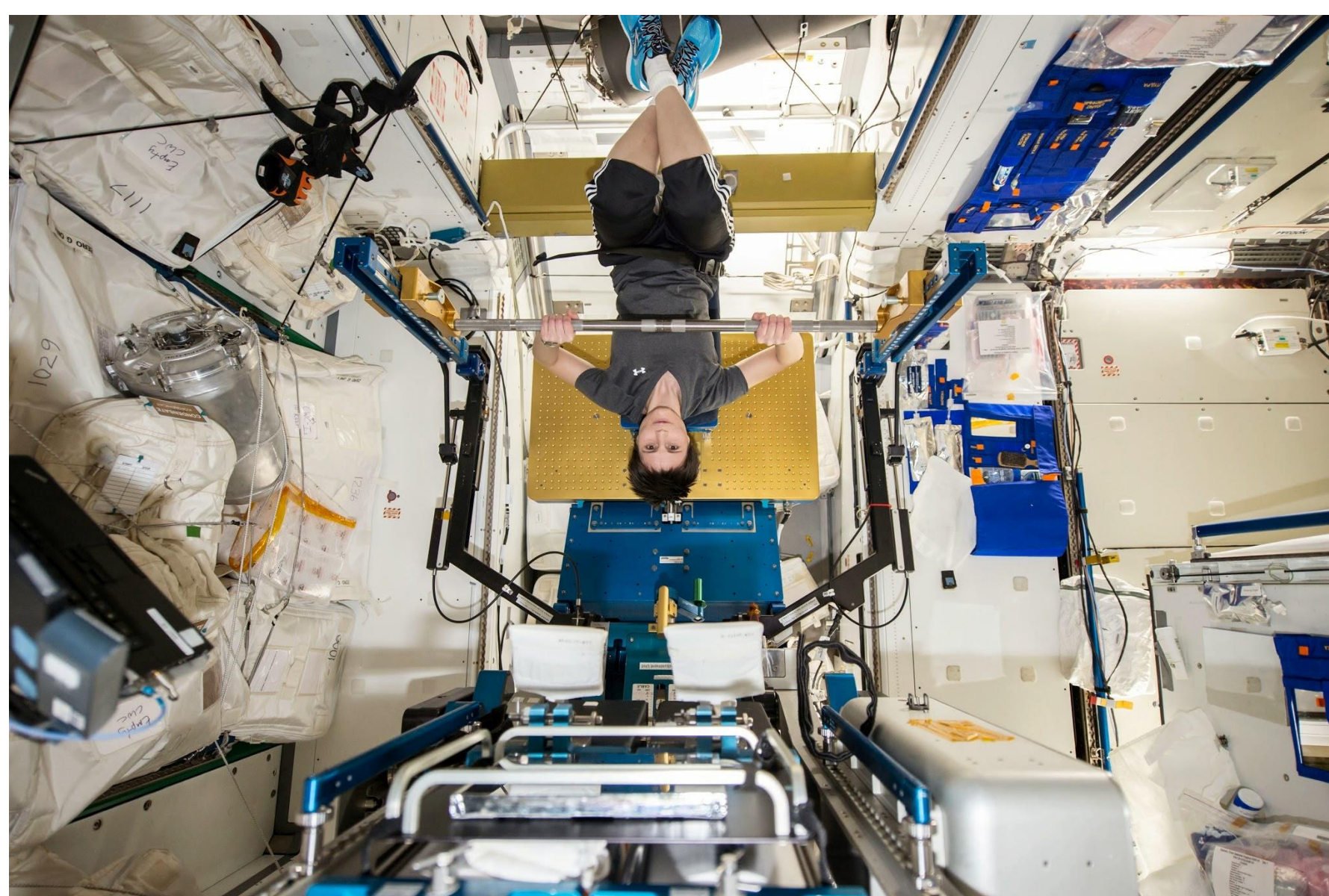


# Clip Brackets for ARED

Glenn Johnson



The Advanced Resistive Exercise Device (ARED) is designed to mitigate the loss of muscle mass, muscular strength, and bone density associated with long-duration exposure to microgravity. It is located in Node 3.

The primary load providing mechanism is the evacuated cylinders which pull against a vacuum to create a constant load. In addition, ARED is equipped with flywheels that can mimic the inertial load of free weights. Using ARED, you can perform exercises with the lift bar or exercise rope. The lift bar provides load from 0-600 pounds and the exercise rope provides load from 0-250 pounds.



