INDUSTRIAL AUTOMATION

R2 SERIES OPERATORS MANUAL

Parts Section

Model R2-X2 eXperimental Model

Cover artwork by John Jongsma

Industrial Automation would like to thank you for purchasing your new R2 Series Astromech droid. The R2 Astromech series droids are made to provide you with a hard working and devoted mechanic and assistant. This manual contains technical drawings and construction images that will help you maintain your new droid so that it will provide you with years of technical assistance on the surface of planets and during voyages in space. A copy of this manual is also stored in your droids memory banks and can be displayed via holographic projection at any time by commanding your droid. However, should you need additional technical assistance with your astromech droid Industrial Automation has many service facilities throughout the galaxy. We provide a full range of service options to keep you droid running in top condition. Please transmit your message on the following frequency and we will be happy to assist you with droid maintenance or repair (Freq. 3.1415.92). We will even come and pick up your droid for service if you are unable to get to one of our facilities. Industrial Automation is dedicated to providing citizens of the Republic with outstanding droid servants and droid maintenance.

Droid Component Parts

This section of the manual describes your droid's basic parts and assemblies and explains their function. Depending on how you ordered your droid from the Industrial Automation factory the parts in this section may be manufactured from a wide variety of materials. Two of the most often used are either CNC machined T6-6061 aluminum or a high impact polymer material. However, other materials have been used in the construction of droid parts such as fiberglass, styrene and wood.

Dome:

The Dome of your astromech droid is an R&J metal spun and laser cut aluminum dome. The dome provides a strong, light protected area for the droid's AI logic unit housed inside. The stock R&J dome is a double layer aluminum dome. The inner dome is a solid aluminum shell that adds additional structural support to the outer dome as well as a mounting surface for all of the droid's internal dome mechanisms. The outer dome has access panels for the internal dome mechanisms that extend out from inside. The dome also functions as part of the droids navigation system using its radar eye and holo-projectors to move without colliding with surrounding obstacles. The dome houses a number of tools the droid used to perform its daily functions. The following Figures show various angles of the stock R&J aluminum dome.

Figure 1: R&J Solid inner aluminum dome

Figure 2: R&J outer dome view 1

Figure 3: R&J outer dome view 2

Figure 4: R&J outer dome view 3

Dome Ring:

The dome ring is the base upon which the dome rests. The dome ring provides structural integrity to the dome and it provides the mounting points for the dome to mate with the body frame. The dome ring in turn rests on the Rockler Dome bearing which provide the rotation capability.

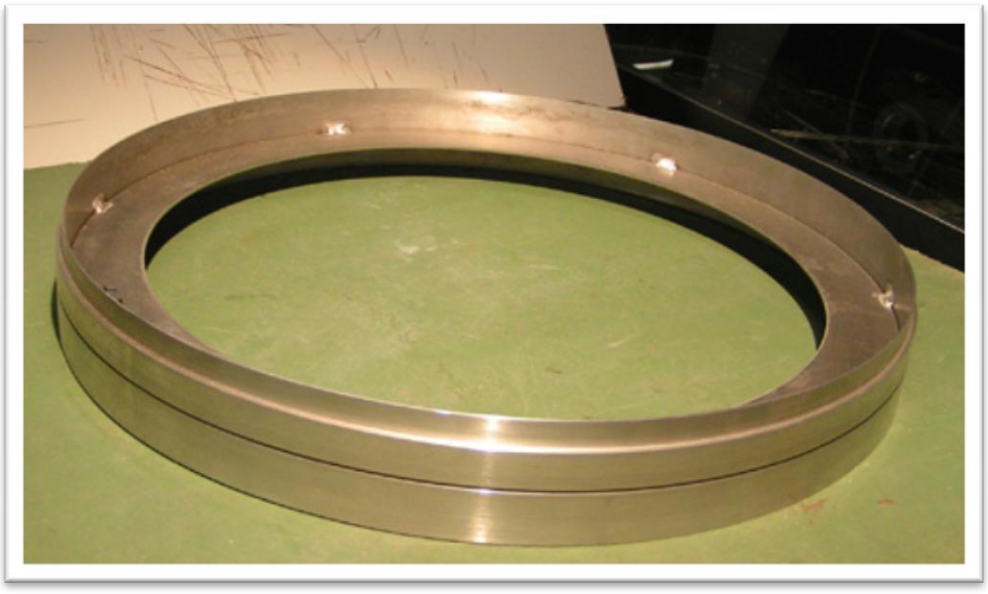

Figure 5: Dome Ring

Rockler Republic Bearings - Dome Bearing:

The dome bearing provides the dome with the ability to rotate. It is an aluminum casing with stainless steel ball bearing inside. The dome bearing is manufactured by Rockler Republic Bearings and is an exchangeable assembly with other droids.

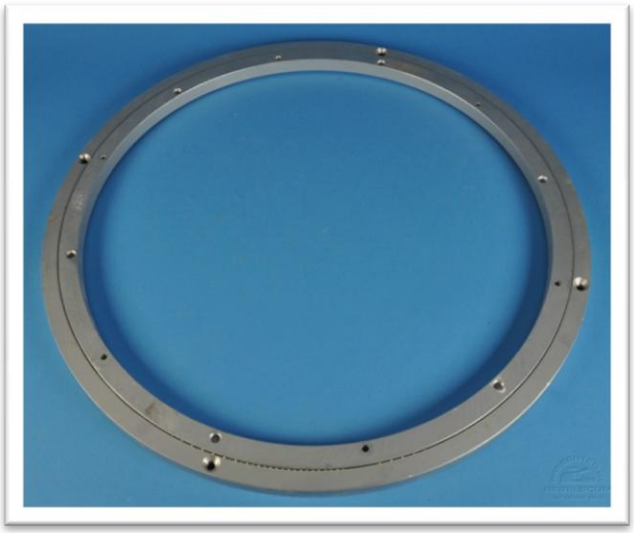

Figure 6: Rockler Republic Bearings 18” dome bearing **- Photo by: Philip Wise**

Holo-Projectors:

Your astromech droid is equipped with 3 aluminum holo-projectors mounted in the dome. The holo-projectors make up part of the droids visual acuity system but also includes an audio visual presentation system. The holo-projectors are capable of displaying 3D holographic images and motion video of the information contained in its memory banks. When not displaying images the holo-projectors are also part of the droids vision system. The 3 holo-projectors on the dome provide the droid with a 360 by 180 degree view of its surroundings. The holo-projectors are also capable of independent movement on their gimbal mounts. This independent movement allows the droid to fine tune its field of view without rotating its dome.

Figure 7: Stock aluminum holo-projectors

Figure 8: Holo-projector disassembled

Radar Eye:

The radar eye housing is a CNC machined T6-6061 aluminum part that covers the radar distance sensing mechanism. The radar eye itself is part of the droid's vision system. The radar eye provides precise distance information to the droids AI unit for

calculating the movement of the mechanical gripper and utility arms as well as its other manipulation devices.

Figure 9: Radar eye **– Photo by: David Shaw**

Radar Eye Lenses:

The radar eye lens is made from a polarized polycarbonate lens material that can have its degree of transparency changed by the droids AI system. If the droid is working on a planet with a large yellow star or multiple stars the droid will alter the radar lens transparency to filter out most of the light. For low light conditions in deep space the droid will change the lens to clear to allow all available light to pass through to the internal sensor.

