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AEROSPACE & DEFENSE™ TECHNOLOGY

The Engineer's Guide to Design & Manufacturing Advances

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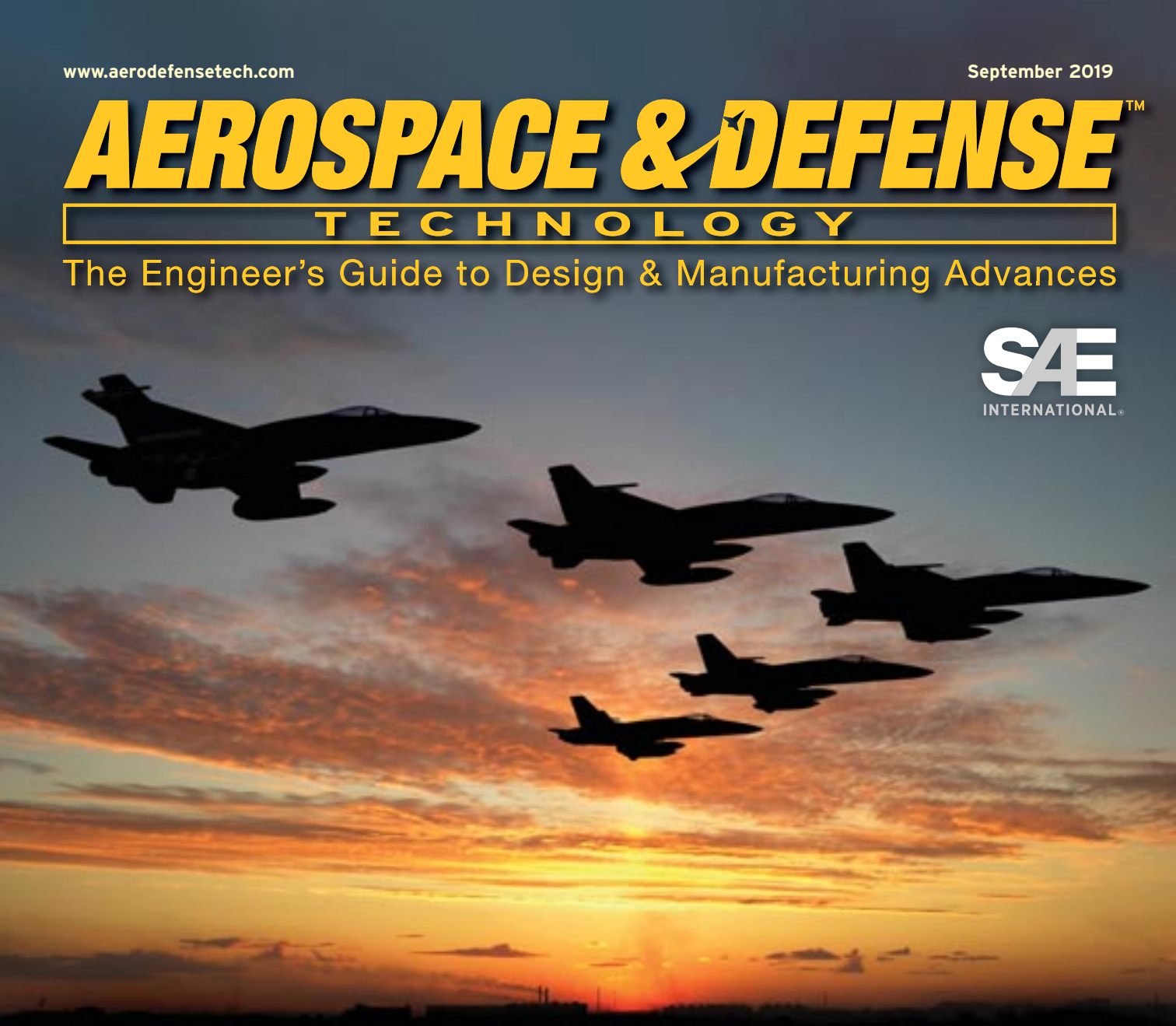


