

Air Casters Turn Cleanrooms Into Safe Spaces for Satellites & Aerospace Assemblies

By John Massenburg

March 24, 2021

<https://industryeurope.com/sectors/aerospace-defence/air-casters-turn-cleanrooms-into-safe-spaces-for-satellites/>

When Lockheed Martin was building a 4,800 kg space-based infrared surveillance (SBIRS) satellite, one of its toughest manoeuvres had nothing to do with launching the satellite into space. First, the company had to figure out how to move the SBIRS satellite into, around, and out of its test chambers, which had no crane system installed. With no crane, Lockheed Martin needed a way to move a structure that was painstakingly heavy, fragile, and expensive across a delicate epoxy-coated floor surface.

Equally important, the company needed a solution that would not contaminate the cleanroom environment, since the introduction of either particulates or volatile organic compounds including lubricants, greases, plasticizers, and more could potentially cause catastrophic failure and prevent the satellite from fulfilling its mission. Given that the SBIRS satellites are part of an early missile warning system for the U.S. military, protecting the satellite and its construction and testing environments were critical.

The solution: a material handling system that could successfully move the large, unwieldy, and breakable structure while protecting the satellite, the floor, and the cleanroom environment all at once. And the answer came through a surprising source - the science of air hockey.

Floating aerospace equipment on air casters

Air hockey is a tabletop game where the puck floats on an ultrathin film of air that reduces the friction coefficient between the puck and the game surface to negligible levels. As a result, players can send the puck zooming across the surface with only modest taps.

Air casters operate on a more controllable version of the exact same principle, albeit scaled up for objects weighing thousands, tens of thousands, or even hundreds of thousands of kilograms. These air



John Massenburg,
President & CEO, AeroGo

casters are doughnut-shaped bags that inflate with compressed air, normally just standard plant air. When the air caster bag reaches maximum capacity, excess air leaks underneath until a thin film of air only about 10 millimetres thick upon which the structure literally floats. With the friction coefficient reduced to less than 1%, an object the size of the SBIRS satellite can be moved with only about one-tenth the amount of force required to push the same object on wheeled casters.

For aerospace applications, air casters satisfy all three issues facing the SBIRS structure, they could:

1. Move a heavy and delicate object successfully with precise positioning.
2. Protect the floor surface from damage.
3. Keep the cleanroom environment pristine so that the satellite would maintain operational integrity in space.

It's not just Lockheed Martin that benefitted. Most of the aerospace industry uses air casters to some degree because of their ability to meet all three of those requirements simultaneously. Boeing, Airbus, the European Space Agency, the Indian Space Research Organisation (ISRO), the U.S. National Aeronautics and Space Administration (NASA), and other private organisations all use air caster-based systems to move and position aerospace equipment ranging from telecommunication satellites to shuttle payloads.



SBIRS 10, 656 lb. satellite moving into test bay on air casters. Source: AeroGo

As clean as air

Air casters produce neither particulates nor pollutants like aerosols or chemical vapours. They require only compressed air to operate, consuming no fuel, requiring no lubricant oils, and emitting no exhaust.

The way in which they protect the floor surface also helps prevent contamination. Material handling solutions that create friction or cause grinding or other breakages can inadvertently release particles and other contaminants into a cleanroom environment. Because air casters are floating, however, the floor surface is protected against scratching, grinding, or gouging. As a result, that film of air no thicker than a business card can protect expensive epoxy-coated surface treatments against damage. - *The author, John Massenberg, is President and CEO at [AeroGo, Inc.](#)*

Air casters also spread the weight of the object being moved over a much larger surface area than something like a wheeled caster, resulting in a total floor loading of around 25 psi. A material handling system like a wheeled caster can produce thousands of psi at the specific points of contact, which can render such a system unusable if the cleanroom includes raised floors.

Moving satellites with ease

Still, it's important to note that no matter how clean the air casters may be, they still need to be able to successfully and safely facilitate the movement of these satellites from point to point.

Air casters require no certification and only simple training to operate. A single operator can move even very large objects using nothing more than human power. For example, a load weighing around 2,250 kg. requires only around 2 to 11 kg. of force to move, depending on the condition of the floor surface.

The air casters can also fit within the footprint of the satellite, can move omnidirectionally, and lift the equipment less than 10 cm off the ground. As a result, the satellites can navigate even narrow corridors, make tight 90-degree turns, rotate in place, fit precisely into position for testing, and go through doorways with low clearance.

Another key issue is preventing shock loads that could damage or de-calibrate the satellite equipment while in transit. Any type of wheeled vehicle or conveyance is guaranteed to transmit vibrations to the equipment; even a crane can inadvertently transmit a shock load when picking up or setting the equipment down. Air casters, however, slide beneath the object to be moved and then smoothly lift the satellite equipment up as the casters inflate. Operators can move the load as needed with the air casters effectively acting as shock absorbers. When positioned, the casters are deflated, and the equipment gently settles into place.

The solution isn't rocket science

For decades, air casters have been a staple at space agencies around the world, including the European Space Agency, the U.S. National Aeronautics and Space Administration (NASA), as well as at commercial aerospace vendors like Lockheed Martin, Boeing, and Airbus. It's easy to see why. Often, many of the most important movement and positioning happens long before the satellite reaches orbit and takes place in environments subject to stringent regulations limiting exposure to contaminants and environmental pollutants like aerosols, chemical vapours, dust, and even airborne microscopic organisms.

The result is a material handling solution that can safely transport virtually unlimited load sizes and shapes on its own or in conjunction with cranes. By utilising air caster technology, facilities managers can more efficiently move aerospace assemblies while maintaining pristine cleanrooms.

- *The author, John Massenberg, is President and CEO at [AeroGo, Inc.](#)*