Figure 10: Radar eye lenses **– Photo by: Azman**

Front Logics and Surrounds:

The front logic surrounds are a CNC machined T6-6061 aluminum surround that houses the front logic electronics and provides some protection of the logic units from debris or other flying objects. Many droids also use a high impact resin based logic surround.

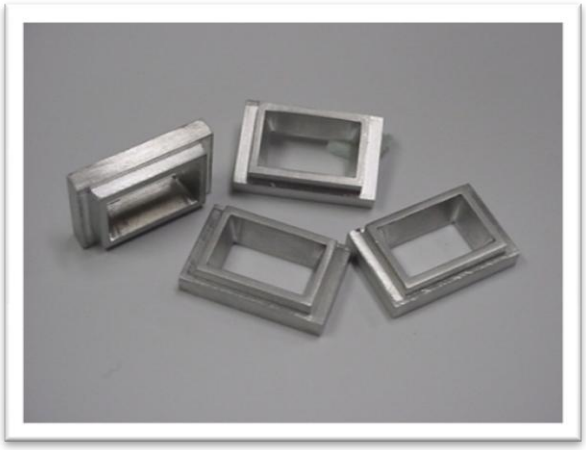

Figure 11: Front logic surrounds

Front Logic Electronics:

The front logics provide you with the droid's current AI state information at a glance. By viewing the front logics you can determine if the droid is working at peak efficiency or not. The droid may also use the front logics to display informational symbols such as warning monikers if the droid is working in a hazardous environment or working with dangerous equipment such as a high voltage or negative power couplings.

Rear Logics and Surround:

The rear logic surrounds are also a CNC machined T6-6061 aluminum surround that houses the rear logic electronics and provides some protection of the logic units from debris or other flying objects. Many droids also use a high impact resin based logic surround.

Figure 12: Rear logic surrounds

Rear Logic Electronics:

The rear logics also provide visual information about the state of the droids other internal systems. The droid may use the rear logic to display maintenance required information or translate the Astromech communications protocol into Aurebesh symbols. Your droid comes with more than 5000 language translations codecs of languages commonly used on Republic planets. However, additional language translation codecs are available from Industrial automation if required.

Front & Rear Logic Bezels:

The logic bezels are a polymer material that holds each LED of the front and rear logic in place. Once all of the LEDs are soldered to the circuit board the bezel slips over the tops of all the LEDs so that they all line up perfectly. The bezel also provides protection for the internal components of the logic electronics.

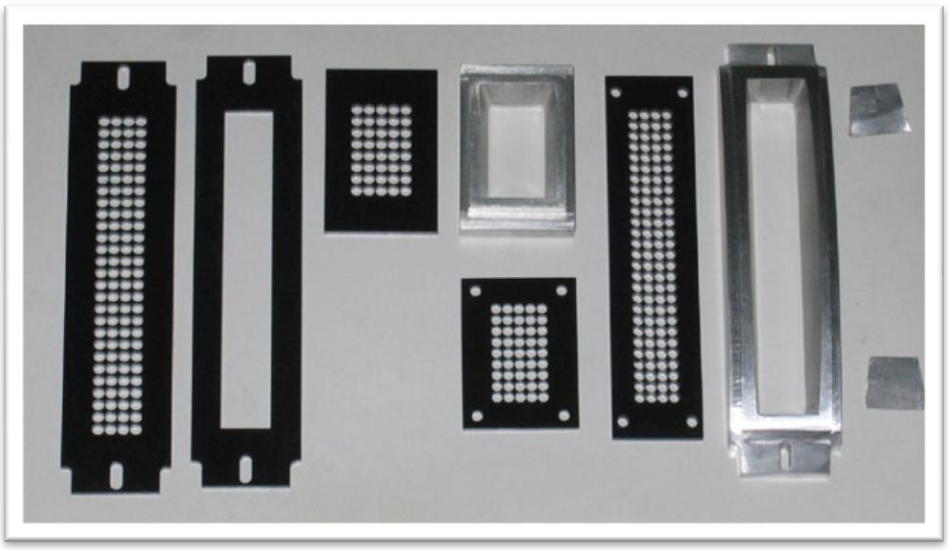

Figure 13: Front and rear logic LED bezels

Dome Bumps:

Your droid is equipped with 2 proximity sensors (dome bumps) for locating power supplies or power droids. If you have an automated Republic credit account your droid may request a power infusion from a Republic power station when it is low on power. Republic credits will be withdrawn from your account automatically and your droid with receive an electronic receipt of the withdraw. Your droid may also request a power infusion from independently owned and operated power droids. Your droid is preprogrammed to withdraw power at a frequency of 120 MHz but automatically adapt to utilize the power stations of the outer rim planets which typically use a 240 MHz power frequency. It is recommended you instruct your droid not to request power from non certified power stations or power droids as drawing power at a non standard or a fluctuating frequency may cause damage to your droids internal circuits.

Figure 14: Dome bumps

PSI (Process State Indicators):

The PSI's or process state indicators display the level of processing happening in the droids AI unit.

Figure 15: PSI (Process State Indicators)

Figure 16: PSI Housing

Periscope:

Your astromech droid is equipped with a standard periscope mechanism that extends from the dome. The periscope is also capable of independently rotating 90 degrees left and right while in the extended position. The periscope allows the droid to view parts above its normal field of view. The droid can also relay the periscope images back to a ships computer or take hi-definition photographs or motion images of parts and store them in its memory banks for later retrieval. The periscope is also useful should your droid accidentally fall into a swamp.

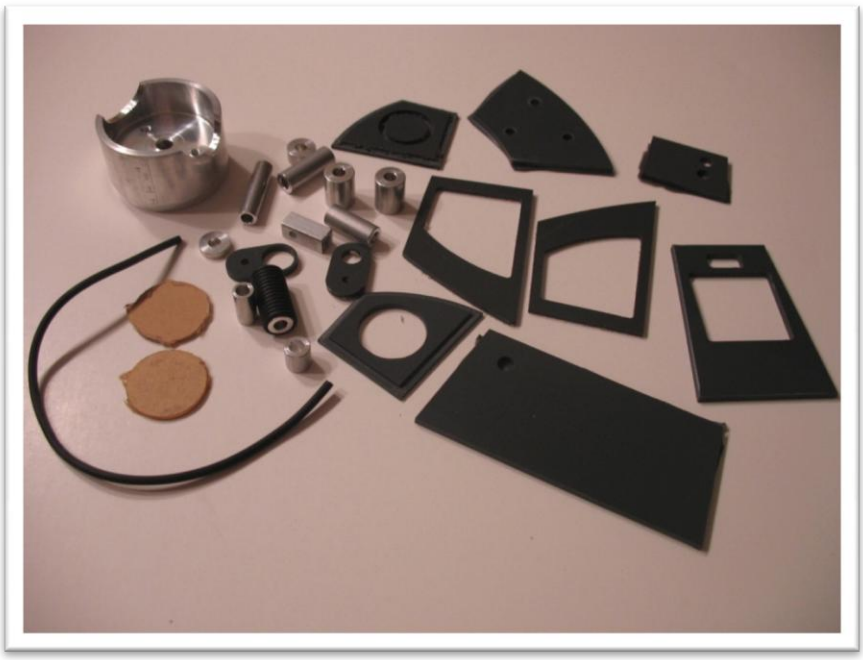

Figure 17: Plastic dome periscope kit parts

Figure 18: Aluminum assembled dome periscope

Life-form Scanner:

The life-form scanner can be used to locate numerous different life forms that may not be readily visible to the human eye. The life-form scanner is useful in search and rescue missions and provides distance and direction data to locate the individual life-forms. The range of a single life-form scanner can be up to 1 mile but will be limited by terrain, harsh weather, or high levels of electromagnetic interference. The range of the scanner can be improved by linking the scanners of several droids and combining the received signals.

