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Conquering Equipment Moving Challenges in Lab Facilities

Transporting large, sophisticated lab instruments requires teamwork and an efficient strategy

BY DEVIN CHANDLER, BSME, AEROGO, INC.
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Moving equipment, machinery, and materials through a lab environment can be challenging. A New Mexico multidisciplinary science and engineering research center, which conducts renewable energy, space exploration, and nanotechnology research, struggled to find a safe way to maneuver newly delivered equipment of various sizes into a cleanroom through multiple chokepoints. The equipment needed to be transported safely through a labyrinth of narrow corridors and doorways in a building packed with other equipment, supplies, and people. Other important considerations included, tight space constraints, preserving cleanroom conditions, and protecting the load, people, and facility from damage.

What material handling system would work best for a lab move like this? Unfortunately, there's no one-size-fits-all answer. Laboratories considering their options need to assess specific challenges they face and the risks inherent with each material handling system before determining the most feasible and desirable option.

This guide identifies the major challenges of moving lab equipment and will help labs avoid pitfalls and make informed decisions.

Challenge #1: Accommodating the load

At the top of the criteria list should be verification the material handling system can successfully accommodate the load's shape, size, and weight. All three considerations are equally important.

Some equipment like large chromatography columns can weigh hundreds of pounds, which eliminates several options immediately, such as human lifting power and simple wheeled vehicles capable of accommodating light to moderate weights. In other cases, equipment might be relatively light but awkwardly shaped or sized, such as centrifuge rotors. Because these are generally light-weight, lab staff may be tempted to carry them, but their odd shapes can make them difficult to lift in an ergonomically safe way.

In general, the most flexible material handling systems for accommodating a range of weights, shapes and sizes include air casters (which float loads on a thin film of nearly frictionless air and function like hovercraft), cranes, and fork vehicles.

Challenge #2: Accommodating the facility

The layout of a laboratory facility is designed to locate dangerous, delicate, and sensitive equipment and supplies away from general use spaces like offices. Safety equipment and structures (fume hoods and chemical storage) are always strategically placed away from entrances and exits to avoid contamination. In addition, a laboratory may be tightly packed to maximize use of space with narrow corridors and doorways that can create bottlenecks. The best material handling system for this layout must fit and maneuver through the tightest point on the intended move path and access hard-to-reach spaces that have been intentionally located away from the main path.

This was the case with the multidisciplinary research center, with its multiple narrow hallways and chokepoints. Systems that require more space to operate are less functional for this environment, such as fork vehicles, which take up a significant amount of space and require a large turning radius in addition to the volume of the equipment. Hand-powered tuggers —hand-operated material handling equipment such as pallet-jacks and tow carts— tend to struggle when there's insufficient room to maneuver, turn, or back up although they are common in labs and cleanrooms. The reason is the tuggers' design is a two-piece system including a base on which the load rests with a separate steering segment connected at a pivot point.

When maneuvering space is a serious limitation, the alternative is a system that works from overhead (a crane) or fits within the footprint of the object being moved (an air caster, pallet jack, or skid that can slide underneath the object and lift it slightly). These systems minimize the space required to move the load.

Some additional questions to consider when trying to accommodate a specific facility are:

- Does the intended load need to move along a single linear path only or must it traverse variable paths?
- Does the move require any verticality (lifting or descent)?
- Is the material handling system capable of accessing and fitting into hard-to-reach places?

- How much space does the material handling system require to operate?

The issues to be analyzed are the system's flexibility and maneuverability. A straight-line path is the easiest to satisfy; a clear indication that any material handling system will work. Air casters and cranes tend to offer the most flexibility to accommodate variable and vertical paths although tuggers and transfer carts can usually move through a labyrinthine facility.

Challenge #3: Preventing contamination

One of the cardinal rules of working in a lab environment is keeping the area pristine to minimize contamination and other safety risks. Additionally, all tools used within cleanroom settings must maintain a range of cleanroom conditions, potentially up to Class 1ISO 8 specifications.

In these environments, it's best to avoid motorized material handling systems because of their requisite fuels and lubricants that produce fumes and volatile organic compounds. Even non-motorized vehicles can introduce contaminants if they involve wheels or surfaces that can grind, scratch, or scrape flooring, potentially producing paint flakes and other particulates. Systems that isolate the load from the floor, either via overhead lifting (cranes) or floating the load above the floor's surface (air casters), will prevent such risks.

