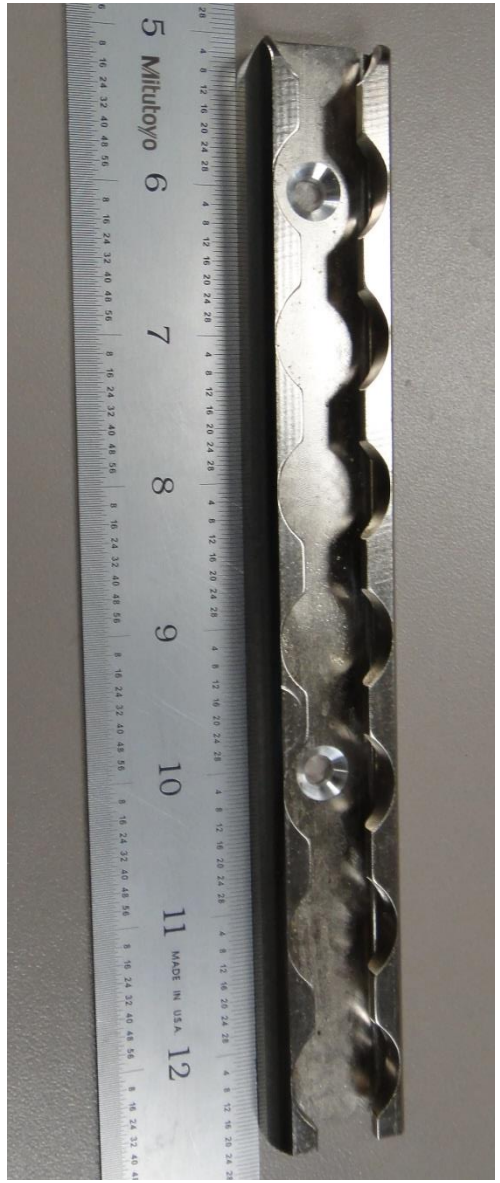
Restraint and Mobility Aids for the ISS

This is a description of some of the equipement used for restraining equipment on the station. This is not a complete list but is only to serve as a representation of some of the varieties of methods used.

Seat track

- Seat track is an aluminum channel developed by Boeing for placing seats in an airplane. Seat track is bolted down in rows on the floor of the airplane. Seats are then attached to the seat track with a seat track foot that fits into the channel and slides between the dots. The airline can then increase or decrease the spacing between seats by shifting the seats in the seat track one inch at a time if desired.
- The inside of the Space Station is composed of many replaceable and interchangeable racks that are about the size of a large refrigerator. Each of these refrigerators are locked into place and form the walls you see in the Space Station. Each of the racks has seat track on the vertical sides of the rack facing the crew. This provides lots of places the crew can place handrails or computers or cameras. Although lots of things can be placed on the wall with Velcro, there are other times the crew needs something attached to the wall and can handle getting bumped or kicked without moving or floating away.
- This is one of many companies that provides seat track and various attachment mechanisms for seat track. There are several others.