Figure 19: Aluminum life form scanner kit parts **- Photo by: Philip Wise**

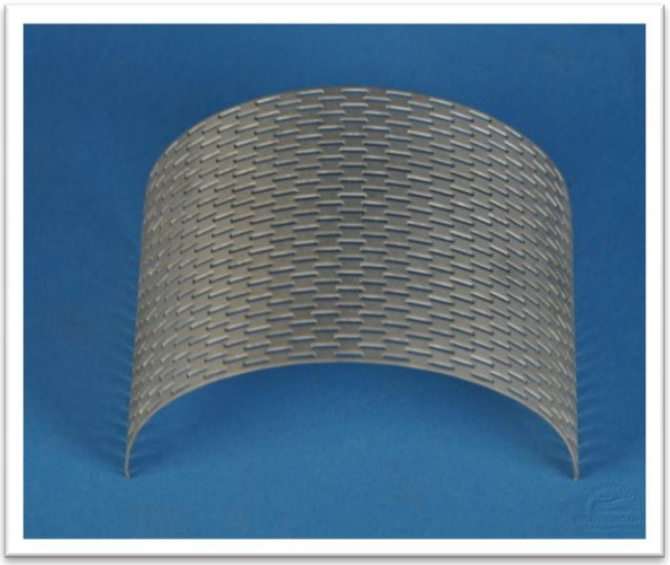

Figure 20: Life-form scanner screen **- Photo by: Philip Wise**

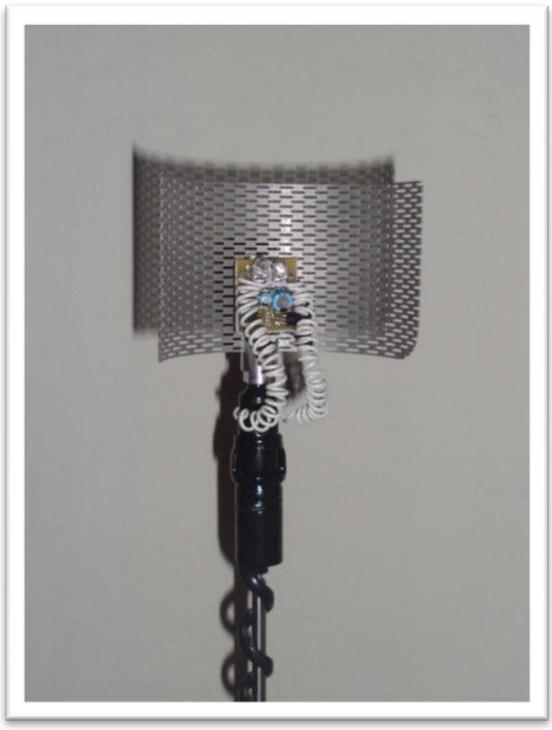

Figure 21: Life form scanner assembly

Frame:

The stock frame of your R2 Series Astromech droid is designed with a high tech aluminum alloy to form a strong and light weight body. The body frame is a JAG 4 - T6 heat treated 6061 aluminum alloy frame. For the X2 series droid the frame has been modified from its original factory specifications to incorporate brackets for removable electronics panels, linear actuators for upgraded shoulder rotation movement, and additional structural members have been added for increased frame rigidity. The following figure shows the stock JAG 4 Frame.

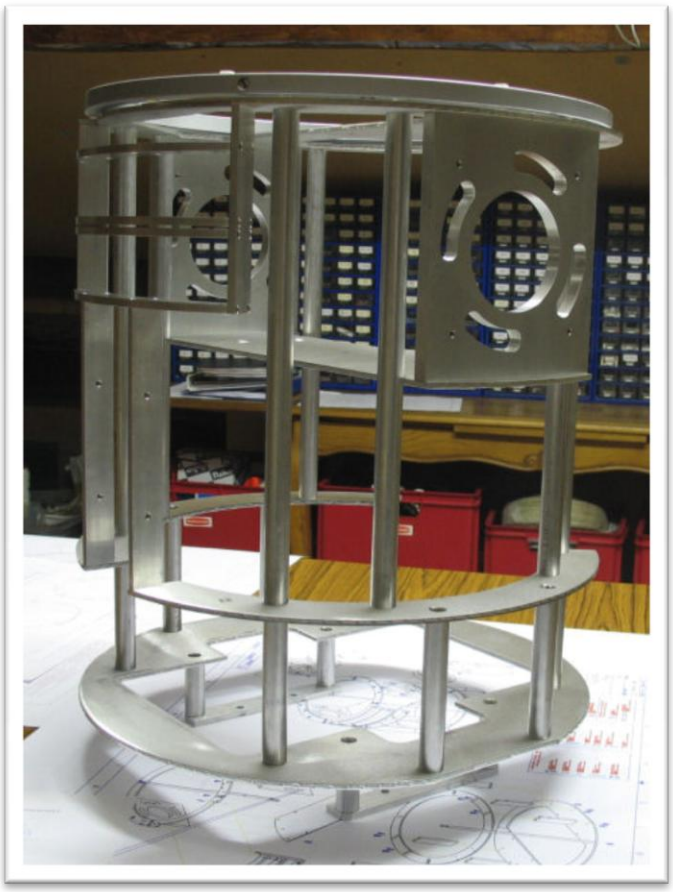

Figure 22: JAG 4 Frame**- Photo: Chris Grootjans**

The stock frame comes with shoulder rotation plates (JAG Stops) that guide the rotation of the legs during the transition from 2 legs to a 3 legged stance and back to standing on 2 legs.

Aluminum Skins:

The internals of your droid are protected from harsh planetary and space environments with standard Sherrell double layer aluminum skins. The Sherrell aluminum skins are made from 0.04 inch thick (per layer) T6-6061 aluminum alloy that are laser cut and rolled to precisely fit the droids frame. The skins provide the panel openings for the mechanical assemblies inside the body to extend from the droid's body while performing its tasks.

Figure 23: Sherrell skins (front and Back)

Large Data Port:

The large data port is a CNC machined T6-6061 aluminum surround that is designed to accept a wide variety removable Republic data media. Data media can be used to upload additional data into your droids internal memory banks or can be used to copy data from the droids memory. Please note that AI algorithms are not stored in the droids memory systems but are stored on non-erasable memory cells.

Figure 24: Aluminum large data port

Utility Arms:

The astromech utility arms are manufactured to exacting standards by CNC milling solid T6-6061 aluminum alloy. The newer version utility arms have been designed as a lighter version of the original utility arms. Utility arms are your droids main devices for external manipulation of work pieces. Standard astromech utility arms will allow your droid to perform repairs on most small to medium size inter-stellar transports manufactured in the last 25 solar cycles of Coruscant. Your astromech droid is also certified to perform repairs on small to medium sized military surplus ships. The utility arms have been designed to be as multi-purpose as possible. This means however that some specialized tasks may not be able to be completed by your astromech droid. For automating highly specialized tasks we suggest you view our line of specialized task droids or speak to one of our galactic representatives and tell them what your specific needs are.

