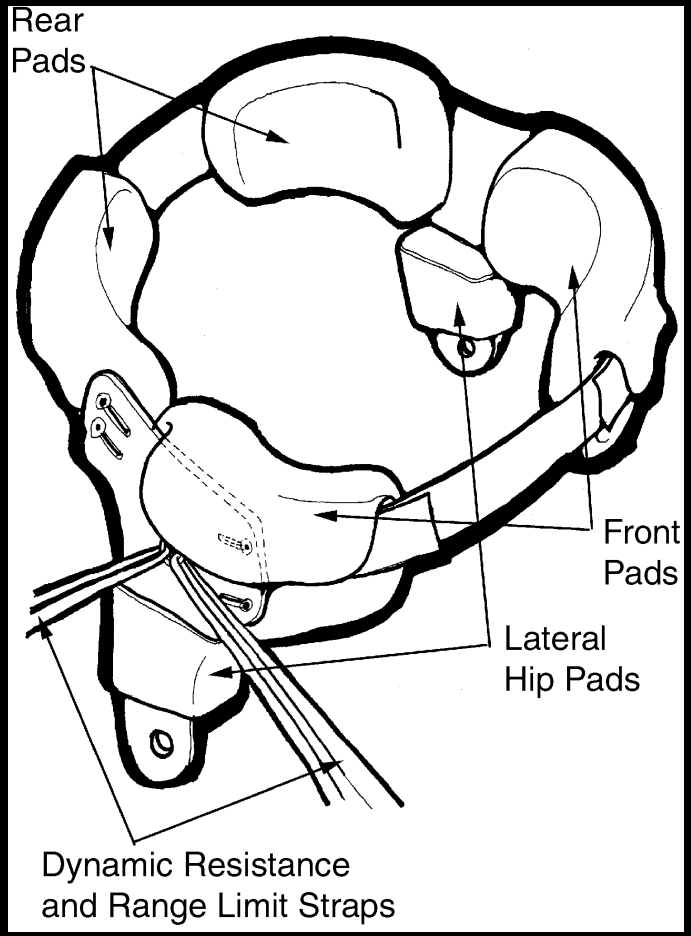
HipGrip Concept





HipGrip Ph1 - Prototype 2





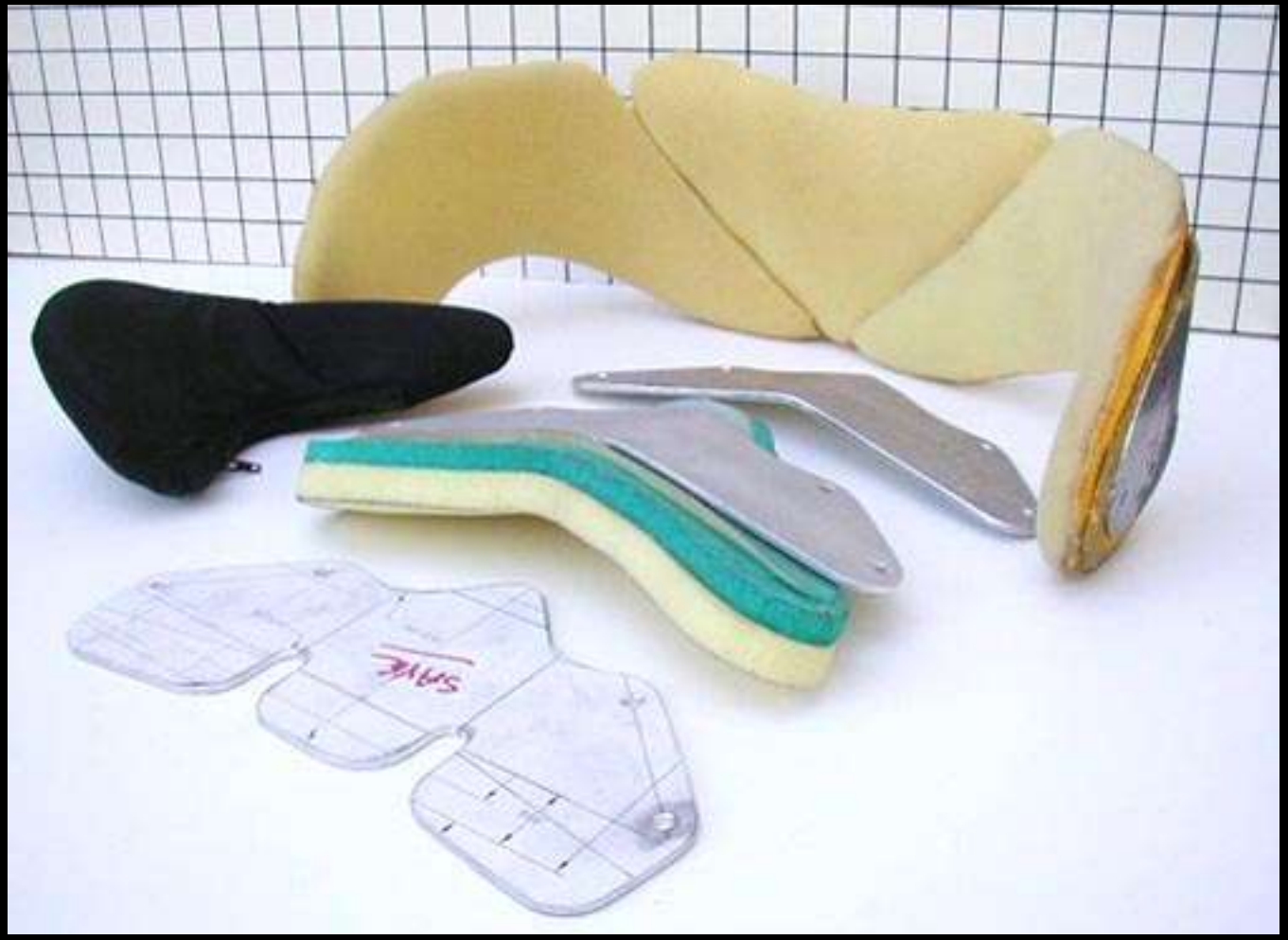
What Is the HipGrip?