Challenge #4: Protecting against loss and damage

Frequently, labs need to move potentially dangerous and delicate equipment and materials. Many of these items cannot safely be exposed to vibration, shaking, or impacts. If the material handling system transmits vibration or shock loads to the columns every time it runs over roughness, bumps, or gaps in the floor, it could damage internal components and affect its performance. In other cases, equipment may be delicate and prone to damage or contain dangerous compounds. To minimize the risk of vibration and shock loads, consider lifting from above (cranes), floating above the floor (air casters), or wheeled vehicles with built-in suspension systems.

Another issue to consider is chain of custody. Does the material handling system require certification, credentials, or skillsets that lab personnel do not possess? If that is the case, potentially valuable or sensitive materials may have to be placed into the custody of contractors or subcontractors. However, not all material handling systems require specialized expertise. Carts, tuggers, and air casters can be operated by virtually anyone with minimal training, so lab personnel can be trained to handle the move themselves, or closely supervise the move to address the hazards, risks, and needs of the lab.

Challenge #5: Protecting against injury

Injuries during equipment moves are surprisingly common even for trained laboratory personnel. Lifting injuries and accidents involving powered transportation vehicles are among the most frequently cited workplace safety risks, according to the U.S. Occupational Safety and Health Administration (OSHA) and the National Safety Council (NSC). The material handling equipment must be as safe for human operators as for the materials and equipment to be moved.

Assess the risks for different systems, especially if the human operators need to exert force for load movement. One example: a load weighing more than 1,000 kg. (2,204.6 lbs.) could sit on a wheeled cart or vehicle, but the force required to move this heavy load can result in ergonomic strain and injury. By contrast, air casters virtually eliminate friction and require only one to five pounds of force per 1,000 lbs. of weight on a level surface.

In general, the safest material handling systems are those that keep the load low and stable while minimizing the effort human operators must exert. “Don't forget injury prevention during loading and unloading of the material handling system too: the safest solutions are those that spare human operators from having to lift objects themselves or potentially put their fingers at risk of being crushed, by using something like skids, pallets, or air casters that can just slide under the load and lift.”

Challenge #6: Fitting within budget

Material handling systems can vary significantly in purchase and operating costs. Cost for a typical indoor crane system may range from a few thousand to tens of thousands of dollars. Cost analysis should also include the expense for certified operators along with the regular maintenance and upkeep motorized equipment always requires. Cranes can be surprisingly slow, which translates into additional costs from time lost due to the wait for an operator or equipment to become available, time to attach the load to the crane, load movement time, and detaching the load and setting it in place. Another potential detriment associated with investment in a crane system is that financial resources might have to be diverted from research equipment or other value-generating activities.

Simpler material handling systems reduce those expenses. Push systems, for instance, excel here. They usually require only minimal operational and safety training, and are relatively inexpensive to implement, maintain, and use. Air casters typically require the least maintenance of the major move systems; they have no moving parts and use only standard compressed air (under 25 psi). Cranes and other motorized vehicles will require the most upkeep and frequent repairs.

Transport service providers, also known as rigging services, can be hired for specific equipment transport jobs. Hiring external services can be a more cost-effective option if the investment in purchasing material handling systems for your lab is too significant.

Evaluate and choose wisely

Many labs will need to move heavy loads, including equipment, machinery, and supplies at least once. Lab managers must choose from a variety of load handling equipment options and services. The varying characteristics of each system makes the selection process challenging and complex. Unfortunately, too many labs default to the system they are already familiar with or have on hand, which may not be best suited for their next move. The research center referenced above initially leaned toward tuggers because of previous experience, but ultimately settled on air casters because of their ability to navigate tight corridors. Other facilities facing different conditions may land on other solutions. Ultimately, the increasing complexity of moving a variety of equipment and the need to keep lab personnel safe increases the importance of selecting the right load-moving system to keep the lab moving productively, efficiently, and cost-effectively.

About the Author

Devin Chandler, BSME. is sales engineer in the Custom Products Group at AeroGo, Inc.

References

1. https://www.nsc.org/newsroom/osha-reveals-top-10-safety-violations-for-fy-21-at