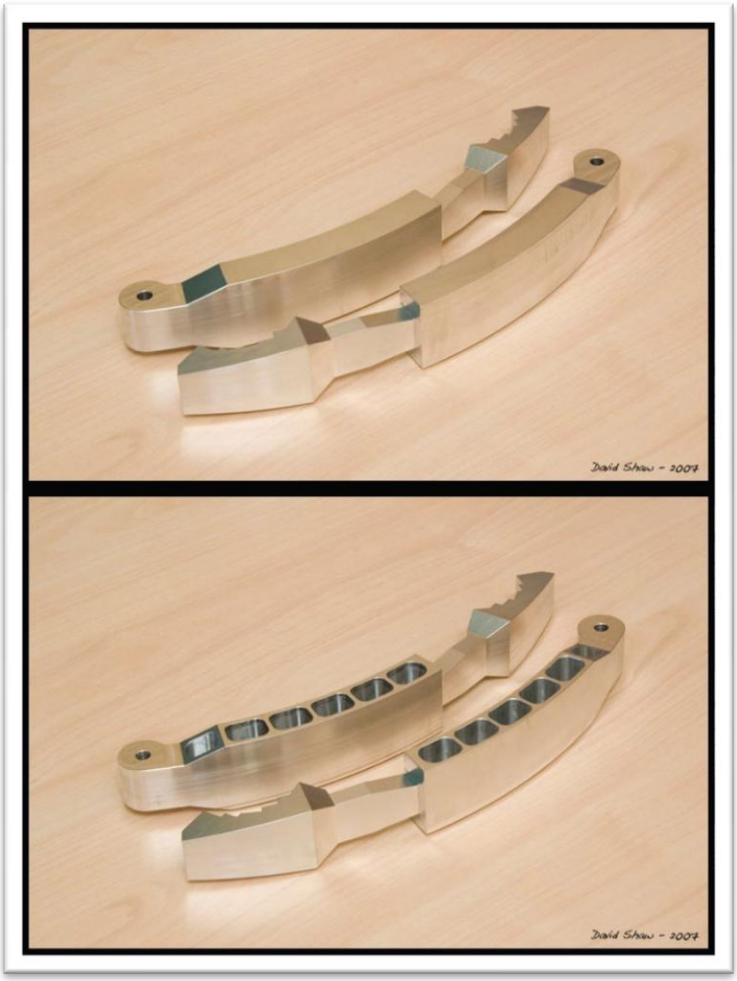

Figure 25: Aluminum utility arms **- Photo by: David Shaw**

Gripper Arm and Claw:

Thanks to the latest design work of Waterset Droid Automation, the R2 series Astromech droids have much improved gripping and manipulation capabilities over their predecessors. In addition to the droids utility arms the gripper claw provides an additional manipulation arm to allow the droid to perform its work. The gripper arm and claw provides the droid with the ability to push, pull, twist, and squeeze. When combined with the utility arms the gripper arm and claw provides the droid with nearly unlimited dexterity for performing repairs.

Figure 26: Aluminum gripper arm & claw **- Photo by: Tom Doucet**

Computer (CPU) Interface Arm:

The computer interface arm is the droids main electronic communications device. The CPU arm is designed to be compatible with all of the public computer interfaces on the Republic planets as well as surplus military equipment. Droids in the service of Jedi Knights or Galactic senators have security clearance to override the security protocols of most Republic computer systems to either request information or execute commands.

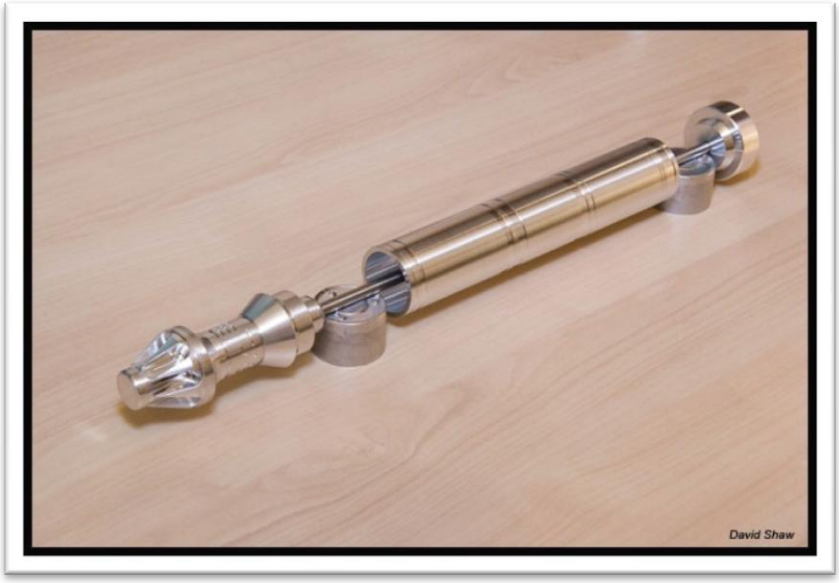

Figure 27: CPU interface arm **- Photo by: David Shaw**

Front Vents:

The front vents and vent surrounds are made from either CNC machined T6-6061 aluminum or high impact polymer material. The front vents act as an exhaust port for ambient air drawn in through the side vents. Droids in the service of Jedi or Galactic Senate members may have their internal protocols overridden to allow the droid to inject a variety of utility gasses into the exhaust ports in emergency situations.

Figure 28: Aluminum front vent inserts and surrounds

Side Vents:

Side vents are made from either CNC machined T6-6061 aluminum or high impact polymer material. Side vents are an ambient atmosphere intake system used to draw in ambient air and use it to cool the internal mechanisms and logic units. When transitioning for work in outer space outside a ship the vents equalize the pressure inside the droids body.

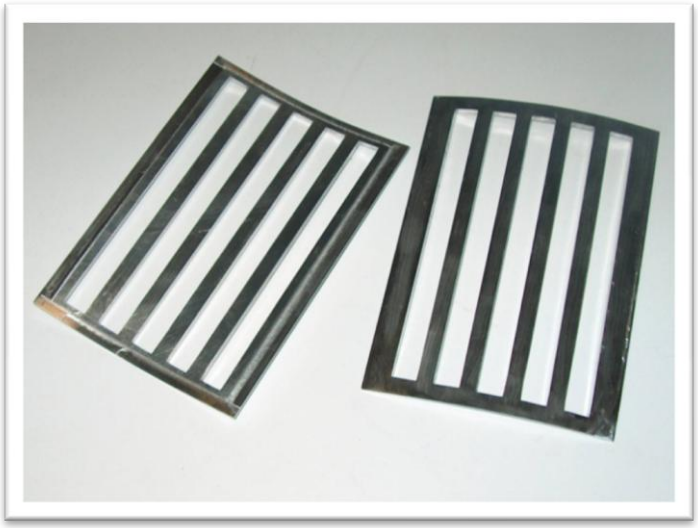

Figure 29: Aluminum side vents

Pocket Vents (Interference pulse stabilizers**):**

Interference pulse stabilizers are made from either CNC machined T6-6061 aluminum or high impact polymer material. Interference pulse stabilizers are used to counter act the multitude of different frequencies of electromagnetic radiation that are present when the droid must work very close to or inside large power reactors. Without these Interference pulse stabilizers the droids internal logic units would become unstable and leave the droid incapacitated with no means of exiting the reactor.