- Dynamic Pelvic Support
- Provides Pelvic Stability
- Allows Controlled Anterior Tilt ROM

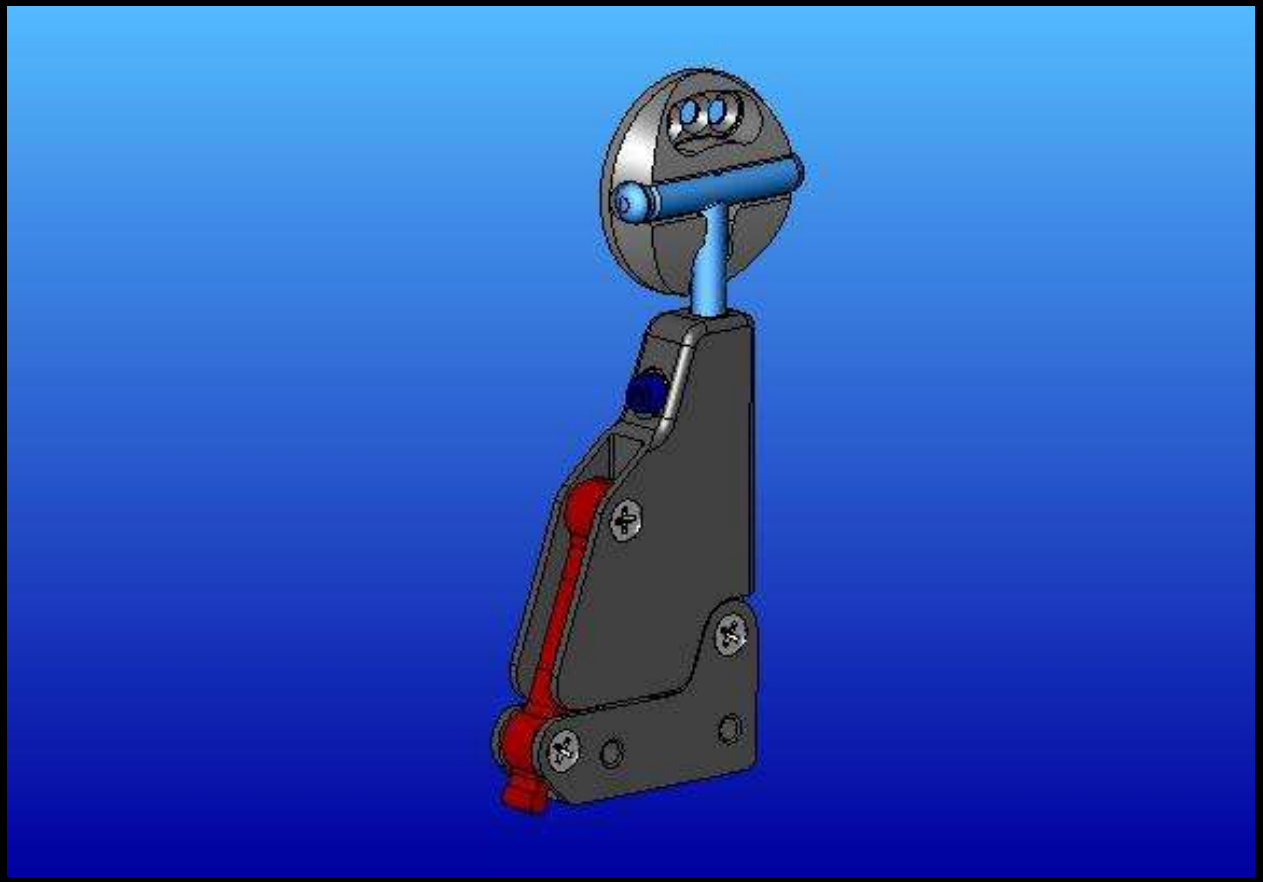
Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

Hip Grip Components

Modular Hardware



Pivot Bracket
Current Design



HipGrip Test Fixture

HipGrip

The HipGrip is a postural seating device designed to help control pelvic position and provide stability while in a wheelchair while allowing range of motion and movement in anterior and posterior pelvic tilt.