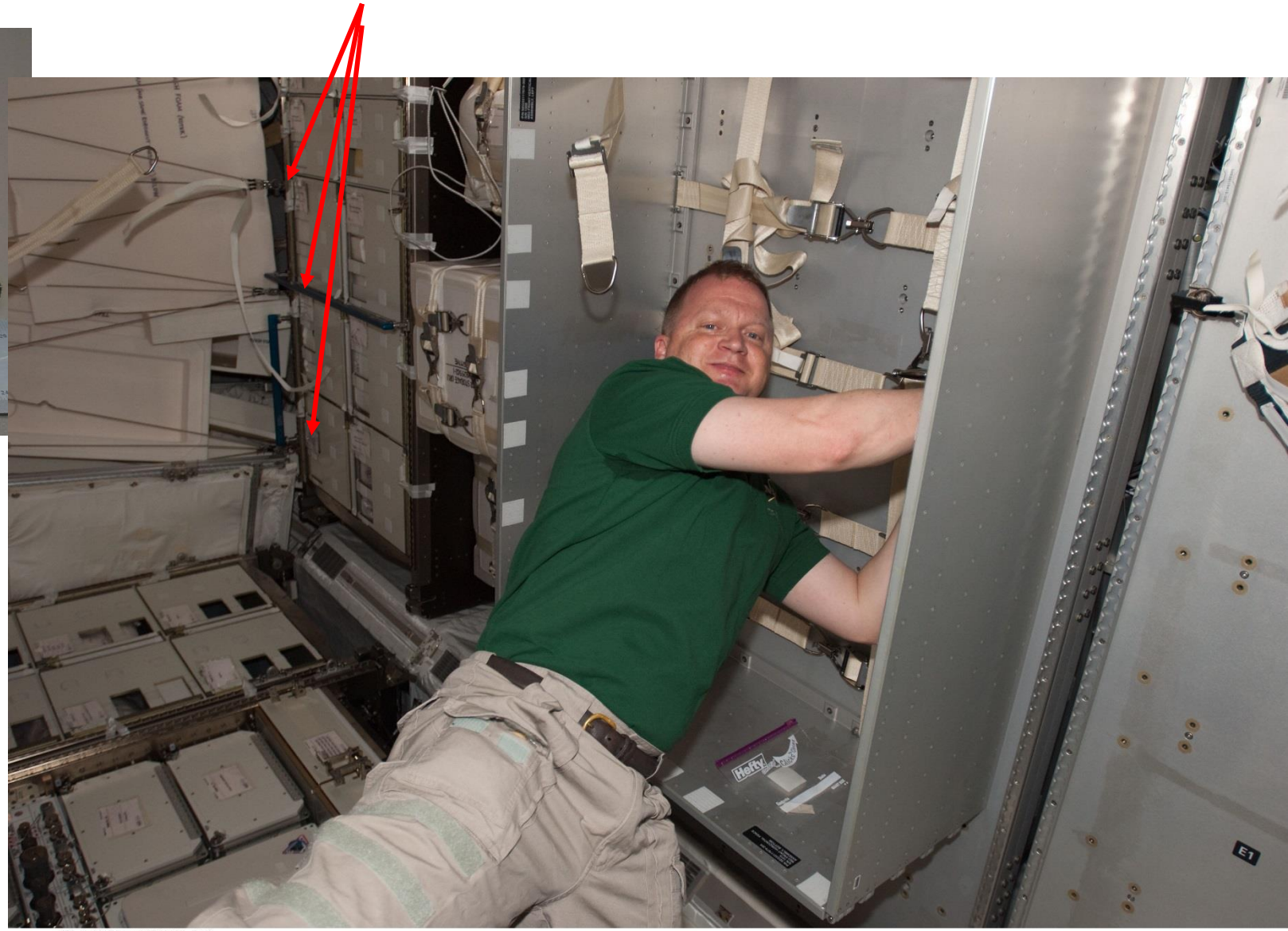
http://www.uscargocontrol.com/Ratchet-Straps-Tie-Downs/Aircraft-Style-Seat-L-Track



Seat track stud ring

Spring loaded with a ring for clipping bungees or other equipment to.

Seat track stud rings being used for making a bungee web



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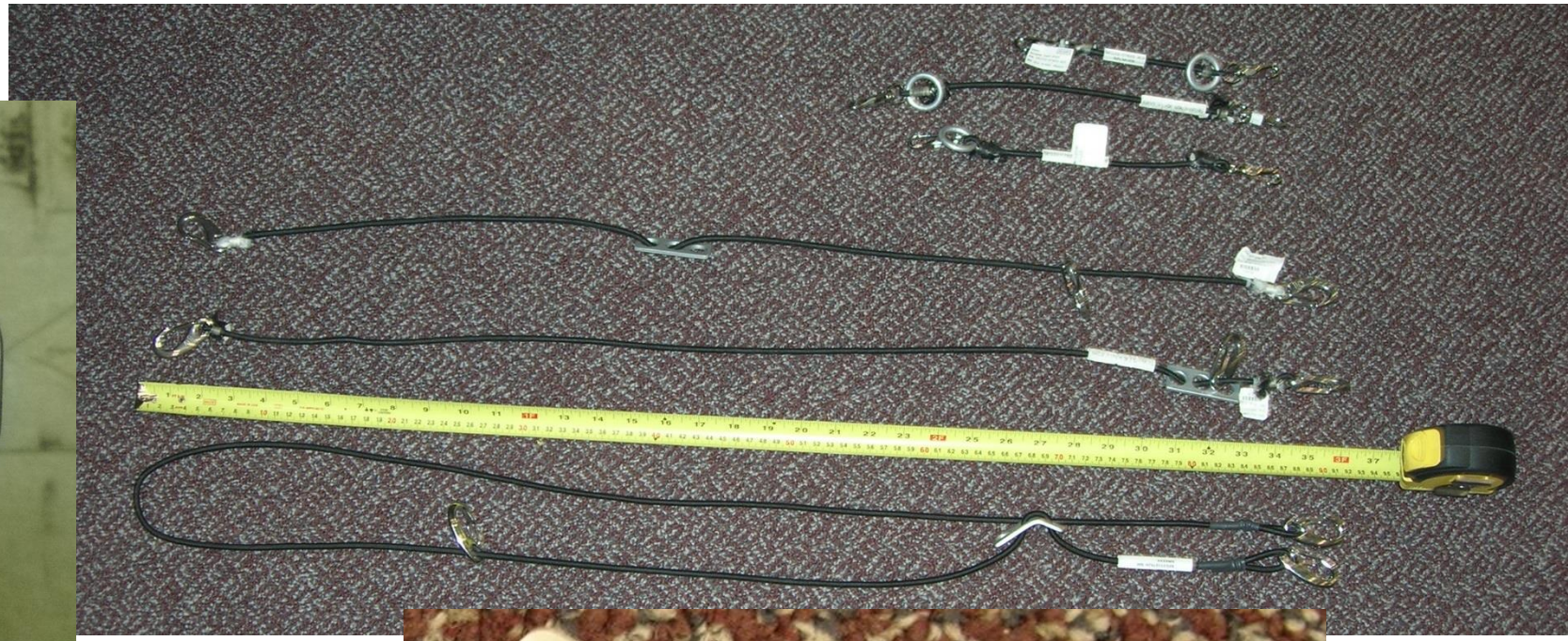
Bungees