Figure 30: Interference pulse stabilizers (pocket vents)

Coin Slots:

Your astromech droid is equipped with a sensor array on the front of the body affectionately dubbed the “coin slots”. The “coin slots” can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material. The “coin slots” are cowling made to cover the sensor array. The following figure shows the “coin slots” sensor cowling.

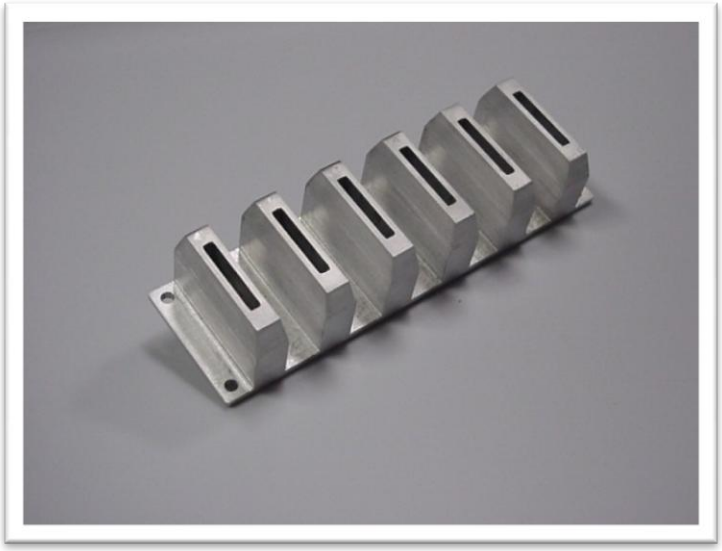

Figure 31: Sensor array cowling (coin slots)

Coin Returns:

Your astromech droid is equipped with tethering rod release ports on the front and back of the body affectionately dubbed the “coin returns”. While working in space outside the ship the droid can extend tethering rods with magnetic ends that will hold the droid to the outer surface of the ship while it’s performing repairs. Once the repairs are complete the tethering rods can be withdrawn back into the body of the droid. The “coin returns” are a T6-6061 aluminum cowling that provide the exit duct for the tethering rods. The following figure shows the coin return cowlings.

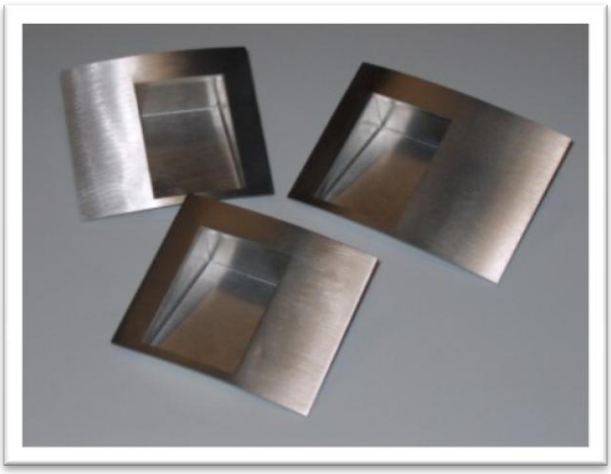

Figure 32: Tethering rod release ports (coin returns)

Power Ports:

The front and rear power ports allow your droid to automatically establish power connections with public power stations or power droids to replenish its power supply. For those situations when no public power ports are available there is an internal manual power port behind the small front panel that can be used with a portable fusion furnace charger. The power ports housings can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 33: Power ports **- Photo by: David Shaw**

Octagonal Ports:

Astromech droids come equipped with a secondary power source in the form of a fuel cell. Fuel cells can utilize various types of hydrocarbons to create electrical power. Some planets have an abundant supply of hydrocarbon fuels and therefore droids stationed on these planets require a mechanism to take advantage of this fuel supply. The fuel cell can supply electrical power to the droids systems directly or it can be used to charge its internal power cells. The octagonal ports are used to establish a connection for the transfer of liquid fuels. The vent openings surrounding the center fuel port will expel the waste water vapor and heat from the spent fuel. The octagonal ports can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 34: Aluminum octagonal ports

Frame Skirt:

The frame skirt provides a protective lower plate for the droid as it travels over rough terrain. The vertical ribs along the outer edge of the skirt are sensors that are calibrated to detect hazardous materials that may be present in the terrain or soil. The sensors can scan for extremely loose soil, sand or water that may cause the droid to lose mobility. The sensors also scan for materials such as radioactive particles in the soil that may damage its internal components. The frame skirt can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 35: JAG aluminum skirt

Legs and Ankles:

The legs of your Astromech droid are part of the Industrial Automation mobility platform. The legs allow the droid to transition its stance mode from 2 legs to 3 legs and back. The legs are made from T6 heat treated 6061 aluminum alloy. These provide a very strong yet light platform for your droid to get to and from its assigned stations. The stock Astromech aluminum legs are shown below in the following figures.

Figure 36: JAG Aluminum Leg **- Photo: Chris Grootjans**

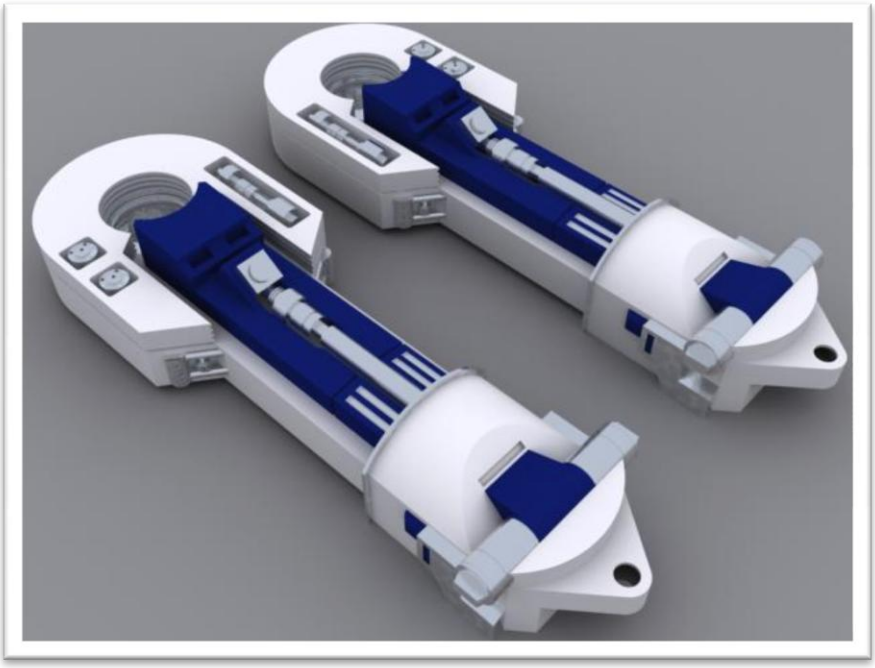

Figure 37: Aluminum Leg Assemblies **- Image by: Chani**

Shoulder Rotation Bearings:

These large bearings are used to provide the rotation mechanism for the legs during the 2-3-2 transitions. The shoulder bearings have an aluminum casing they are mounted in. The casing provides the attachment point for the bearing to the frame. The casing also provides the attachment point for the shoulder levers that are used to rotate the legs & shoulders. Oddly Astromech droids share this assembly with satellite dish rotation mechanisms used throughout the galaxy. Depending on the model droid this part can be interchangeable or only slightly modified from the satellite dish rotation mechanism.

