

White Paper

Air Casters' Role in the Modular Construction Marketplace



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Innovative Load Moving Solutions

Executive Summary

Today, Permanent Modular Construction (PMC) is growing at unprecedented rates. Interest in modular construction, in general, has seen comparable growth rates, with increasing attendance every year for conferences similar to the Modular Building Institute (MBI) World of Modular convention, which is in its 35th year.

While the advantages of factory construction include shorter lead times, simultaneous site development and structure manufacturing, safer work environments, and higher levels of quality control over site-built projects, there are inherent challenges at the offsite manufacturing locations. Moving completed buildings or module sections (such as for hotels and offices) around and through manufacturing facilities can be dangerous, damaging, and inefficient. In the worst case, assembly lines can come to a standstill if a modular building or sections need to be reworked. If not adequately managed, the economic, quality and time-sensitive advantages of offsite modular construction can be lost quickly.

Air casters are the solution to the challenge of moving these expensive, awkwardly heavy modular buildings inside the manufacturing plant's environment. Air-caster-equipped modular building facilities can: 1) increase productivity, 2) mitigate safety concerns, 3) improve delivery time, 4) offer opportunities to cross-train and repurpose single-trade workers; and 5) indirectly help to decrease on-site waste.

Trends in Construction

Conflicting marketplace goals make it increasingly difficult to achieve cost reductions for onsite building in the construction industry. The Modular Building Institute has registered the phrase “Greener, Faster, Smarter®” to indicate how modular building can help achieve these goals. These ideals are great for society, for builders, and for enhancing efficiency, but they increase costs for the construction industry as a whole. “Greener” means increased attention to ‘sustainable’ materials, green building codes, less waste. “Faster” means rushing to meet deadlines, which puts more pressure to perform and deliver. “Smarter” usually means investing in better, newer methods, which inevitably cost money. If executed correctly, modular construction has an answer for all three, and it is this benefit that has increased the move to modular.

Tighter completion schedules put pressure on production, which often requires more (skilled) workers, paying premiums for faster delivery, re-scheduling, and regrouping at the cost of other opportunities. Delays by weather, supply chain, and insufficient manpower complements can thwart completion schedules, and worsen with each unmet deadline.

Industry segments using modular

construction are becoming more varied and imaginative. It would not seem that larger projects such as multifamily housing, institutional and assembly, retail commercial, educational, and healthcare segments would be able to apply the concept of building a building inside another building, but they can. These large footprint multi-faceted projects are increasingly relying on modular construction.



Portable structures move through manufacturing process on air caster rigging systems.

More marketplace issues suggest the need for innovation. They include:

- **Output Quality:** Building codes. Must meet quality standards to be acceptable to sell; to sustain life, to meet marketplace demands.
- **Input Analysis:** Labor. Materials. Machinery. Time. Real Estate. Facilities. Everything is measured; data are collected and sifted continually.
- **Safety:** Safety is an issue both for building occupants and for both site-built and offsite construction workers.
- **Competition:** Companies vie for contracts in an unpredictable industry. The Pace survey included a portion of the 212 companies they presume to encompass the overall modular building industry. They noted “the value of construction starts can be incredibly volatile from year to year,” making the need for tight controls vital.
- **Greener. Faster. Smarter:** Applies to the entire construction industry. The construction industry has its challenges, and Permanent Modular Construction offers answers. When air casters are used in facilities where manufacturing modular buildings, the result is better quality, a safer work environment, lower costs, and a higher ability to meet competition as will be shown here.

Inadequacies of Common Heavy Equipment Moving Options

The construction of modular units inside acre-large modular building production facilities offers answers to the more significant challenges noted above. Inside the modular building facilities, equipment that has been used in the past has itself posed complications and delays. To move the oversized, off-balanced structures and building modules, companies have used rails, wheels, conveyors, and overhead cranes, which have the following disadvantages.

1. Wheels can damage floors. Heavy wheels can gouge and mar floors.
2. Wheels move more easily in a straight path and are sometimes resistant and “awkward” when turning in a circular path. Movement is difficult with friction challenging the forward momentum, which puts stress on the building and on the employees involved.
3. Conveyors and rails take up floor space to install them, and they run in straight lines.
4. Conveyors and rails do not allow flexibility of moving the modular structure in and out of the production line.
5. Rails, conveyors, and overhead cranes are expensive and require permanent monuments and structures to be built.
6. Overhead cranes are inherently dangerous.

Forward-thinking manufacturers of modular buildings are using air caster technology to overcome these disadvantages and increase productivity at lower costs.

¹ http://www.modular.org/documents/document_publication/mbi_sage_pmc_2017_reduced.pdf

Benefits of Air Caster Technology

Air casters, sometimes called air bearings or air skates, float heavy loads on a nearly frictionless film of compressed air, which is .003 to .005 inches (.08 to .13mm) thick. The air diminishes the forces of gravity and friction.

The consequence is a lower-profile, reduced-friction alternative to moving heavy equipment or objects in almost any environment—an especially valuable technology for the PMC industry.

With the use of air caster technology, the building components are assembled inside a modular building factory on top of air caster-supported platforms. The air casters allow for complete omnidirectional movement of the buildings from the early, lighter framing stages to the final, heavier stages where doors, siding, floors, roofs, and sometimes bathrooms, fireplaces and inside structures are added, depending on specifications. The finished units can be as large as 16 feet by 72 feet, and from 20,000 to 60,000 pounds. When these unwieldy buildings or components are gently moved on a cushion of air, fewer workers are needed to transport the structures, fewer accidents occur, less damage is done to the manufactured modular building and the work facility. With air casters, there is more control, less jerking, less worker fatigue, and stress. Also, the buildings are moved to the workers' stations, much like on an automobile production line, instead of workers moving to the buildings stationed around an assembly plant. This timesaving is how the modular building industry can often promise 30-50 percent quicker project completion times than traditional onsite building projects. Air caster technology improves production speed and makes meeting these ever-more demanding deadlines possible.