Russian style Bungees have a fuzzy surface that is Velcro compatible with Velcro.

US style bungees have adjustable lengths by a slide mechanism in the middle.



Bungees range in color depending on when the material is purchased and when they are built.

Russian bungees on the old galley table

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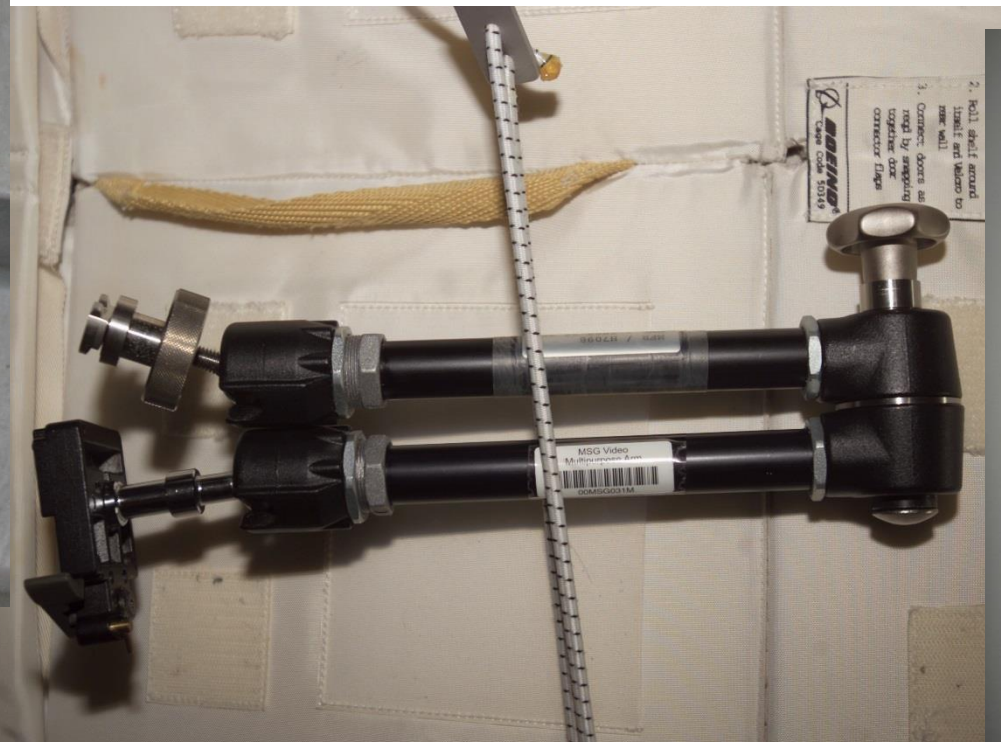
Multi-Use Bracket (MUB) aka Bogan Arm