# Clip brackets for the ARED

(Advanced Resistive Exercise Device)

ARED is one of several exercise devices on the ISS and is used to keep the astronauts healthy while in the zero-g environment. It can be configured to do squats, bench press, deadlifts, heel raises. ARED has vacuum cylinders that act as the resistive force or the “weight” for the astronaut’s exercises. The lifting arms of the ARED need to be locked down to allow the air to be removed from the vacuum cylinders. When not in use, ARED is folded up so it takes up less space but the main lifting arm is still able to float around some. The crew are currently using Velcro straps to hold the arms in the down position which is ok but the straps wear out from use and have to be replaced. Sometimes the straps float away and get lost. Some astronauts have suggested that some kind of clip or bracket would be better than the Velcro straps.

Problem:

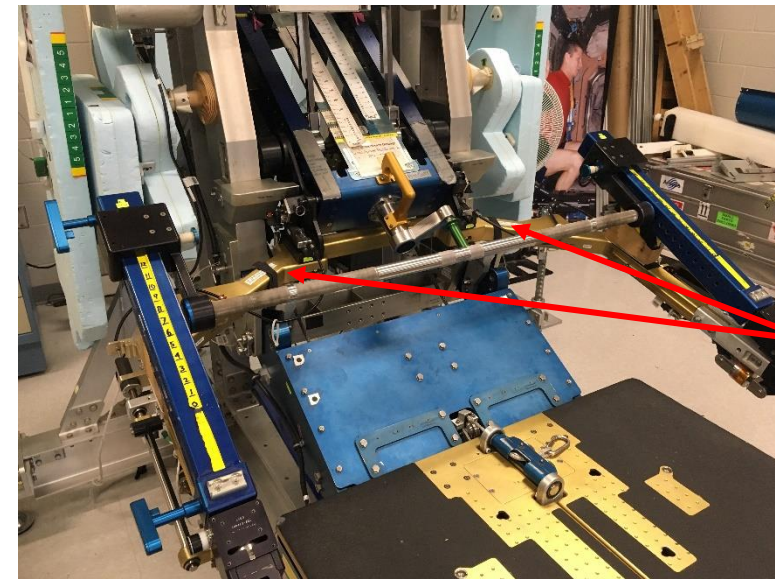
Develop some kind of clip or bracket that opens or rotates out of the way to allow motion of the lifting arms but stays connected and out of the way when the crew is exercising.

Tips:

- Might attach through one of the holes on the side.
- Might clip on like a C clamp between the arm and the support
- Could be 3D printed or metal
- Could be cloth strap but needs to stay attached to ARED so straps don’t float away.



This is ARED being used on the ISS for bench presses.



Location where we need either one or two clips that could hold the arm of the ARED down.

This is the ARED used for training at JSC

# Explaining the operation and need for ARED

Smarter Every Day gives a great tour of ARED with astronauts and engineers explaining how ARED works and why it is so important.

- <https://www.youtube.com/watch?v=05oOst9kZXQ>

Astronaut Mike Hopkins demonstrates ARED in the training room.

- <https://www.youtube.com/watch?v=7oBvNxbTF28>

Scientists and engineers at Glenn Research Center explain some of the research behind the ISS exercise equipment