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Air Caster Technology Reduces Industry's Stressors

In general, offsite building construction offers solutions for the construction industry, and for each of the issues plaguing that marketplace. Air casters can further enhance the positive effects of modular construction.

- **Output Quality:** Controlled offsite construction environments increase quality. Air casters make production lines more efficient, with repetitive assembly operations resulting in fewer errors.
- **Input Analysis:** Labor, materials, and equipment are measured and quantified because all three can be found at the manufacturing facility immediately, rather than trying to find and account for them at various, rotating jobsites. At the facility, air casters reduce measurable labor costs by cutting the number of employees needed, increasing the quantifiable speed and efficacy of moving input materials, and improving the ability to put a cost to equipment repositioning (as an example) around a single plant—in contrast to multiple outdoor locations.



Customized supports match manufactures' process requirements.

- **Safety:** Using air casters in the modular building offsite facility reduces injuries, decreases the risk of overhead crane accidents, and simplifies moving the huge buildings.
- **Pushback:** While union pushback is an issue, using air casters allows workers to learn a new skill (air caster operation and science) and fosters cross training. The latter advantage is particularly significant as the Sage Report's conclusion states, "PMC also represents a potential response to growing skills shortages among the nation's construction workforce."
- **Competition:** Air caster technology ensures better efficiencies of assembly, decreased costs, and increased quality. PMC companies are better equipped to meet and beat their competition, win more contracts, and stay in business.
- **Greener. Faster. Smarter:** Using air casters indirectly helps reduce waste (Greener) at project sites, directly increases the speed (Faster) of production, and is a noticeably Smarter (and safer) way to move heavy, large and unwieldy modular buildings.

In summary, air casters offer surprising, innovative, flexible, low-cost options to existing load moving alternatives in the offsite modular building facility.

² http://www.modular.org/documents/document_publication/mbi_sage_pmc_2017_reduced.pdf

AeroGo's Product Line for the PMC Industry

Three AeroGo products supply solutions to the Permanent Modular Construction industry. Two are existing products in the AeroGo lineup, and the third is AeroGo's longstanding commitment to responsiveness to the industry's needs for customized systems.

1. The Air Caster Rigging System

- Can be repositioned to fit a variety of load weights and shapes and handles uneven loads
- Offers lightweight modern aluminum construction for easy handling and insertion
- Superior lift height enables insertion moves and overcomes floor surface irregularities
- Precise air pressure regulators with a filtration system
- Customizable support structures based on manufacturer's requirements
- Exceeds ASME B30.1, 2:1 overload requirements for air casters



2. Aero-Drive (also called Power Drive)

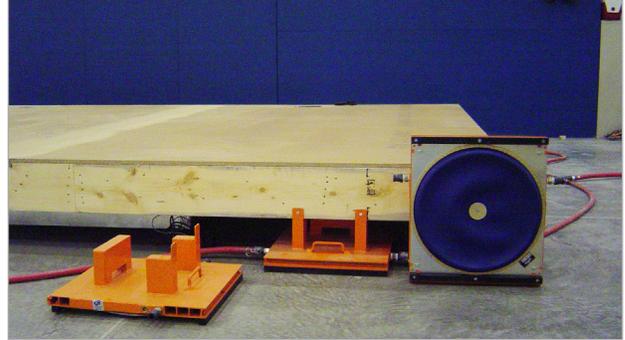
- Provides direct wheel steering and high torque for intuitive and precise placement of heavy loads, even in tight spaces.
- User-friendly, centralized fingertip controls allow the operator to precisely position and place loads in any direction.
- Easily adjusts for varying loads.



3. AeroGo Customized Systems

- Experience: Years of engineering and design knowledge in the industry
- Variations: Addressing a variety of modular building challenges

AeroGo is committed to the modular building industry with standard and custom products that have proven to help meet the rising demands for modular construction.



Summary

It is important to reconsider the viability of the traditional site-built construction project, surrounded by dirt and weather, before starting to build. To offset increasing building costs, many segments of the traditional construction industry are being shifted to offsite PMC projects including education, multi-family housing, office, government, healthcare, dormitory, hospitality, and retail. Twenty- and even thirty-story buildings are being built using modular processes. Walt Disney World and Hilton Hotels among many others already have modular-built projects in place.

Off-site modular construction speeds delivery and enhances quality because of its control and measurability. Incorporating newer technologies, such as air caster equipment, will pay for itself in productivity and efficiency enhancements, improved worker safety, shorter lead times, and lower project costs leading to higher profits and corporate viability. Air caster technology by AeroGo has a dependable history in this environment with a stable engineering base and an open mind to make their customized solutions in the modular building industry even better.



About the company:

Since 1967, AeroGo, Inc. has been manufacturing innovative load-moving equipment, using wheels and hovercraft technology to move heavy, awkward, or delicate loads. Companies large and small benefit from AeroGo's worldwide dealer network, experienced product specialists, and skilled engineers. From Standard Product offerings to highly customized Engineered Systems, AeroGo has an innovative solution for every load moving need.



“AeroGo maintains a dynamic and interactive management style to allow greater flexibility in meeting the requirements for our customers. Managers become active participants in every program, from the program's inception through installation, training, and operation in our customers' facilities. We optimize communication between departments and our customers by creating teams for each project and by reducing the management levels between upper management and first line supervision.” John Massenbug, CEO, AeroGo, Inc.



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