Understanding Fiber Optic Transceiver Design and Test Rules

Operational Considerations for High-Reliability Interconnects

Using Air Caster Technology for Satellite Assembly

From the Publishers of TECH BRIEFS

Air Caster Technology
Safeguard Satellites During Assembly and Testing

If there is a prime example of the need for friction-free, precise and delicate equipment movement in the aerospace and defense industries, satellite positioning during the testing cycle should be at the top of the list. Whether in a clean room or another environment, there is no margin for error when it's time to move the "bird" even a short distance. Anything short of a smooth relocation means unacceptable property loss and project delays if this most intricate piece of aerospace equipment is damaged. Disassembly is hardly an option.

Safe and exact motion and placement are necessities. So is avoidance of vibration or other external forces likely to negatively impact or de-calibrate the satellite and components, ruining sophisticated technology. A number of NASA contractors and other aerospace corporations are turning to an alternative – air-bearing equipment that slides under the satellite mounting, then lifts and moves the satellite, free of damaging vibrations.

Moving the 10,656 lb. SBIRS satellite into test bay on air casters.

Avoiding Friction and Vibration

Satellite positioning, assembly and testing must be precise, smooth and vibration-free. Vibration isolation is mandatory, but the probability of vibration damage increases significantly when a crane lifts the satellite at its top. Most satellites are designed to be secured at their base so they can be lifted from the bottom. Wheeled casters move satellites at the base, but are not the most reliable of solutions for eliminating vibration or friction issues, especially the latter.

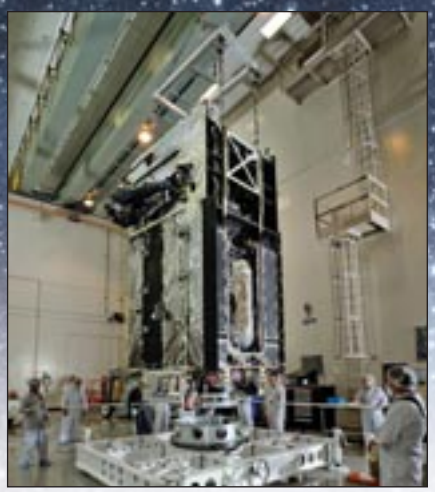
The technology of air casters has proven to be the industry's growing alternative. This advanced technology is the outgrowth of a traditional air hockey game played on a low-friction table with pucks suspended on a cushion of air. For satellites or other structures, compressed air in the casters gently lifts the structure at the base while friction is practically eliminated. Air casters can turn a satellite in its own footprint by maintaining higher pressure and capacity, both critical when movement must occur in tight and limited spaces. The same pressure and capacity enable air casters to precisely move structures with triple the capacity as those raised by wheeled casters.

Air bearings have proven to be indispensable for satellite assembly and testing. Their design and subsequent enhancements support advanced lifting capacities and omnidirectional movement. An operator can safely lift and move the satellite in any direction and in tight clearances. Although satellites can be considered large and unusual loads, air casters can easily maneuver them into tight spaces without requiring additional space for a danger-free zone.