Available from
Bodypoint

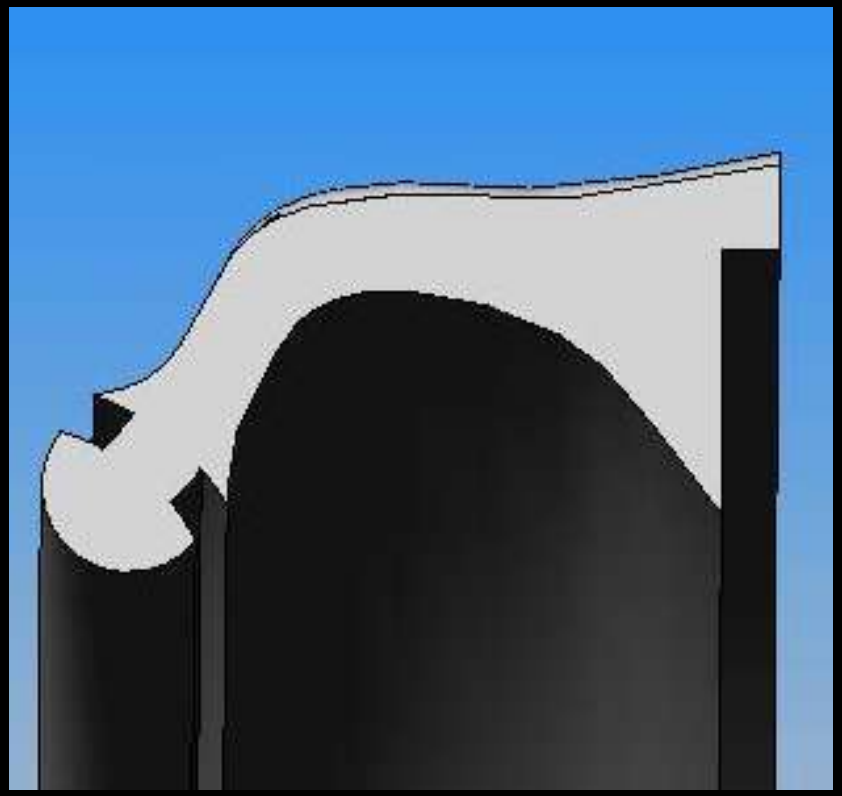
Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