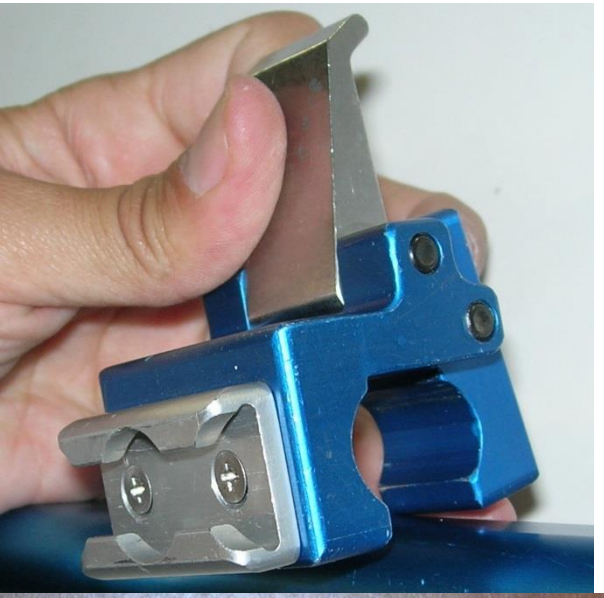
Multi Use Brackets are a commercial product that have been modified to have NASA style ends. They have a seat track foot on one side and a camera shoe on the other. When the central handle is loosened the two ball ends and the center joint loosen and the arm is floppy and can be positioned as desired. Once the center handle is tightened, the joint and ball ends lock in the current position and are difficult to move. These are used to hold cameras, power supplies, computers, experiments…they are lots of places.



IP Clamp

An IP Clamp (International Partners Clamp) is a commercial camera device that has been modified by NASA by placing a seat track button on one side. They are very good for clamping onto a square rail like that of a Russian style handrail. This allows crew to place seat track in places they don't normally have it.

Handrail Clamp



Handrail clamp holding a Multiuse bracket holding a video camera

Handrail Clamps allow the crew to place a piece of seat track in the middle of a handrail no matter its location in the module. This can help them place a camera or computer or small experiment exactly where they want it. These are designed to fit snugly on the curvature of the US handrails.

Handrails

Handrails are used for helping the crew with their mobility around the station as well as keeping them stationary when desired. Crew often hold themselves in place using their feet to hook into the handrails. Handrails come in 3 different lengths—8.5”, 21.5” and 41.5” where the measurement is from the center of one seat track foot to the center of the other seat track foot. The larger one can either be placed going up and down the rack or across the front of the rack horizontally. There are two types of US style handrail. The original type of handrail can be attached or removed with one hand. The newer version requires two hands but was much less expensive to produce due to the fewer number of moving parts.

Old style—easy to use

new style—cheaper to build

Flex Bracket

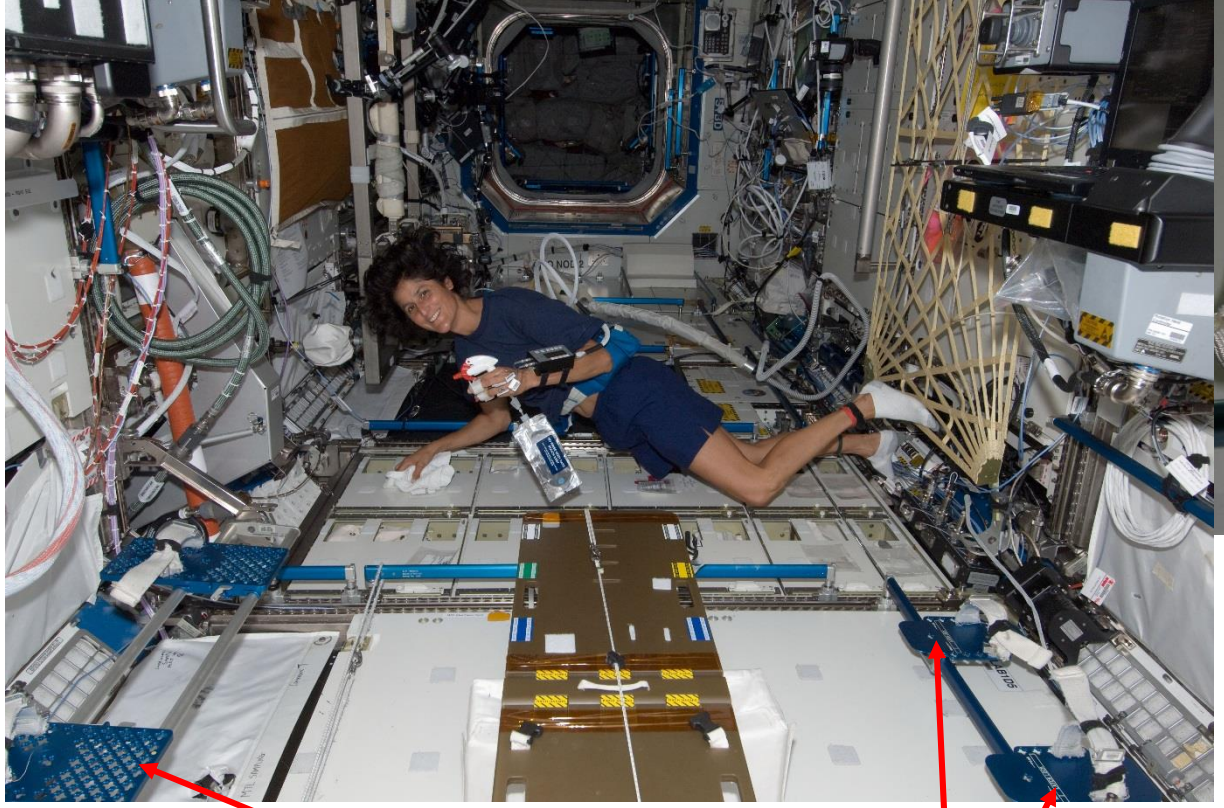
Flex Brackets are composed of several small sections that are able to rotate on each other and stay in the position they were left in. They have a NASA camera shoe on one side and a seat track foot on the other. The plastic segments are made of Lock Line which is commonly used in machine shops to direct the cutting and cooling fluid for various machines. These are not intended to hold equipment rigidly but are often used for lights or other equipment that is in a temporary position.