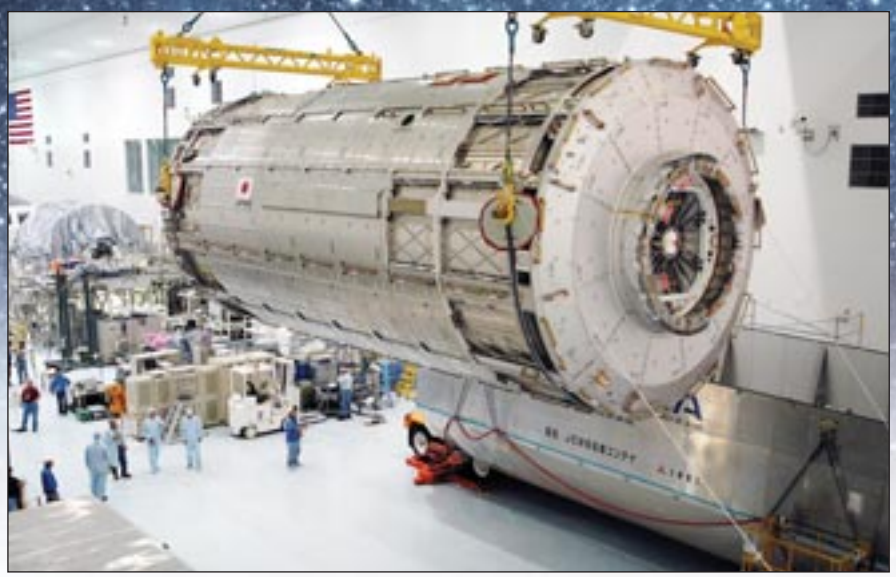
Clean Rooms, Air Casters and Cranes

Most satellite testing is conducted in clean rooms where contamination must be avoided at all costs. Contamination and vibration are just two major concerns that, if not completely addressed, jeopardize satellite functionality and safety. NASA and commercial satellite manufacturers emphasize the importance of procuring equipment for testing and positioning in a clean room environment that will not damage the satellite. Another concern is avoidance of damage to the clean room floor. That stipulation eliminates the use of wheel casters for repositioning since they could easily wear grooves or cause other imperfections to the room's pristine concrete and epoxy floors.

The remaining options for satellite movement are cranes and air casters, both of which must comply with NASA's strict criteria. The most obvious drawback with cranes is the extensive



Lockheed SBIRS satellite



The 96,000 lb. shuttle payload trailer is moved and positioned in a cleanroom.

Lockheed uses air bearings with a powered drive to move the 13,600 lb. AEHF SV2 satellite and transport structure.

space required for them to operate effectively and safely. While some testing and/or clean rooms can accommodate crane usage, many other facilities lack the access and have no desire for budgetary reasons to expand the testing facility to accommodate them. Composite fabric air casters cross steps and gaps allowing for omnidirectional movement even when conditions are less than optimal, which is usually the case with confined spaces.

SBIRS and Air Casters

Lockheed Martin can attest to its reliance on air casters for satellite movement. In this case, the satellite is SBIRS (Space Based Infrared Surveillance) that provides early missile warning to the United States military. Described by Lockheed as "one of the nation's highest priority space programs," its missions also include technical intelligence and "battlespace awareness." The corporation's SBIRS consists of a combination of satellites and other payloads that perform their functions in two orbits: Geosynchronous Earth and Highly Elliptical.

Testing the satellite before it could be delivered to the launch site initially posed a challenge for Lockheed Martin. The test chamber for the 10,565-pound SBIRS had no crane access and the expense of extending the crane into the test room was considered prohibitive. Instead, the corporation turned to air casters for a viable and less costly system to move the important defense satellite. The casters' load modules were embedded into the support structure, which enabled the positioning of the satellite into the exact site in the chamber without damaging the epoxy floors or compromising the environment.

Lockheed, NASA's prime contractor for its Orion Deep Space Capsule, has incorporated air bearing technology for Orion capsule movement at the Kennedy Space Center. The company used custom air bearing pallets that allow small crews to move a capsule across the floor of its facility.

The technology of air casters developed nearly 60 years ago continues to evolve as evidenced by development of stronger fabrics that easily support higher PSIs. These improvements have clearly caught the attention of an aerospace industry always on the lookout for improved functionality without compromising the safety of equipment and personnel. Ease of lift while eliminating the possibilities of vibration, shock or electrostatic discharge has given the industry generally – and satellite manufacturers specifically – an exceptional load moving alternative as is the case at Lockheed Martin.

High Tech Solutions for High Tech Environments

Hard to believe that a technology associated with air hockey from decades ago has progressed to the high-tech realm of satellite movement and testing. Air bearings have proven vital for securely moving satellites on the ground so they can reliably function after launch and deployment, benefitting national defense and space exploration.

This article was written by John Massenburg, President and CEO, AeroGo (Seattle, WA). For more information, visit ***http://info.hotims.com/72997-500****.*