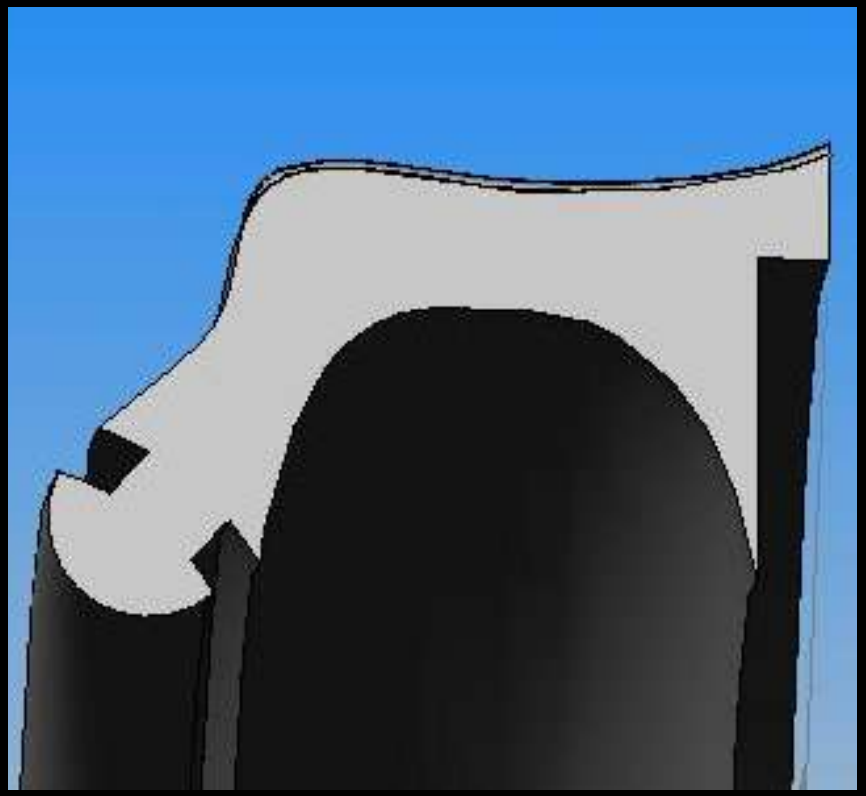
Functional Forward Reach

Functional Reach Downward

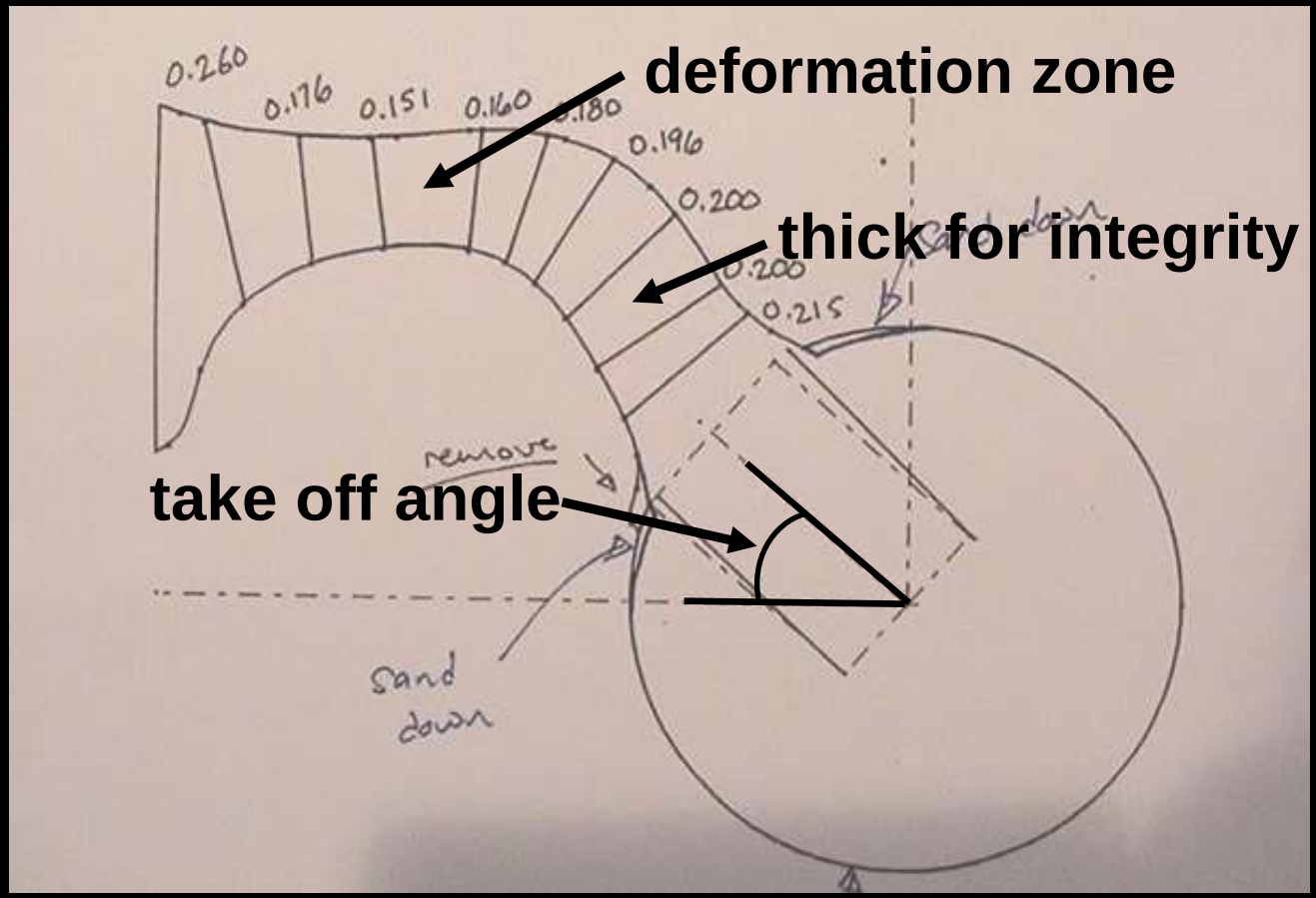
FlexRim – Combining the discrete compliant fasteners into one

