

# Cover for ARED Cable

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 3F2.

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 0-150 pounds.

#### Cover for the ARED cable

To aid in the positioning of the ARED, there is a cable release that locks the arms in one position and when activated allows them to be in a second position. For some unknown reason, the cable release for the ARED gets damaged and has to be replaced about every year or so. It is believed that it gets bumped by crew as they reach for the computer or maybe by feet as someone passes by—not really understood. Currently it is being replaced at least once per year.

Problem: Make a cover for the cable release that will allow the cable to move but prevent damage from passing feet or unwanted bumps.

- Needs to be at least semi rigid to protect from bumps and kicks.
- Transparent or easy to move for inspection purposes.
- It would be best if it clips into place without having to disassemble the equipment but strong enough not to be kicked off easily





ARED cable damage on ISS

ARED in use on the ISS

Damage to cable that needs to be replaced.

This portion moves forward when cable is pulled

## 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

<u>https://www.youtube.com/watch?v=-TU10kVctal&t=86s</u>

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.
- <u>https://www.youtube.com/watch?v=YxImeOomkUk</u>



This is a picture of the ARED used for training at Johnson Space Center. The training hardware does not get as much use as the one on orbit but it does not seem to have the same problem.

This is the location for the cable covers needed

#### Replacement Cable

This is the replacement cable that is flown up when the ones on orbit are damaged. Both cables get replaced but the one on the right side of ARED seems to get damaged more often.



### Names and dimensions



### Motion of cable



Sleeve = .5" Black cable



- Because both cables have been replaced a number of times, the crew is now required to inspect both on a regular basis. If the covers you design are made of a transparent plastic, the inspection is easier (on orbit it would be a polycarbonate but you could make yours from acrylic if needed to show your idea). If you choose to make it out of a non transparent material, it needs to have quick access so it is easy to see the state of the cable.
- NASA will need 2 covers, one for each cable on ARED and 4 more will be needed for the training units on the ground.