Figure 38: Original Satellite motor assembly

Figure 39: Satellite motor assembly bearing

Shoulder rotation Hubs:

The shoulder rotation plates provide the attachment point for its legs. The shoulder rotation hub is mechanically rotated via the droid's internal mechanisms and causes the legs to rotate during the 2 to 3 leg transition and also from 3 legs back to the standing 2 leg position.

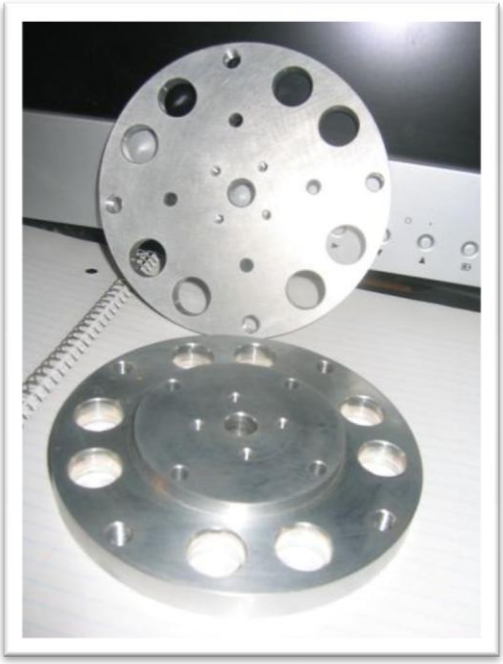

Figure 40: Shoulder rotation plate **- Photo: Chris James**

Shoulder-to-body Spacer:

The shoulder-to-body spacer keeps the droid's legs separated from the body correctly so the legs do not interfere with the body during the 2-3-2 transitions. These are made of solid aluminum machined for weight reduction and drilled to fit the hole patterns to connect the droids legs to the frame. The shoulder-to-body spacers can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material. Four Dura-steel socket head bolts are used to connect each leg to the frame.

Figure 41: Aluminum shoulder-to-body-spacer **- Photo: Chris Grootjans**

Shoulder Horseshoes:

The shoulder horseshoes are the mounting points for the shoulder hydraulics and other hydraulic mechanisms that raise and lower the side booster jets. The shoulder horseshoes can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 42: Aluminum shoulder horseshoes **- Photo: Chris Grootjans**

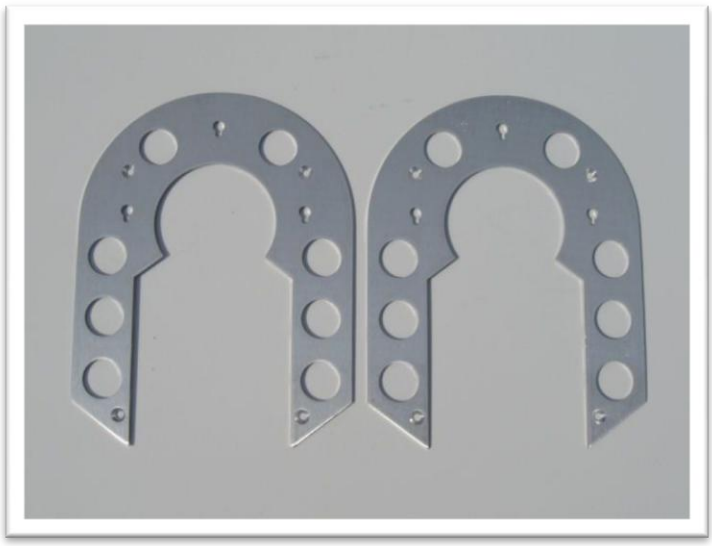

Figure 43: Horseshoe shims **- Photo: Chris Grootjans**

Shoulder buttons:

The shoulder buttons are part of the droid's hydraulic mechanism for raising the booster covers and deploying the booster jets. System lubrication is injected through the shoulder buttons. The shoulder buttons can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 44: Aluminum shoulder buttons

Shoulder Hydraulics:

The shoulder hydraulics are part of the droid's hydraulic mechanism for raising the booster covers and deploying the booster jets. The shoulder hydraulics can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 45: Aluminum shoulder hydraulics

Shoulder hubs:

Embedded in the center of each shoulder hub is a radar sensor that alerts the droid to persons or other droids approaching it from either side. Sensors are effective up to 40 feet. The shoulder hubs can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 46: Aluminum shoulder hubs

Under Shoulder Details:

The under the shoulder details are part of the droids hydraulic mechanism for raising the booster covers and deploying the booster jets. The under the shoulder details can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 47: Aluminum under shoulder details

Booster Covers:

Booster covers house your droids directional motion rockets while not in use. The booster covers protect the rocket assembly from damage and debris. The booster covers can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 48: Aluminum booster covers

Booster Rocket Assembly:

When the booster rockets are deployed the booster covers open on a hinged joint and angle to booster rocket in preparation of rocket ignition. This assembly can dynamically alter the angle of the booster rocket to guide the flight path of the droid under booster rocket power.

Figure 49: Booster Rocket Assembly **- Photo by: JAG**

Booster Rockets:

Booster rockets provide the droid the ability to adjust its spacial position relative to your ship or transport while in outer space. This allows the droid access to damaged sections of the ship that need repair. The booster rockets are designed for use in space but in emergency conditions can be used as VTOL (Vertical take-off and landing) rockets on low gravity planets. Booster rockets consume liquid fuel stored inside your droid and can only sustain flight for a short period of time depending on the G force present on the planet's surface. Your droid's AI unit is programmed to use its booster rockets on a planet's surface only in emergency conditions and only when flammable materials are not present. Overriding these protocols in your droid's AI unit is illegal under Republic law and subject to fine and imprisonment. Droids in the service of members of the Galactic Senate or Jedi Knights are given special dispensation to reprogram droid AI units and in some circumstances may have these protocols overridden.

Figure 50: Booster rocket **- Photo by: JAG**

Leg hydraulics:

The leg hydraulics are the mechanism for raising and lowering the booster covers and deploying the directional motion rockets “booster jets”. The leg hydraulics can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 51: Aluminum leg hydraulics

Outer Leg Ankles:

Outer ankles connect the leg to the foot drive units and provide the rotation point for the foot to rotate when the droid performs 2-3-2 transitions.

Figure 52: Aluminum outer ankle

Outer Ankle Bracelets:

The ankle bracelets are protective coverings for the top of the ankle joints and protect the ankle from dirt and debris that may drop from above.