- <https://www.youtube.com/watch?v=-TU1OkVctaI&t=86s>

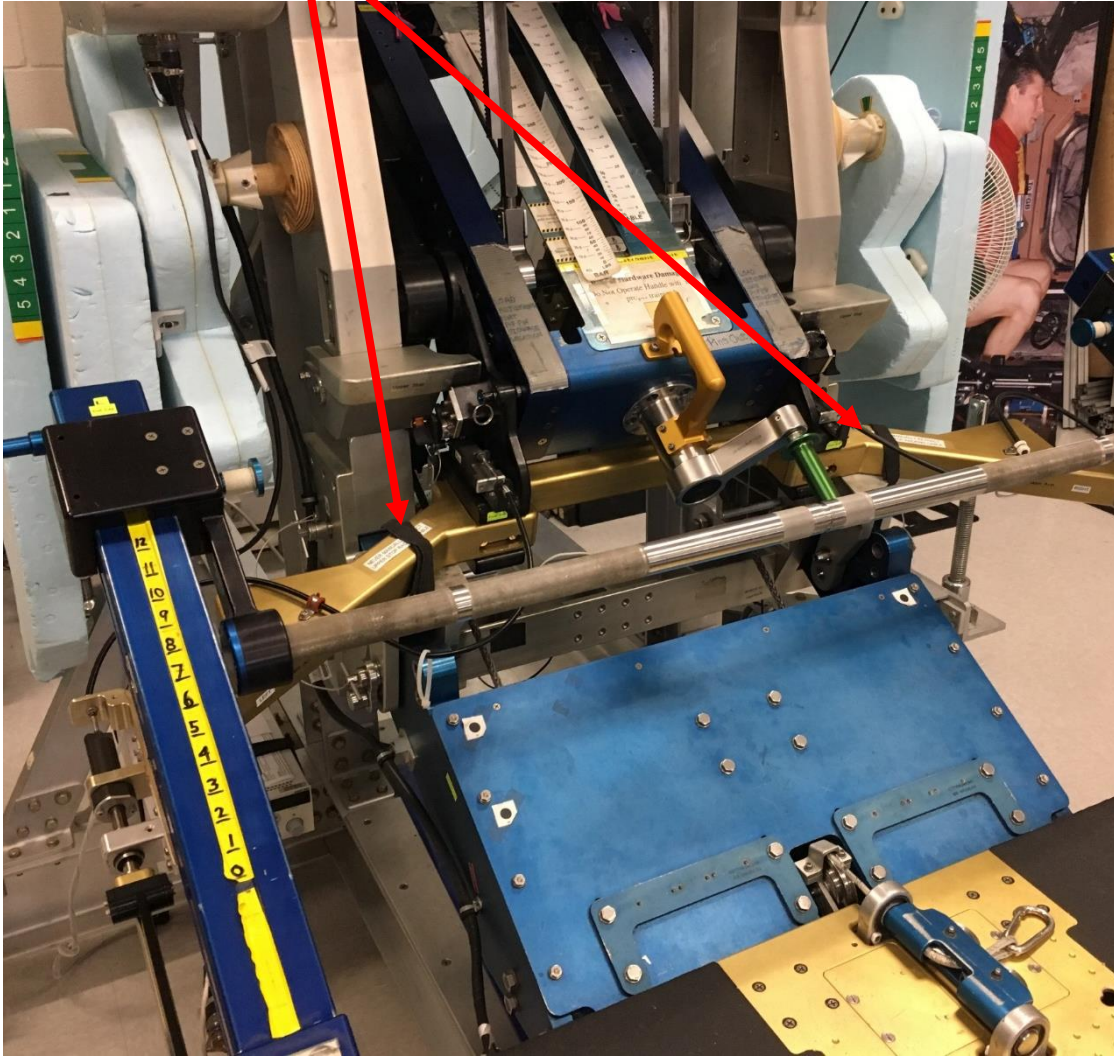
Suni Williams gives a great tour of the ISS and at about 16:54 she shows how she sets up ARED and gives a demonstration. Notice how she unstraps the arms.

- <https://www.youtube.com/watch?v=FXv9AZI3fw4>
- Scott Kelly gives a demonstration of exercising on ARED.
- <https://www.youtube.com/watch?v=YxImeOomkUk>