The best profiles were fully developed and tested

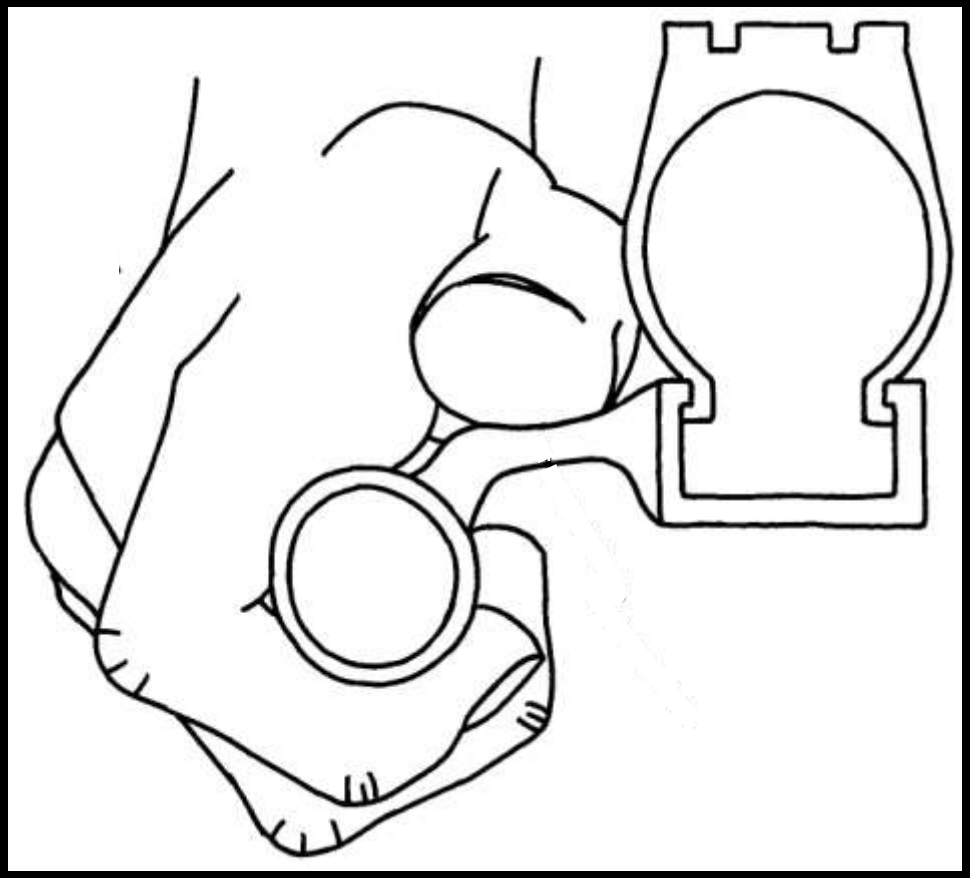




The subtle details of the final profile were refined

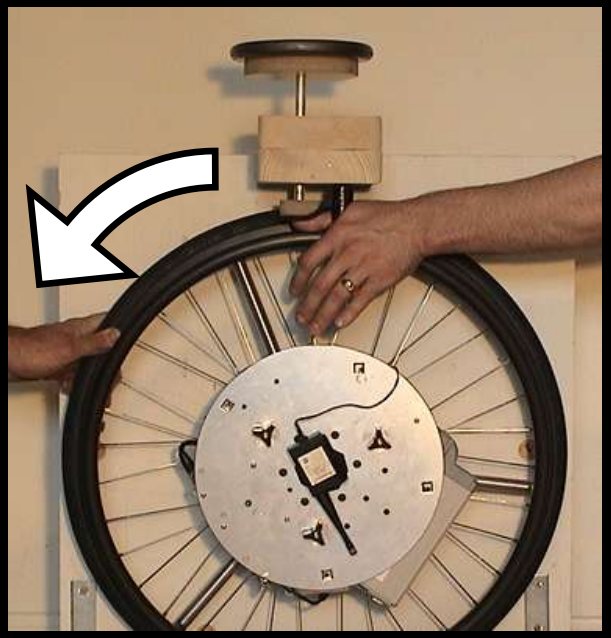


FlexRim Ergonomic Pushrim

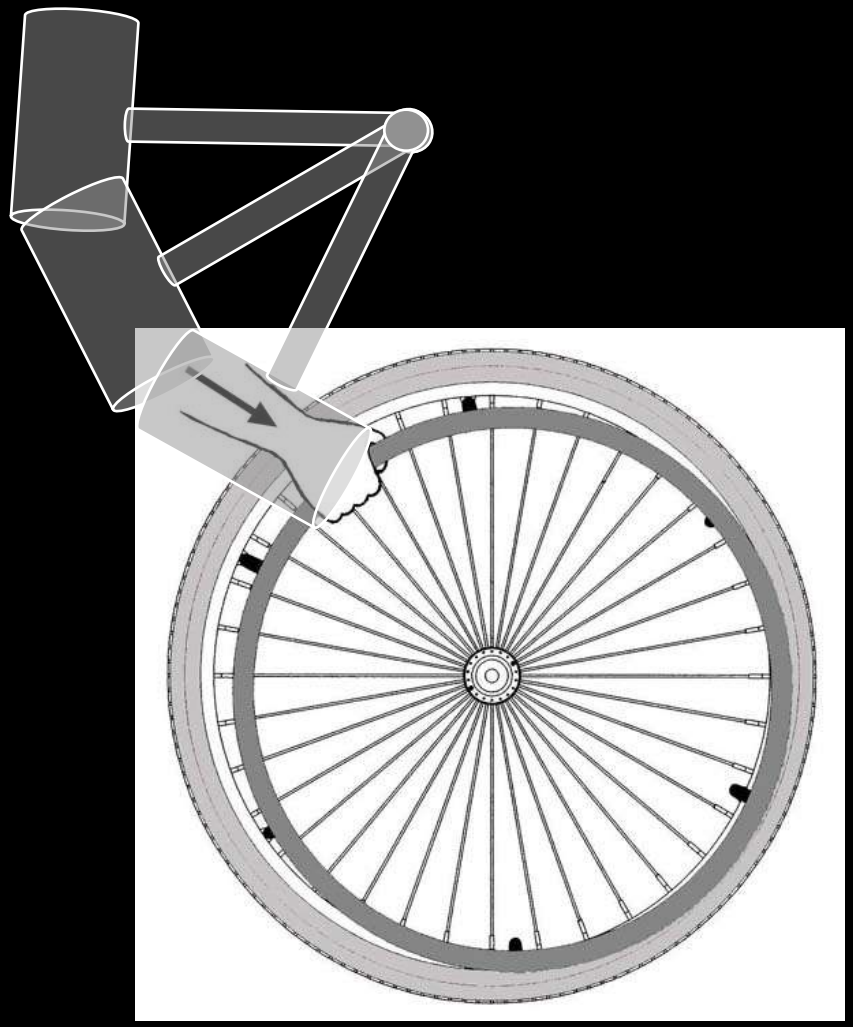


Frictional improvements

Preliminary tests show over a 2x increased frictional coefficient

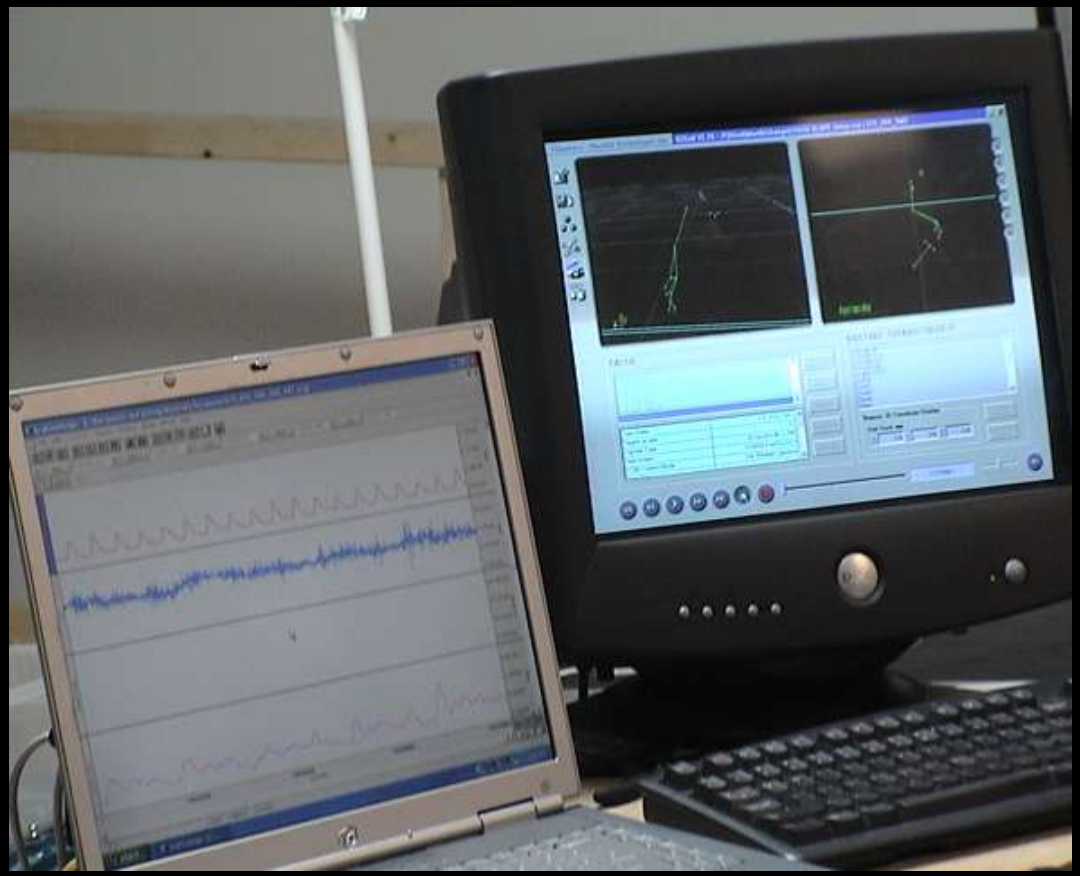


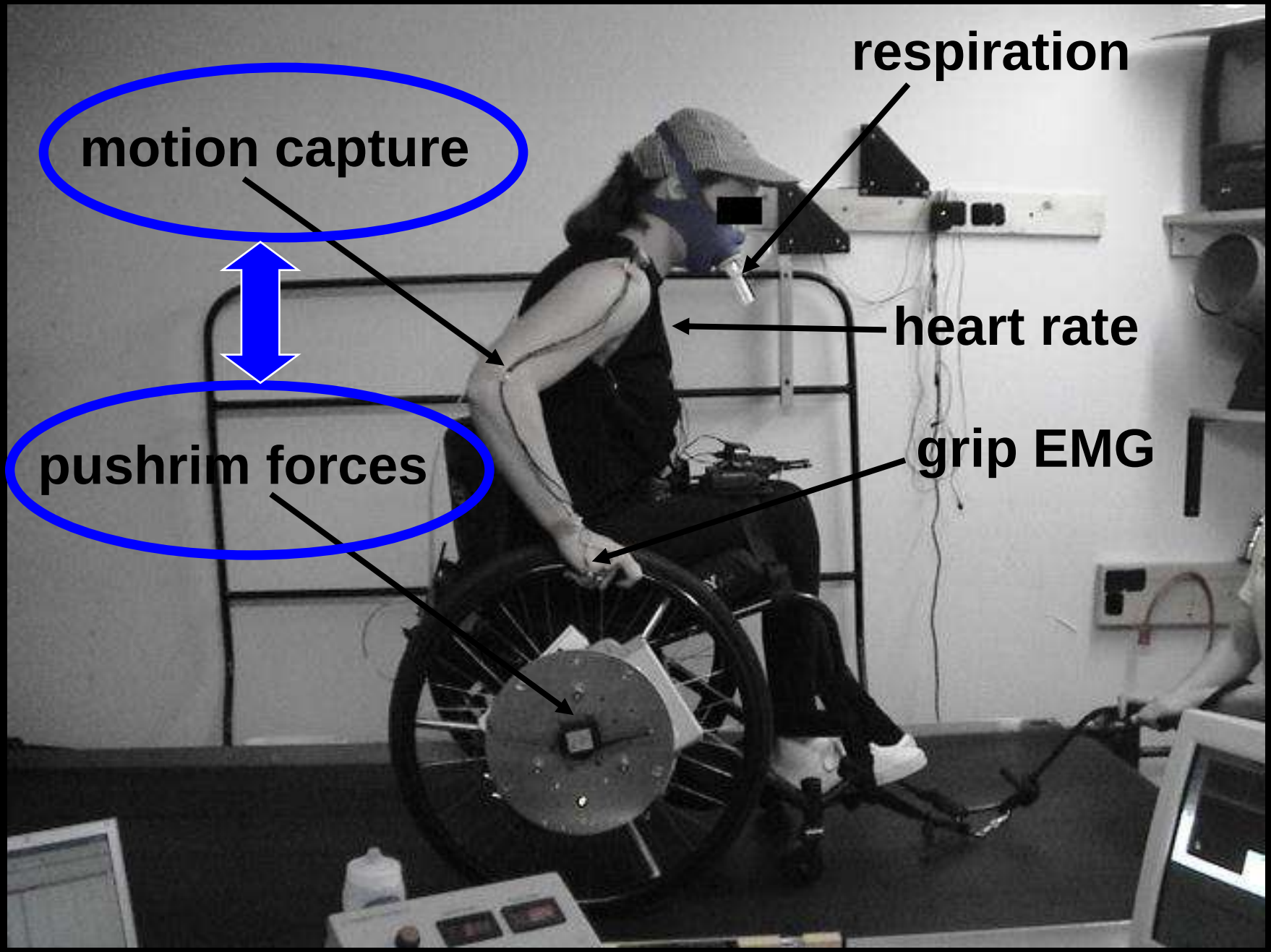
Impact absorption



Applied a 120 lb repetitive load in one place until failure

Subjects are tested over a wide variety of usage environments




respiration
motion capture
heart rate
grip EMG
pushrim forces

Baseline study – FlexRim

FlexRim

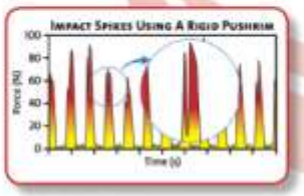
Design