Figure 53: Aluminum outer ankle bracelets

Outer Ankle Cylinders:

The outer ankle cylinders can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 54: Aluminum ankle cylinders

Outer Ankle Cylinder Supports:

The cylinder supports provide additional structural integrity for the ankle cylinder hydraulics. The cylinder supports can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

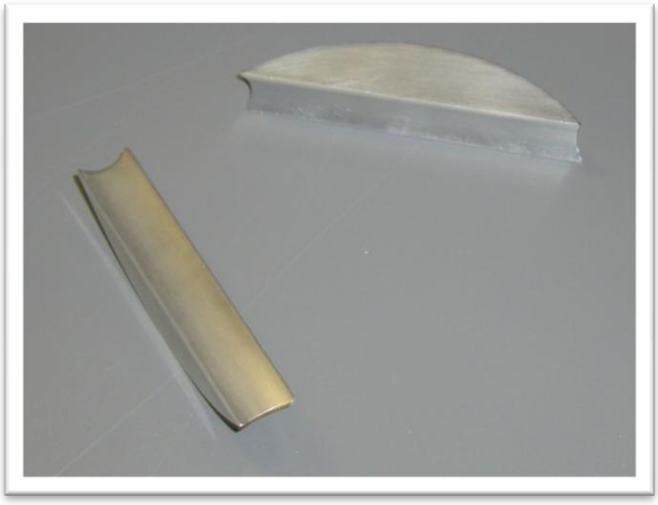

Figure 55: Aluminum cylinder supports

Outer Ankle Cylinder Wedges:

The wedges are protective coverings for high pressure oil routes for the ankle cylinder hydraulics. The ankle wedges can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

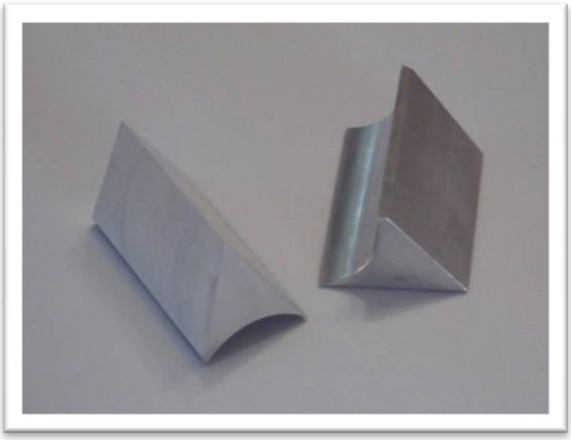

Figure 56: Aluminum cylinder wedges

Outer Ankle Details:

These ankle details contain high pressure oil routes for the leg hydraulic mechanism. The ankle details can be made from either a CNC machined T6-6061 aluminum or a high impact polymer material.

Figure 57: Aluminum ankle details

Drive System (foot shells):

The feet of your droid provide it with the locomotion necessary to traverse many types of planetary terrain or on space platforms. The foot housings are made from high strength and durable 10 gauge steel plate pieces that are laser cut and arc welded into the foot housings.

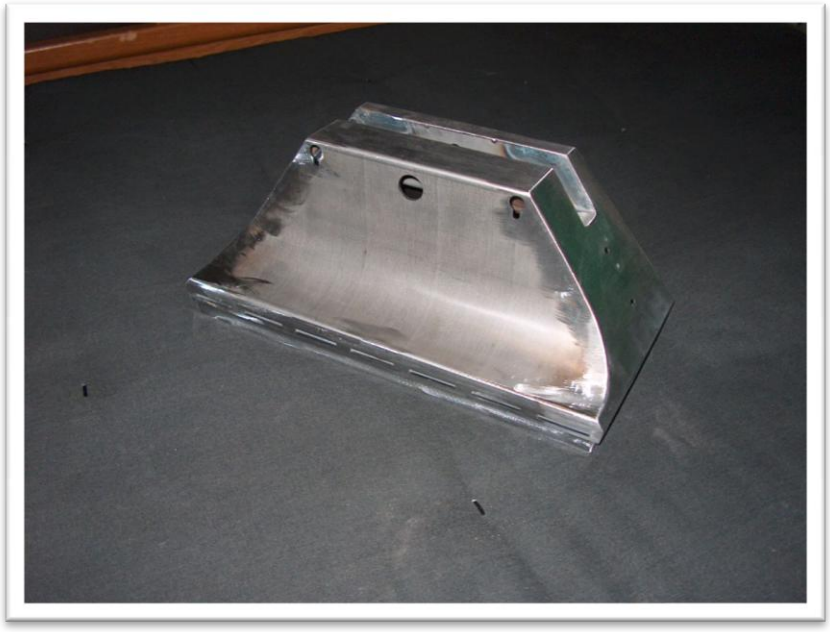

Figure 58: Stock JAG steel foot housings

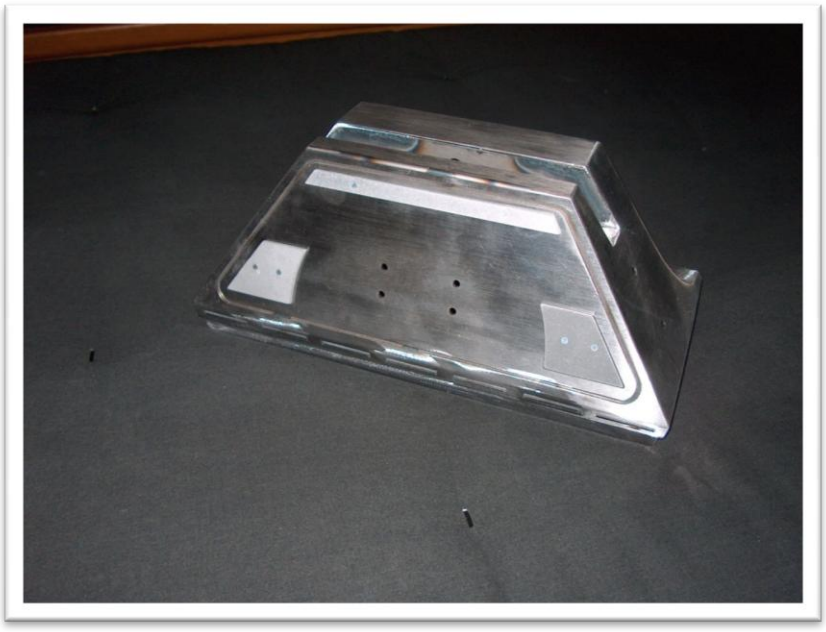

Figure 59: Stock JAG steel foot housings

Drive Feet Details:

Figure 60: Outer foot housing details

Drive Foot Strips:

Figure 61: Drive foot strips

Power Source Housings (Battery Boxes):

The power source housing are protective shells for the droids main power cells. Each housing contains 1 power cell capable of supplying 1000 mega Jules of energy for droid motion and utility devices.

Figure 62: Power source housings

Figure 63: Custom battery box nuts

Battery box harness:

The battery box harnesses are specially designed mechanisms that provide direct access to the droid's main power packs. If your droid requests a power infusion most power droids and fixed based stations will run a diagnostic on the main power sources before delivering the power infusion. If the diagnostic determines there is a problem with one or more of the droid's power packs these harness mechanisms allow automated droid mechanics to open and replace the main power packs. Your service agreement stored in your droid's memory systems will determine if a service droid or fixed based power stations will be allowed access to your droids main power packs. If your service agreement prohibits access to the droid's main power packs your droid may be refused a power infusion should the diagnostic reveal a problem.

