View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by NASA Technical Reports Server

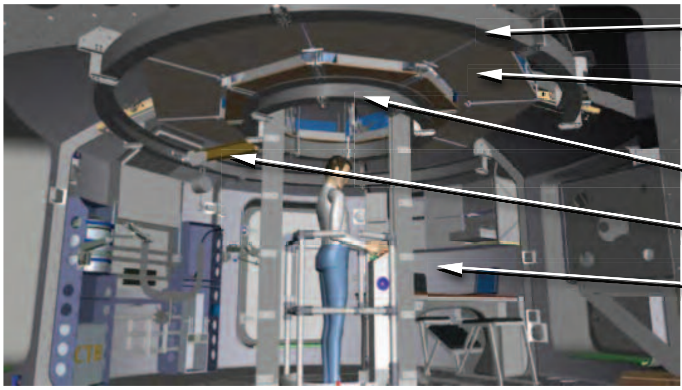
Technology Focus: Mechanical Components

Radial Internal Material Handling System (RIMS) for Circular Habitat Volumes

The novelty of this system is its configuration as a circular habitat.

NASA's Jet Propulsion Laboratory, Pasadena, California

On planetary surfaces, pressurized human habitable volumes will require a means to carry equipment around within the volume of the habitat, regardless of the partial gravity (Earth, Moon, Mars, etc.). On the NASA Habitat Demonstration Unit (HDU), a vertical cylindrical volume, it was determined that a variety of heavy items would need to be carried back and forth from deployed locations to the General Maintenance Work Station (GMWS) when in need of repair, and other equipment may need to be carried inside for repairs, such as rover parts and other external equipment.



The **HDU Material Handling System** and stowage system installed on the ceiling of the habitat.

The vertical cylindrical volume of the HDU lent itself to a circular overhead track and hoist system that allows lifting of heavy objects from anywhere in the habitat to any other point in the habitat interior. In addition, the system is able to hand-off lifted items to other material handling systems through the side hatches, such as through an airlock.

The overhead system consists of two concentric circle tracks that have a movable beam between them. The beam has a hoist carriage that can move back and forth on the beam. Therefore, the entire system acts like a bridge crane curved around to meet itself in a circle.

The novelty of the system is in its configuration, and how it interfaces with the volume of the HDU habitat. Similar to how a bridge crane allows coverage for an entire rectangular volume, the RIMS system covers a circular volume.

The RIMS system is the first generation of what may be applied to future planetary surface vertical cylinder habitats on the Moon or on Mars.

This work was done by Alan S. Howe of Caltech; and Sally Haselschwardt, Alex Bogatko, Brian Humphrey, and Amit Patel of the University of Michigan for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-48293

Conical Seat Shut-Off Valve

This valve has applications in high-pressure and high-flow conditions.

Stennis Space Center, Mississippi

A moveable valve for controlling flow of a pressurized working fluid was designed. This valve consists of a hollow, moveable floating piston pressed against a stationary solid seat, and can use the working fluid to seal the valve. This open/closed, novel valve is able to use metal-to-metal seats, without requiring seat sliding action; therefore there are no associated damaging effects.

During use, existing standard high-pressure ball valve seats tend to become damaged during rotation of the ball. Additionally, forces acting on the ball and stem create large amounts of friction. The combination of these effects can lead to system failure. In an attempt to reduce damaging effects and seat failures, soft seats in the ball valve have been eliminated; however, the sliding action of the ball across the highly loaded seat still tends to scratch the seat, causing failure. Also, in order to operate, ball valves require the use of large actuators. Positioning the metal-to-metal seats requires more loading, which tends to increase the size of the required actuator, and can also lead to other failures in other areas such as the stem and bearing mechanisms, thus increasing cost and maintenance.

This novel non-sliding seat surface valve allows metal-to-metal seats without the damaging effects that can lead to failure, and enables large seating forces without damaging the valve. Additionally, this valve design, even when used with large, high-pressure applications, does not require large conventional valve actuators and the valve stem itself is eliminated. Actuation is achieved with the use of a small, simple