

Choosing Motion Components for the Long Haul of Space Systems

Motion component specialists stand ready to help you specify parts that perform reliably for the life of their missions.



Not too long ago, NASA was synonymous with space exploration. Today, the number of entities active in the space industry is not just limited to government agencies and well-known companies. It is growing exponentially to carry out all manner of missions, each with unique challenges that demand innovative technologies to solve them. Success requires not only carefully selected motion components, it also means partnering with a motion specialist that can ensure these components perform reliably and work as planned in their space mission. This article will explain why the right motion specialist can give you the certainty of knowing that the component you're specifying is designed for the life of the space system it will go into.

When you collaborate with a motion product specialist with a long legacy of proven experience and application data from space missions, you'll leverage their expertise to better determine the product elements that will perform reliably and those that will need modification or replacement before deployment. Here are some selection tips along with insights into how the right partner can help you succeed in space.



Light Components and Innovative Coatings Pull Their Weight in Space

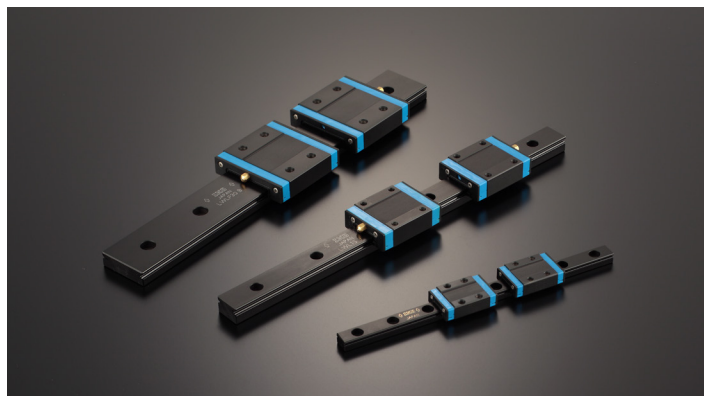
In space systems, a proven design is only the first step toward meeting the application challenge. Because adding just a few ounces to a component's weight can translate to thousands of dollars in payload costs, subsequent design iterations often call for the initial performance to be replicated but at a lower weight. An ideal motion specialist helps designers achieve an optimal performance-to-weight ratio to keep costs in line. Some "lightening" strategies can include choosing a smaller size product, using lighter-weight rolling elements in linear guides or adding extra holes to rails in addition to the mounting holes.

You'll also need to account for harsh conditions like extreme temperatures, vacuum environments and high radiation, to name a few. While it's certainly possible to find coatings that protect against these extremes, other conditions in space may prohibit their use. A motion component specialist with extensive knowledge about coatings in space can propose the right surface treatment for the job. For example, black chrome coatings offer exceptional rust prevention on stainless steel. Another option, fluorinated black chrome, offers even greater corrosion resistance on stainless steel than other materials.

Contamination and Corrosion Prevention

No matter if it's a hard particle or dust, contamination cannot be tolerated. Without proper precautions, components will eventually degrade due to contamination. When space-bound products are developed in a cleanroom environment, be sure to seal the system as best as possible or isolate the functioning components so they are not exposed to additional contaminants. Your component specialist will walk you through accessories like non-contact seals, shields or end plates that are specially engineered for hostile or corrosive environments. For example, a non-standard seal may be very close-gapped and, if stainless steel materials are used, can be engineered to create a labyrinth-type barrier to prevent particle incursion.

Another threat to motion devices in space applications? Corrosion and its impacts. Even ground-based systems are often located near oceans where saltwater can introduce corrosion to vital equipment. For these reasons, stainless steel can be a sensible choice of material for motion devices.



LWL miniature linear guides can be specified with black chrome surface treatment for exceptional rust prevention.

As mentioned earlier, your motion component specialist can recommend an appropriate coating for the application, such as corrosion-resistant black chrome, or a fluorinated black chrome surface treatment that resists corrosion while preventing foreign matter from adhering to the part surface. When specifying protective coatings for linear guides, be sure to keep in mind that some areas such as track rails and slide units require extra fortification against corrosion.

Finally, ask your motion component manufacturer about your application's thermodynamics. Material hardnesses can change at certain temperatures and, in turn, can also change a part's load capacity. Also, consider whether a phase transformation is possible. What if the part will be used where there are temperature swings of 300 to 400 degrees, such as in a solar array? At IKO, we can assess a component's materials and understand their thermodynamics. From there, we can help identify if a potential problem could occur, if clearances are required and how the temperatures affect, for example, bearing preloads.