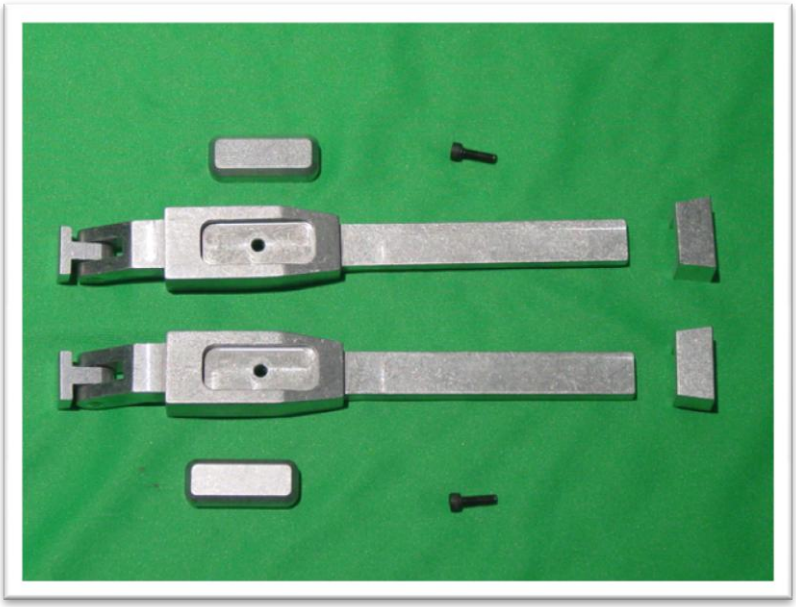

Figure 64: Power source box harnesses

Knurled hose fittings:

These fitting connect the main power pack cables to the drive units in the foot housings.

Figure 65: Knurled hose fittings **- Photo: Chris Grootjans**

Power Source Cables:

The main drive power cables are composed of a high temperature super conducting material for delivering maximum power to the droid's drive units in the foot housings. The cable material is covered with a flexible polymer composite to prevent accidental discharge to ground. The outer layer is a copper alloy mesh that protects the internal cables from damage.

Figure 66: Battery cable protective hoses

Stabilizer Foot Housing (Center Foot):

Industrial Automation has provided your Astromech droid with a stabilizer foot as part of its mobility platform. The stabilizer foot housing is made from high strength 10 gauge steel plates that are laser cut and welded into the stabilizer foot housing. During long distance travel the stabilizer foot extends from the body of the droid and keeps the droid stable while moving over uneven terrain. Once the droid reaches its destination the stabilizer foot retracts and the droid transitions to a 2 legged stance to perform its maintenance functions. The following figure show the stock JAG steel stabilizer foot housings.

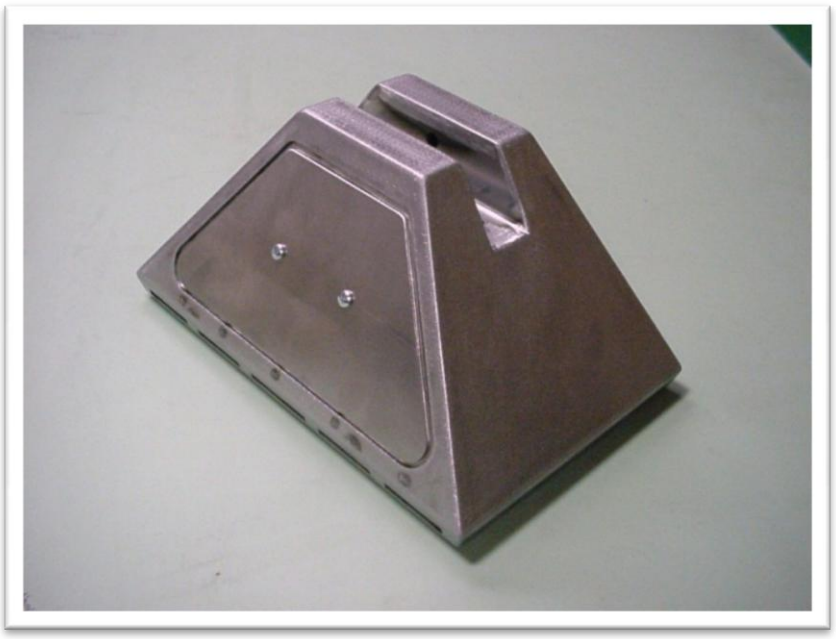

Figure 67: Stock JAG steel stabilizer foot housing

Stabilizer Foot Details

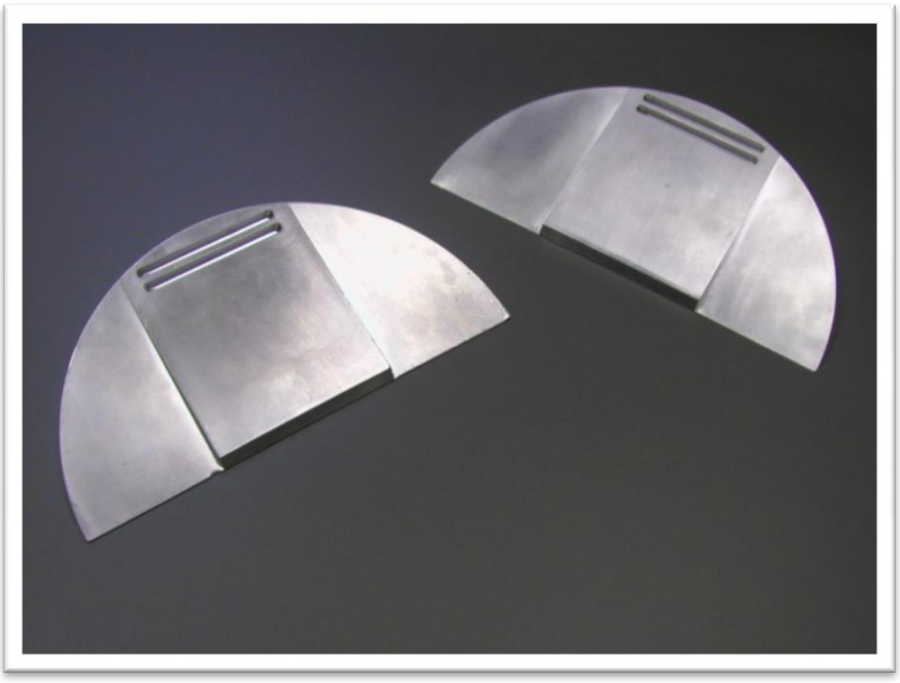

Figure 68: Stabilizer foot details

Stabilizer Foot Strips:

Figure 69: Stabilizer foot strips

Stabilizer Foot Ankle:

The stabilizer foot ankle provides the connection from the stabilizer foot housing to the body of the droid. It allows the stabilizer foot housing to rotate during deployment of the center leg.

Figure 70: Stabilizer foot ankle

Stabilizer Foot Ankle Cylinders:

The 2 stabilizer foot ankle cylinders are mounted on each side of the center ankle and provide a hydraulic shock absorption system for the stabilizer foot. They also cause the foot to rotate during the deployment of the center foot. If necessary the droid can utilize the hydraulics of the center foot to fine tune the height of its stance by forcing the foot to rotate while on the ground.

Figure 71: Center foot ankle cylinder