The FlexRim consists of a durable high friction rubber surface that spans between the aluminum pushrim and the wheel. The shape of the rubber is ergonomically designed to conform to your hand when gripped, making it the most comfortable pushrim you will ever use.

Because the rubber is flexible, the pushrim can compress to allow your wheelchair to squeeze through narrow doorways.

Overuse Injuries

Shoulder and wrist problems are very common among wheelchair users. Impact loading is one of the contributing factors. Your hands and arms absorb impact spikes when you first hit the pushrim, illustrated in the graph below.



- Reducing impact is one strategy recommended to help protect you from developing overuse injuries.

Impact Testing

Impact loading of the FlexRim was studied for a wide range of impact intensities.

- The FlexRim was found to consistently ***reduce impact loading by 10%.***

Propulsion Testing

In lab testing, wheelchair users pushed with both a standard pushrim and the FlexRim on a research treadmill. Grip muscle activity, oxygen demand and power generated were all measured during propulsion and compared across pushrims.

Results of the testing were:

- Users required ***12% less grip force*** to push with the FlexRim.
- Overall ***grip exertion was reduced by 15%.***
- On average users required ***12% less oxygen*** to push with the FlexRim than with a standard pushrim.
- Users generated ***13% more power*** when using the FlexRim.

The ergonomic benefits of the FlexRim have been published in numerous scientific journals and in a PhD dissertation at Stanford University.

FLEXRIM BY SPINERGY

Advanced Ergonomics

Beneficial Designs

research/design/education

Designing beyond the norm to meet the needs of all people.