Insist on Only the Most Reliable Components and Accessories

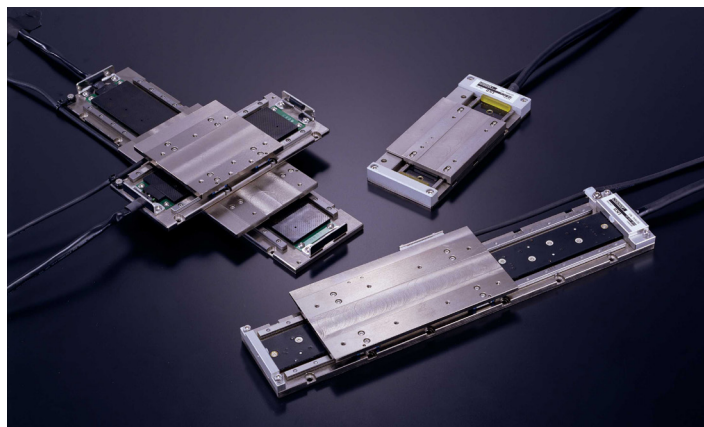
If a single component fails in space, oftentimes the entire system fails. Unlike many ground-based applications, there is no swapping out a defective component. And, many missions may take years to reach their intended destination, so sending maintenance and repair personnel to address an issue is prohibitive. Everything that goes into space must be designed for life from the beginning, starting with the standard products.



IKO linear guides ride aboard NASA Jet Propulsion Laboratory's Mars Curiosity rover. Launched in 2011, the Curiosity rover is still operational.

Component manufacturers continue to make great advances in creating ever-shrinking, lightweight components that make efficient use of space and are economically attractive. When you can find these characteristics in mission-proven components, you'll have a good foundation to begin optimizing your component. Here is what to look for in common motion components for space applications, along with some use cases, using IKO products as examples:

- **Linear bearings.** Make sure your linear guide materials have metallurgical properties that deliver smooth, accurate motion with good rigidity. This is why, for example, IKO linear guides have proven successful in a variety of space applications from autonomous exploration vehicles to the Mars rovers. One particular miniature stainless steel guide — the LWL2 Series — has a mere 2-millimeter track width and a slide unit width of just 5 millimeters.
- **Mechatronics and positioning stages.** Linear motor and ball screw positioning stages are continually shrinking in size. Many feature compact and lightweight driving mechanisms, low sectional heights and narrow widths for tight installations in space systems.
- **Crossed roller bearings.** An orthogonal arrangement of rollers that make good contact with the raceway gives crossed roller bearings effective rotational accuracy in a compact size for space-constrained designs. They can be easily modified to withstand vacuums and low temperatures aboard spacecraft.
- **Spherical plain bearings.** Despite their simple design, spherical bearings are well-suited for sophisticated space applications, such as in the pads that stabilize and reposition rocket boosters that are caught by a launch tower's mechanical arms.



IKO's NT Series linear positioning tables are available in compact sizes. In fact, the NT Nano linear table comes with an 11-millimeter sectional height, 38-millimeter width and 62-millimeter length. Despite its small size, an integrated neodymium magnet provides excellent thrust, speed and accuracy.



Crossed roller bearings come in a wide range of sizes and can be modified to withstand punishing conditions aboard spacecraft such as vacuums and low temperatures.

Take a Motion Specialist With You on the Long Journey to an Ideal Space Component

Not every manufacturer can participate in the space sector. When it comes to space applications, it takes a company that has a skilled team of engineers with strong base knowledge of space applications plus the right standard products to choose from and modify over time. That's where IKO comes in.

At IKO, we're equipped to work with you over the long haul, engaging with you through the many rounds of R&D and months and years necessary to develop an ideal product for space. Our experts will assess your application requirements,



share past experiences and create predictive models to point the way to success. In addition to lending our expertise to the project, we have a large roster of machining centers and several means of obtaining specialty materials. These resources give us the flexibility to quickly make modifications, mockups or even create a standard part for testing. And, we can provide specialty coatings or change a part's physical composition to better achieve its motion requirements in the application.

IKO can fast-track prototypes to customers and develop proof of concepts promptly in collaboration with your engineers — through each phase and all the way to the finished product's deployment. Whether the motion component is intended for flying craft, exploration vehicles, robotic mechanisms or ground support equipment, you'll get the peace of mind from knowing that your motion product is designed to meet or exceed the expected lifetime of its intended equipment.

Out-Of-This World Products and Support

In the ever-growing and diversifying space industry, there are many component suppliers to choose from. That's why it's important to distinguish a motion component specialist who provides innovative components that will deliver a long lifetime of reliability in space. At IKO, we offer a broad lineup of standard products that make a great starting point for creating an ideal spacebound part. And when you partner with us early in the selection process, we can bring a wealth of space application knowledge, machining and materials availability, coating expertise and development know-how to the project to ensure your final product performs as intended for the lifetime of the mission.

For more information, please visit our website at www.ikont.com.

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