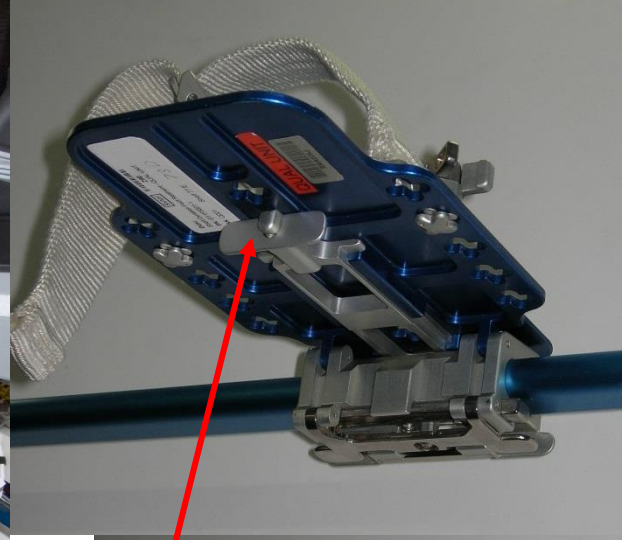
Camera shoe

Flex bracket holding a work light

Short Duration Foot Restraint

The Short Duration Foot Restraint latches onto the handrail and can be locked into either a horizontal position on the handrail or a vertical position. The positioning is controlled by the slide lock on the underside of the foot plate. The foot strap can be on any of the 11 "+" positions on the foot plate. This allows crew to use it as a small holding plate for experiments occasionally.