GripRim

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

Benefits of a Universal Design Canoe Seat for Paddler Function

Alida Lindsley, Seanna Kringen,
Peter W. Axelson, Patricia E. Longmuir

Beneficial Designs, Inc., Minden, NV

Greg Lais, Beth Vandehaar,
Michael Passo

Wilderness Inquiry, Minneapolis, MN

Beneficial Designs
research/design/education
Designing beyond the norm to meet the needs of all people.

Adaptive Canoe Seating

Available from

Chosen Valley Canoe Accessories

Universal Canoe Seating System Components

Bench Seat with
- Sidewall
- Brackets

Universal Canoe Seating System Components

Pelvic and
Low Back Support

Universal Canoe Seating System Components

- Upper Back and Lateral Thoracic Support

Methods - Endurance

- MedGraphics VO2000 portable metabolic system
- Resting, self-selected paddling, and self-selected pace + 20%

Methods - Strength

- Dynamic power from Concept2 rowing ergometer
- Maximal isometric paddle pull

Lateral Balance Test

Water Egress Testing

Wave Ski

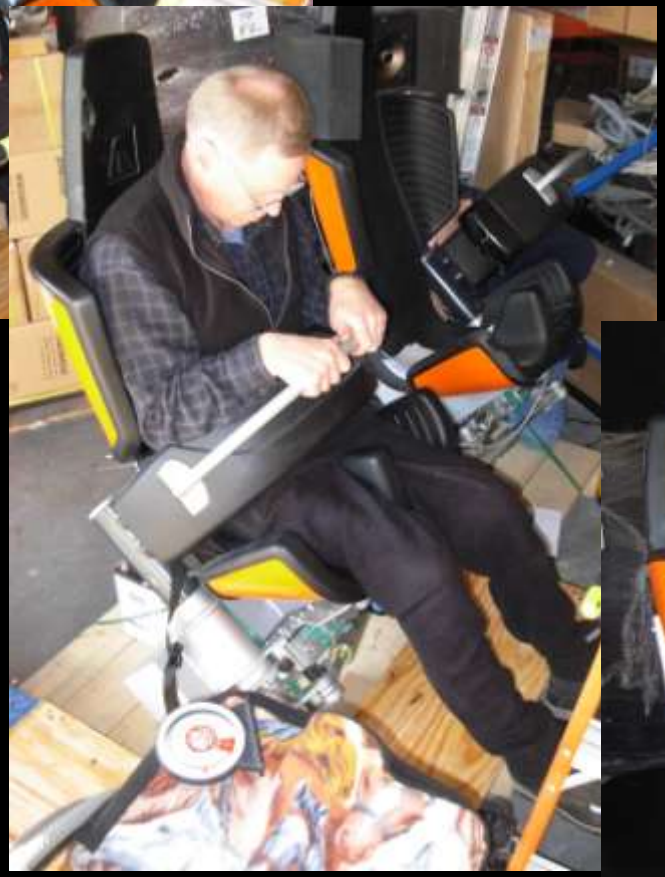

2
3
4
5
6

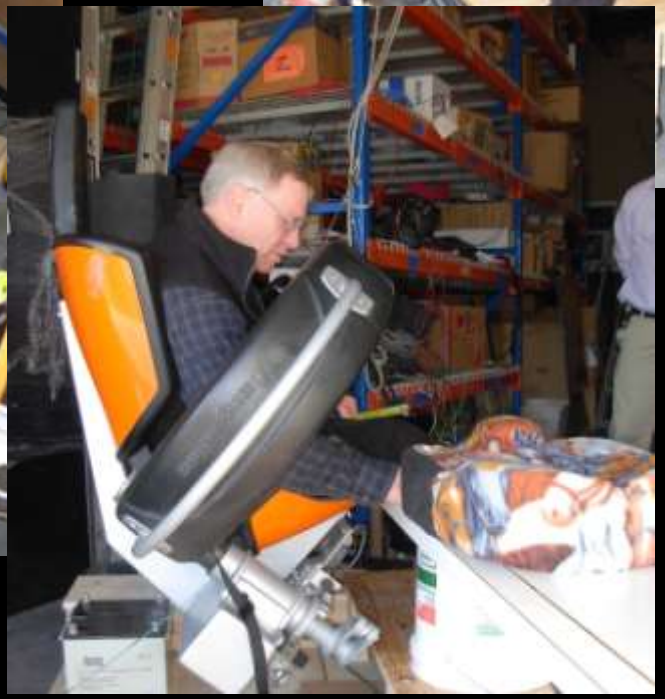

DIR 24


BRIELVLIET
Formule


car N-55
car N-54
car N-54
2013. 12. 23 13:43


2013. 12. 23 13:46






2013. 12. 23


2013. 12. 23 13:18


2013.12.23 13:19


2013.12.28 13:19


TRANSFORMERS
THE RIDE-3D
2013.12.23 13:42

Beneficial Designs, Inc.

Minden, Nevada

www.beneficialdesigns.com
peter@beneficialdesigns.com
775.783.8822 voice
775.783.8823 fax