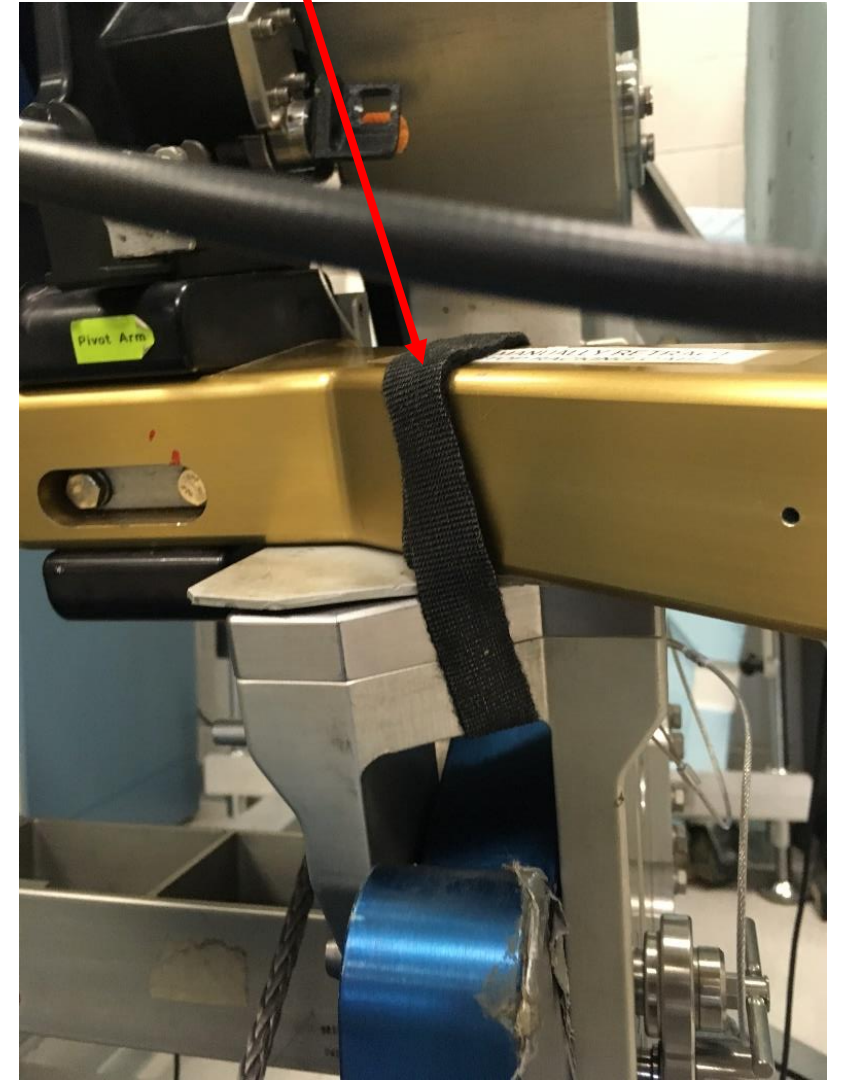


# Current solution with Velcro strap

Velcro straps



Velcro strap right side

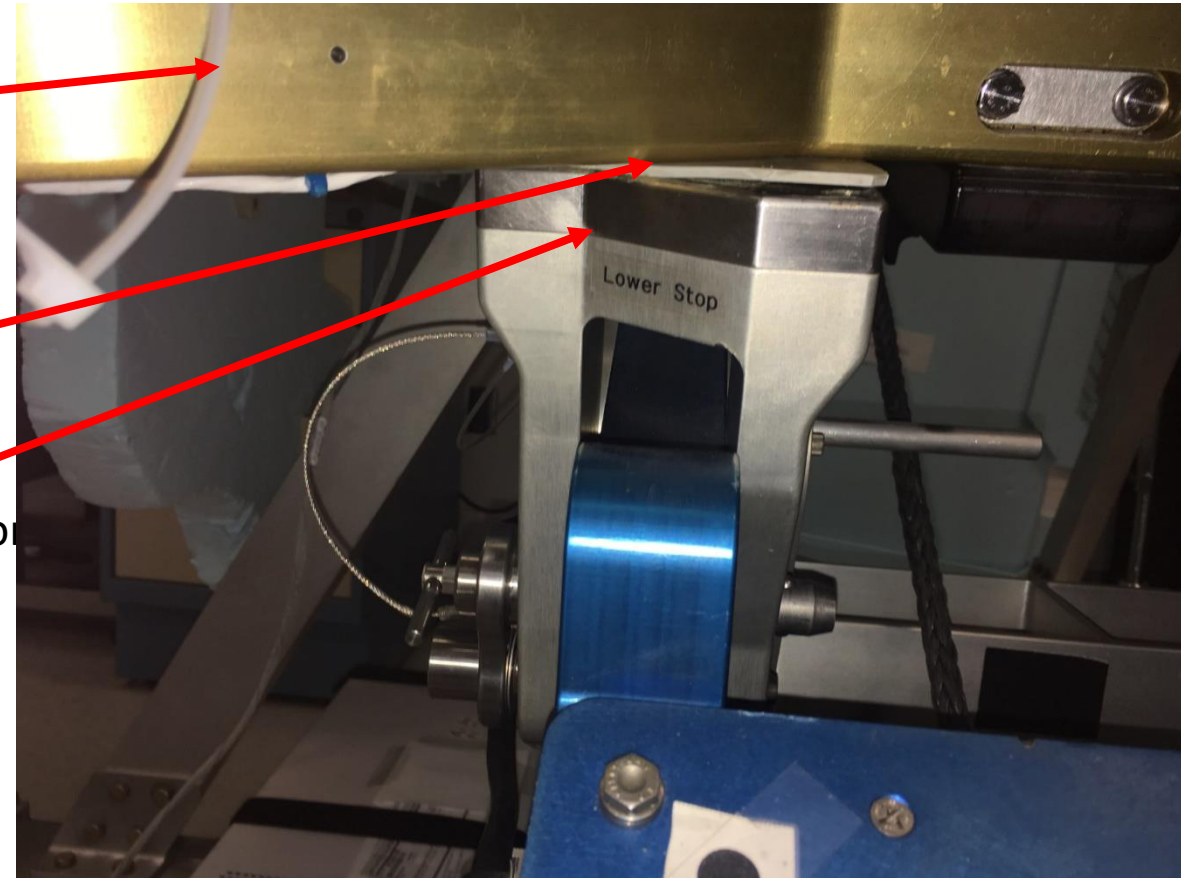




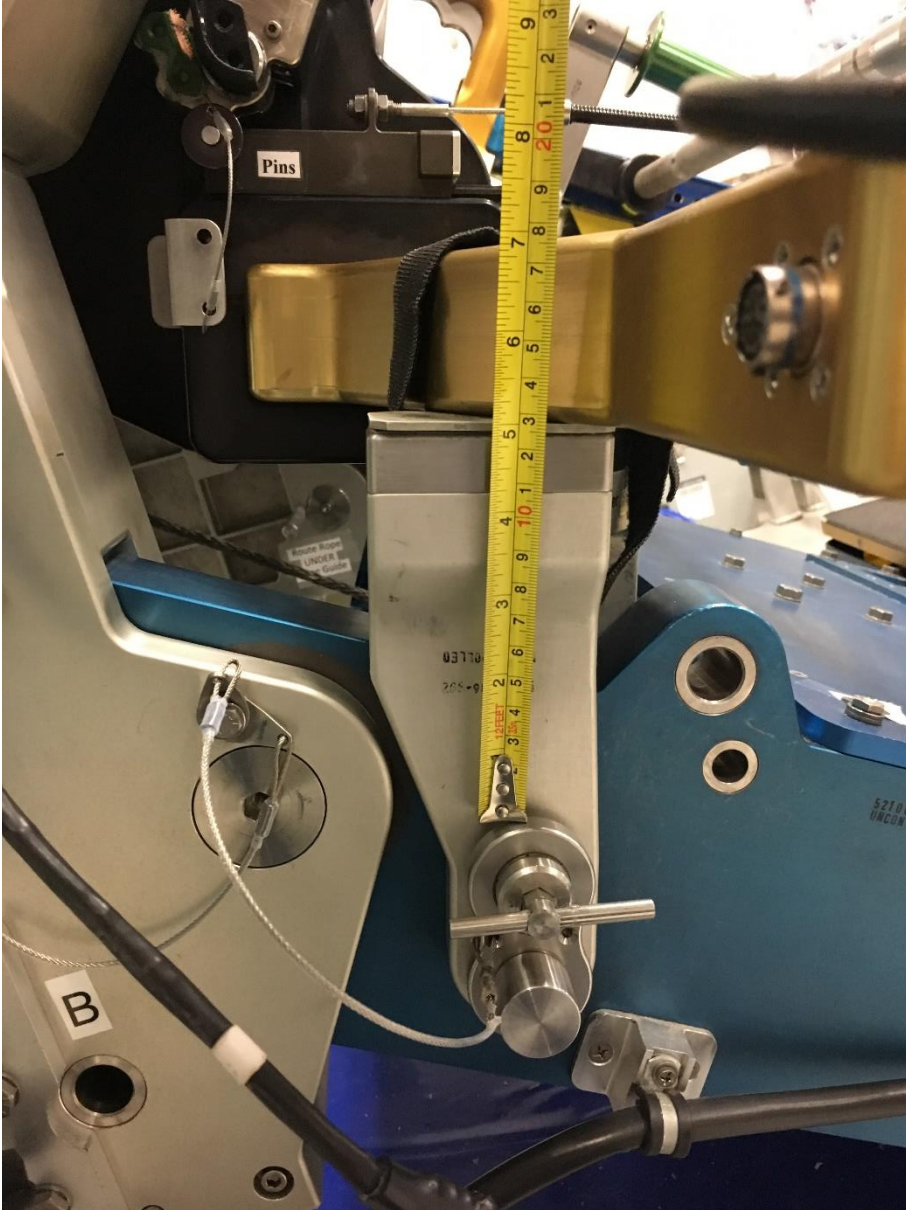


Pictures have been added to help with dimensions. Use the dimensions on the tape measure to help find other dimensions in the same photo. Use the zoom function of the pdf presentation to help you with more accurate measurements. You can also measure some angles right off the picture if they are in the same plane. Don't be afraid to estimate some of your distances. NASA is looking for a good idea and we will develop the final design to have all the correct dimensions.

- Lifting Arm
- Rubber bumper
- Lower stop for Lifting Arm motion
- $\frac{3}{4}$ " hole
- $\frac{1}{2}$ " hole