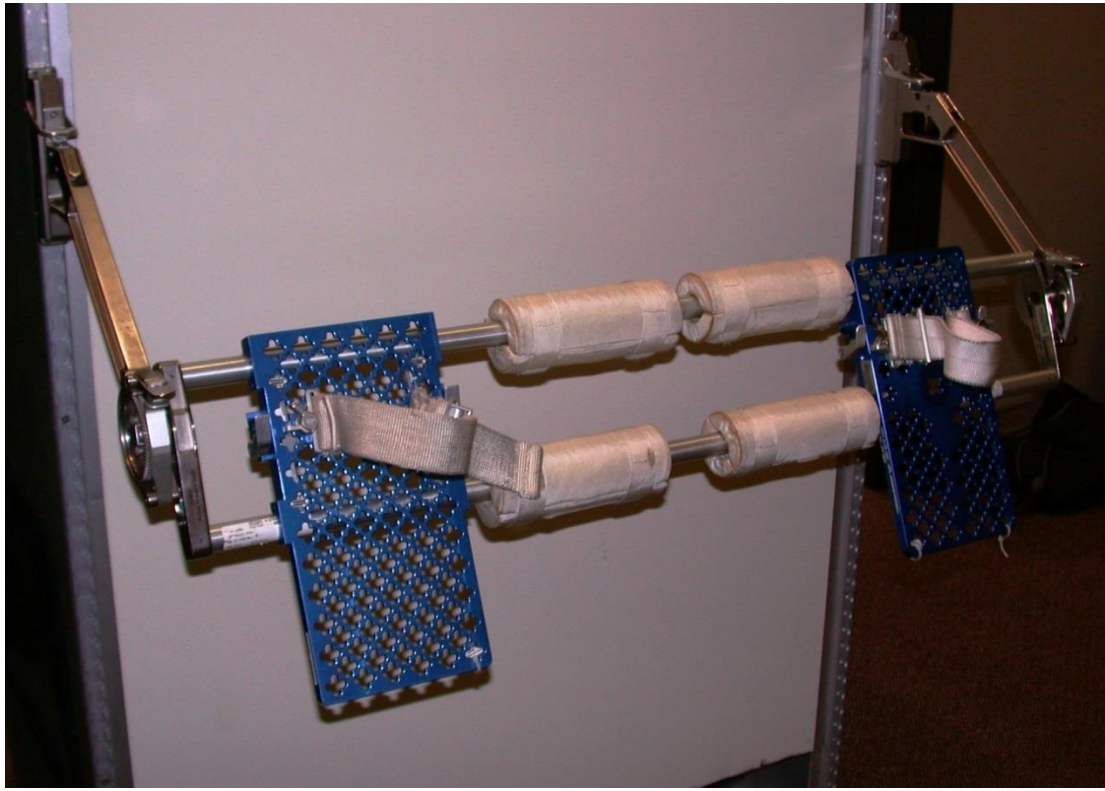
long duration foot restraint

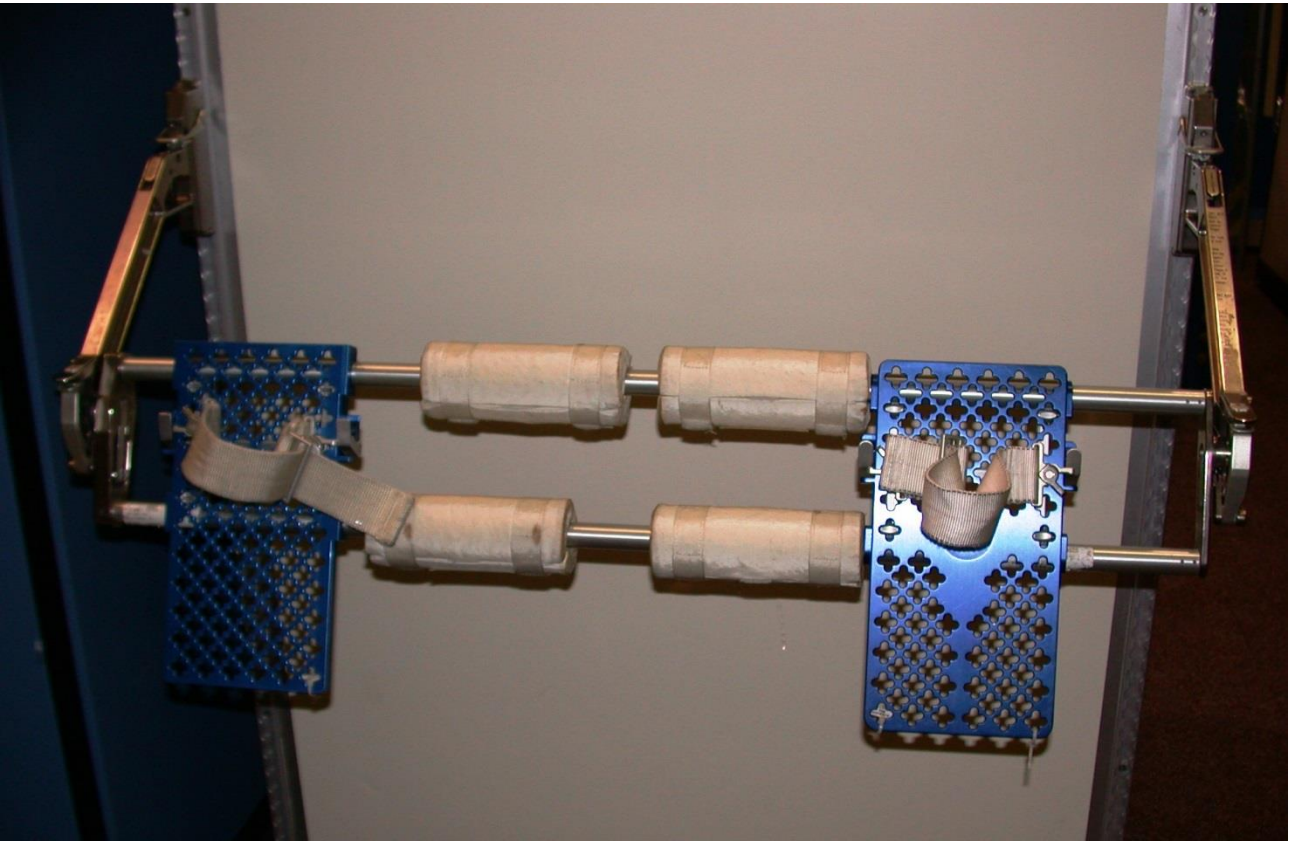
Short duration foot restraint

Slide lock for horizontal or vertical position

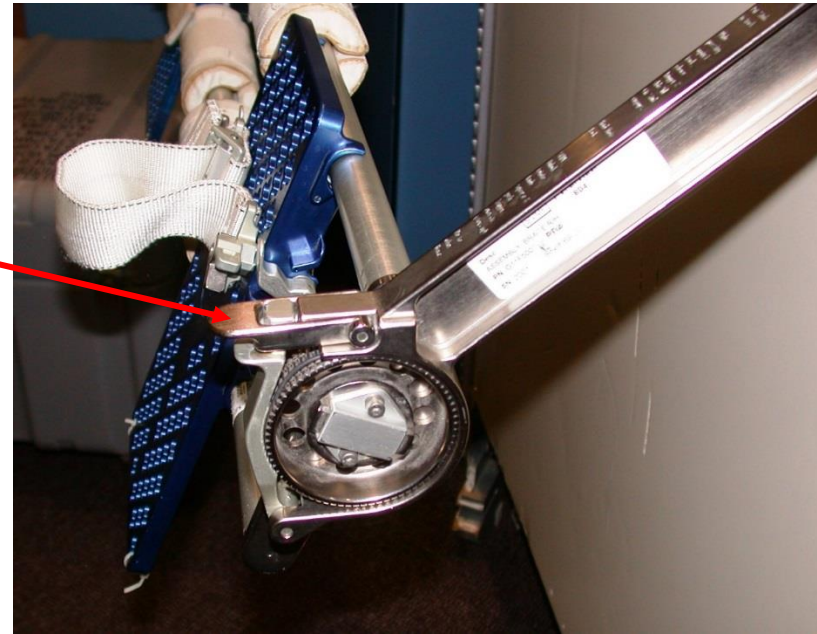
Long Duration Foot Restraint

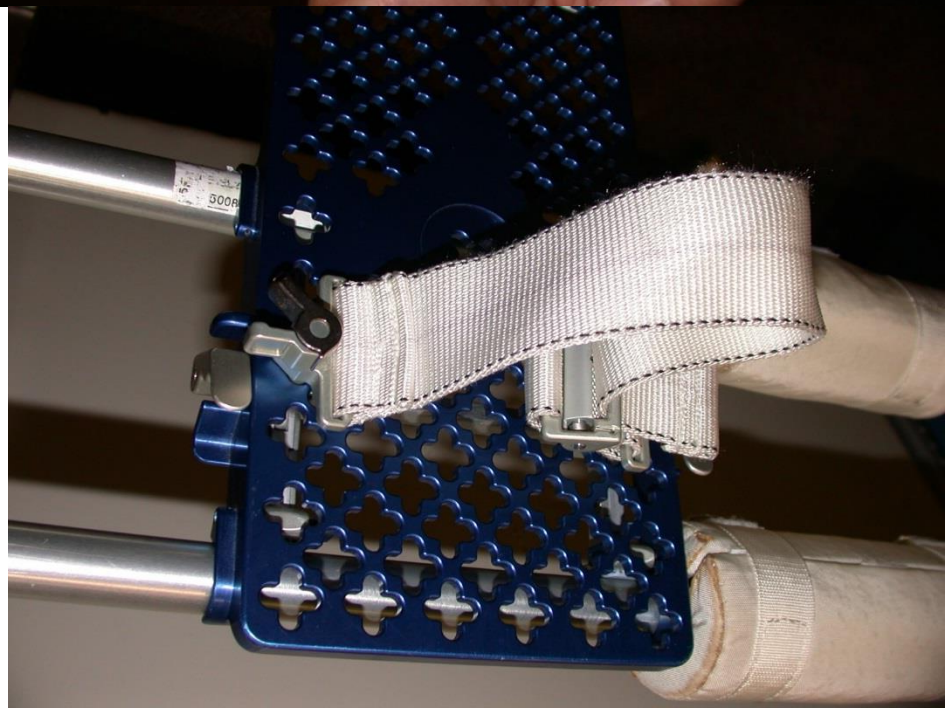
The Long Duration Foot Restraint fits across the front of a rack and is designed to provide a more adjustable and comfortable positioning for crew to be able to work for longer periods of time. It can be placed at any height on the seat track on the face of a rack. The foot plates clip onto the double bars at any distance apart. The double bars are able to rotate and provide multiple angles for a person's stance. Instructions for installation are written on the bars.