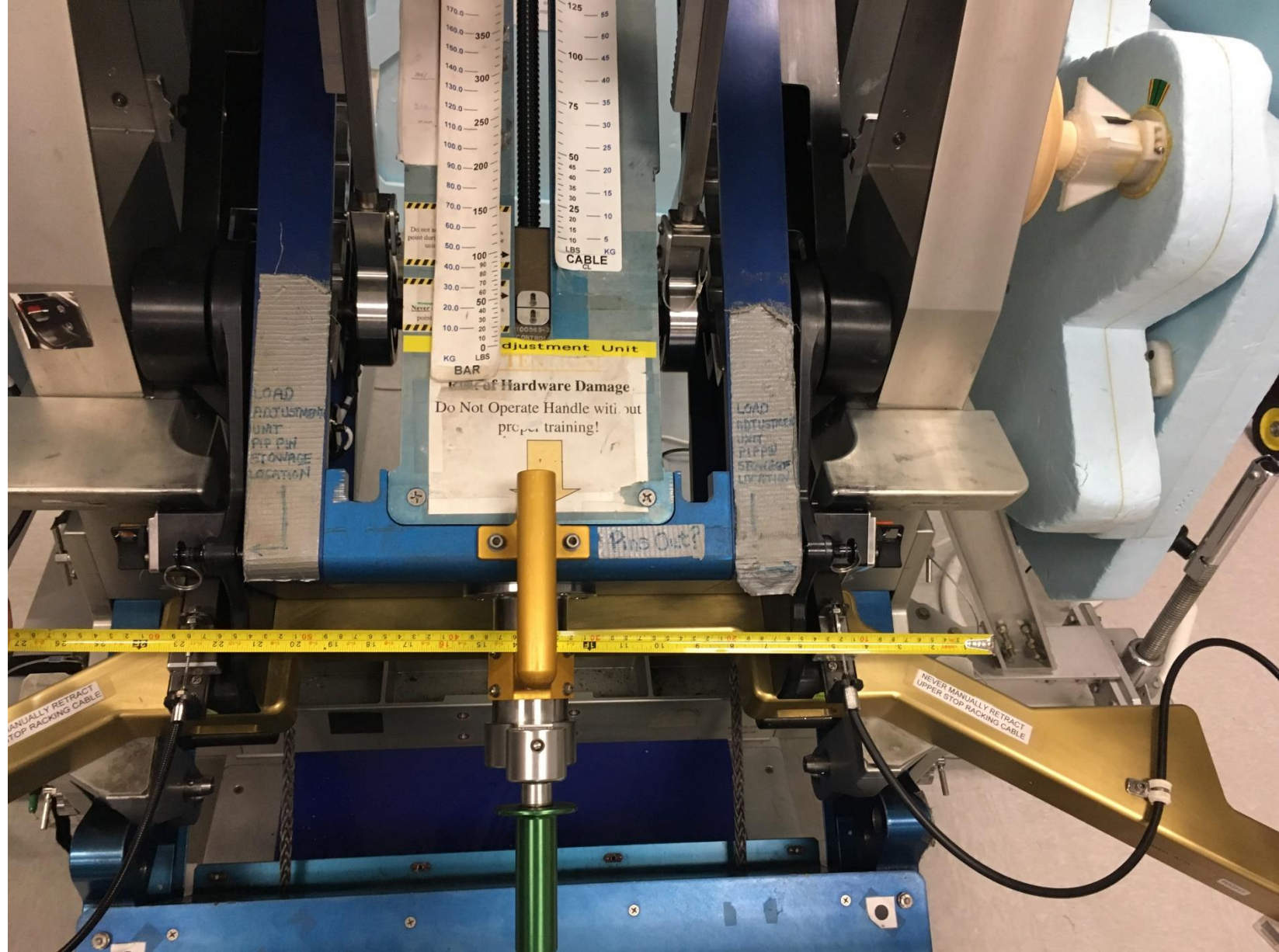
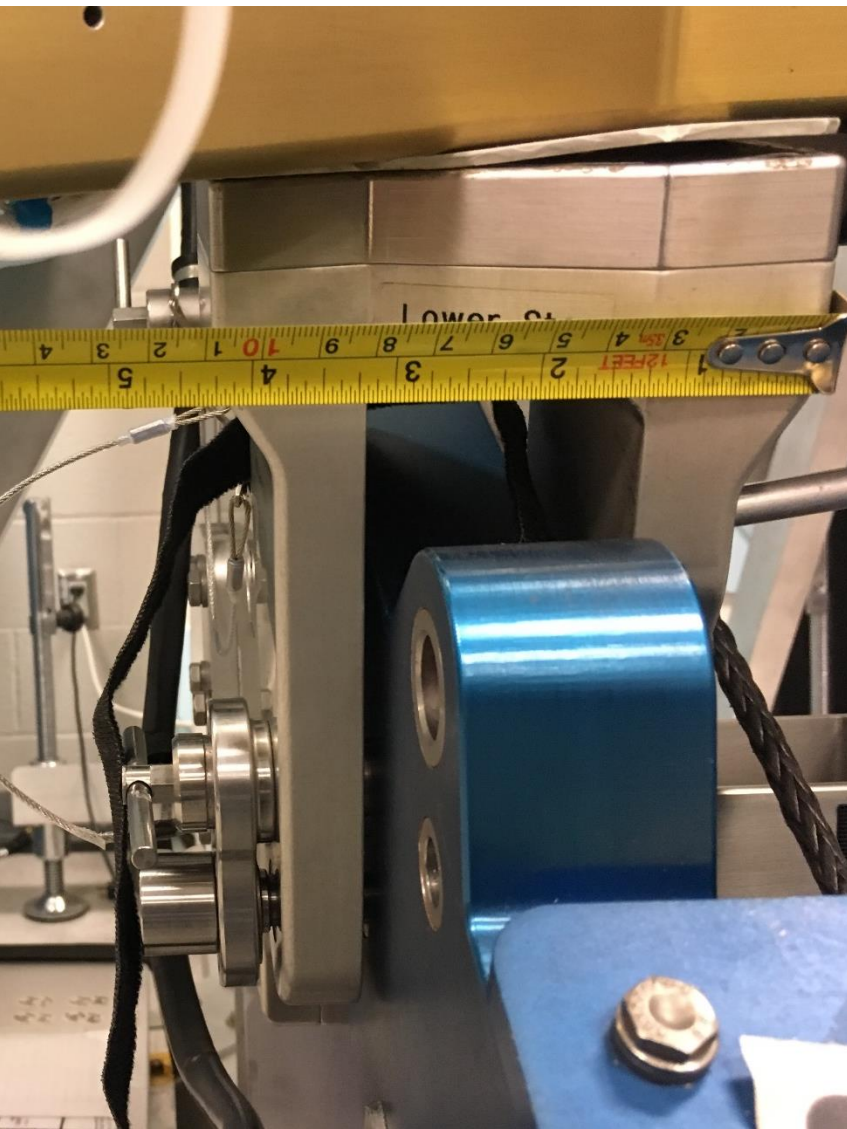


Left Outside view with lifting bar raised about 3 inches. Notice in the Scott Kelly video that the holes stay stationary compared to the lower stop.

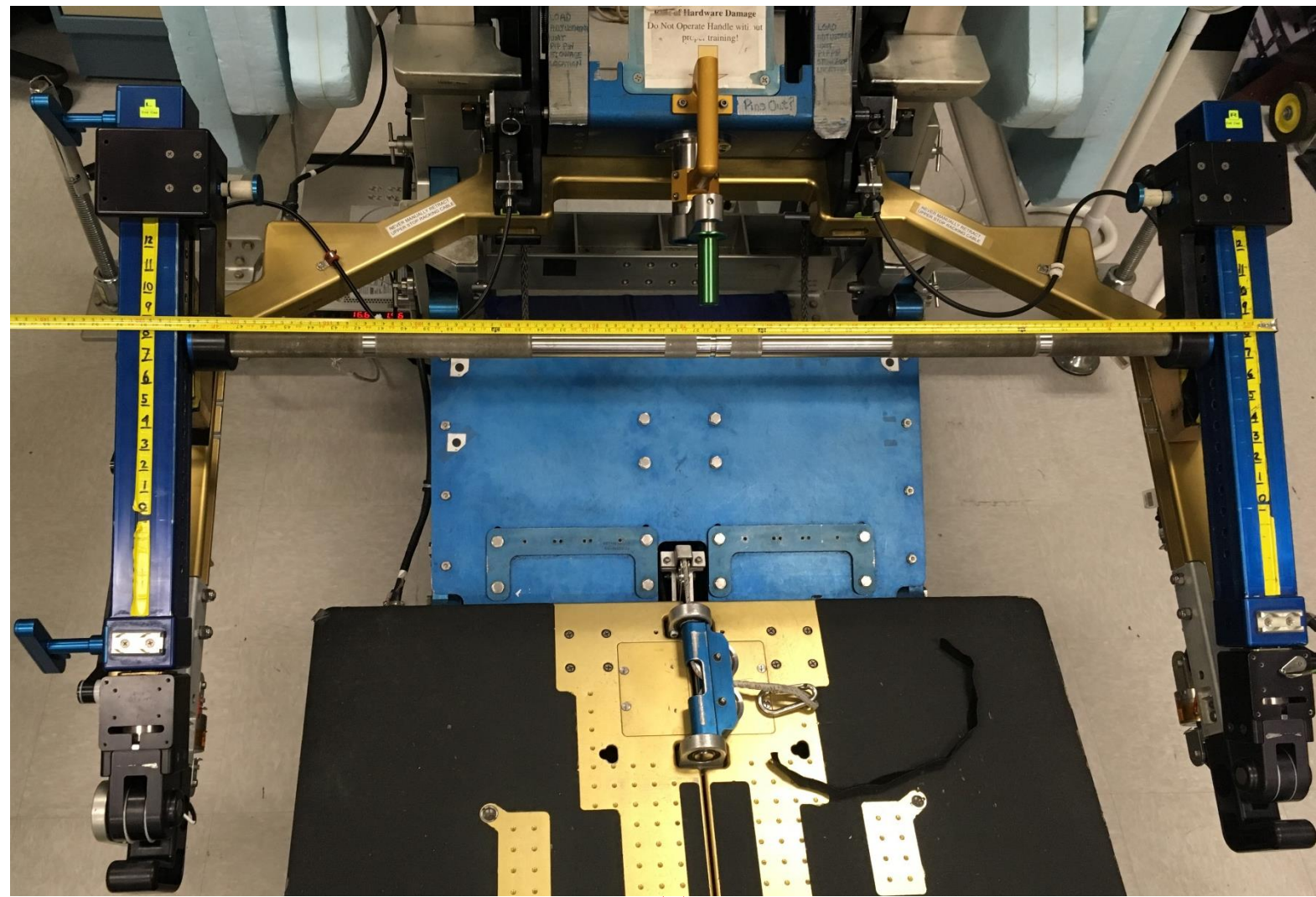
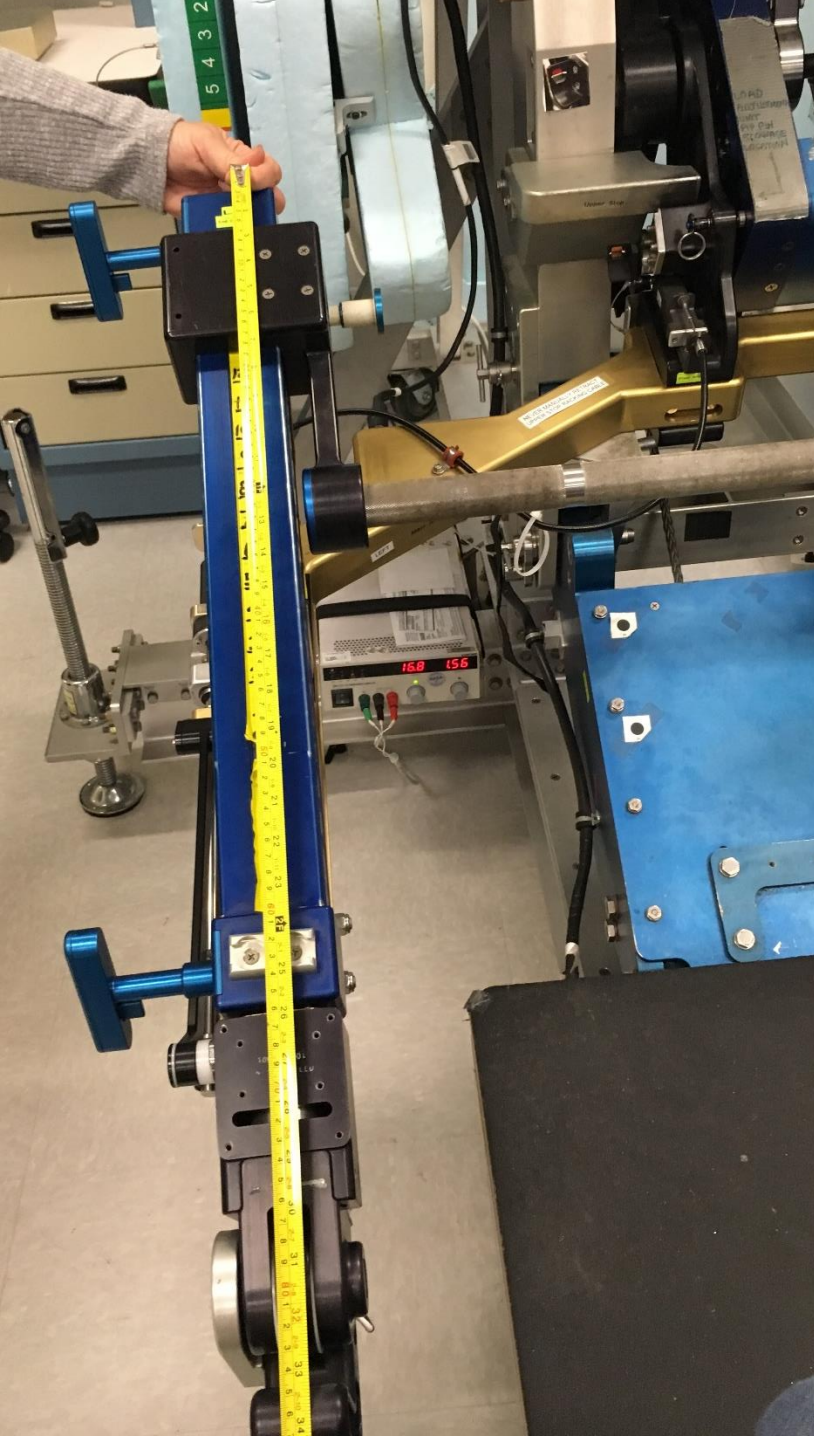


Front view of right side









Each of the divots in the base is 1" apart



# Possible options

- Make a locking lever that would have a pin that snaps into the  $\frac{3}{4}$ " hole and rotates onto and off the Lifting Arm to hold it in place or release it for exercise. Use the  $\frac{1}{2}$ " hole instead?
- Make a clamp that would fit through the same opening the strap is going through.
- Make a strap that is easier to use and won't get lost when not in use.

Part of the problem with Velcro straps is that they get used several times a day and the Velcro wears out in a fairly short time so they have to be replaced.