Lock mechanism for the rotation of the double bars





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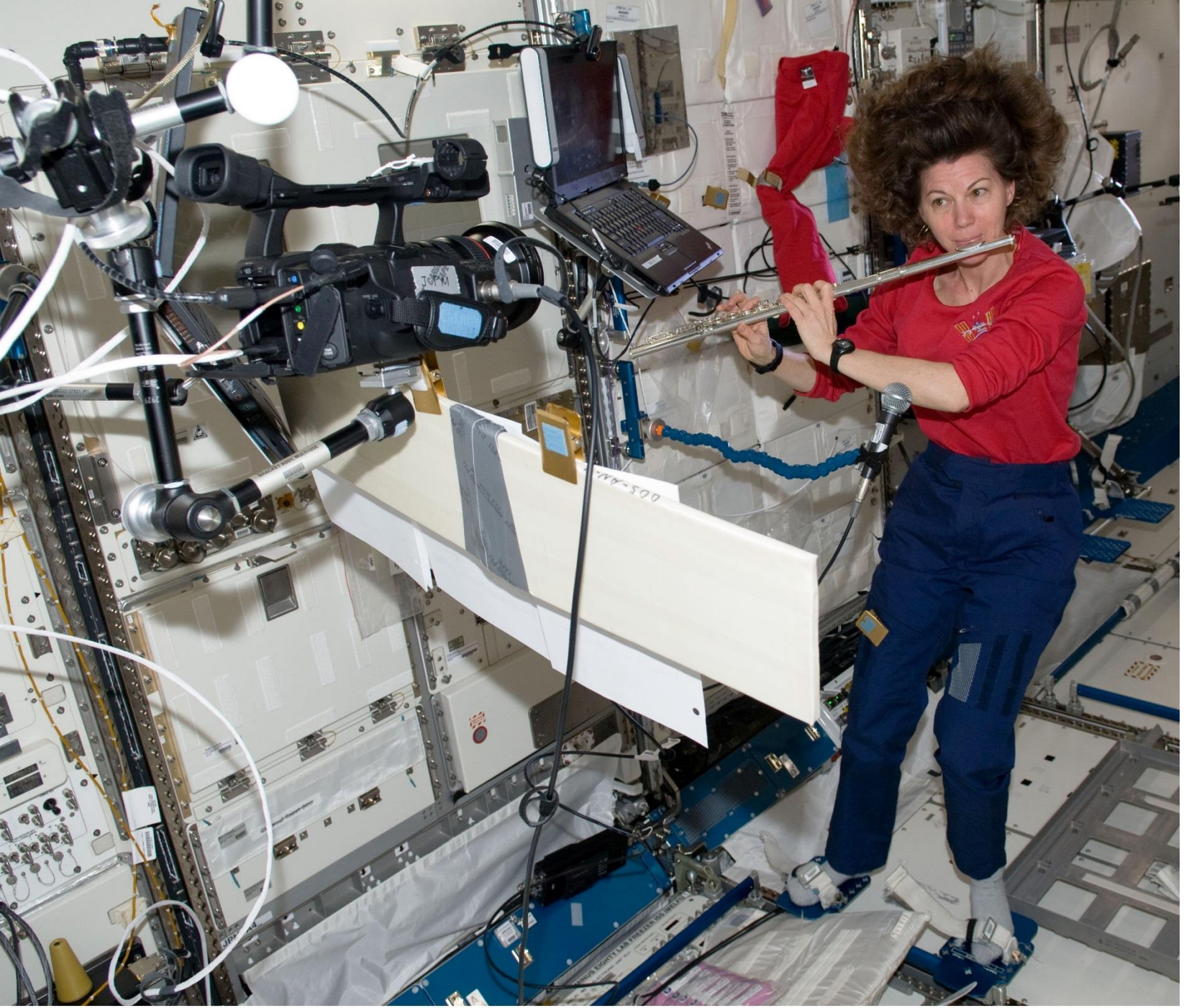

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- Can you identify all the different restraint devices in this picture? I count 8.