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CHAPTER 5

Advantage

Expecting the Unexpected

Using scenario planning to improve the lab construction process

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Beyond the partnership of owner and architect, all major lab construction projects are delivered by loosely organized systems also comprising vendors, contractors, subcontractors, and fabricators. As new laboratory buildings come on line with plans that call for sophisticated technology, the installation of which must be carefully sequenced, it is essential for both owner and architect to understand project roles, resources, systems, and to ensure that all participants are fully vested in the project's successful completion.

Two of the most important elements of scenario planning in suc-

they must take to bring the project to a timely and successful completion.

EQUIPMENT PLANNING AND PURCHASING

Beginning early in project planning, architects and laboratory planners work with owners to assess and accommodate the specific equipment needs of laboratories and procedure rooms. Much of this equipment may be developed by vendors and manufacturers on an "as purchased" basis, where equipment is not fabricated until an order is

cessful lab design are the careful sequencing of equipment delivery and installation, and the scrupulous examination of the impact of the new laboratory's operational requirements on campus-wide systems.

To ensure the unhindered completion of a lab project, owners usually engage construction managers, pro-

gram managers, clerks of the work, or management consultants to synchronize this complex task. As the advocate for the owner during construction, however, the architect often undertakes risk management consulting and scenario planning,

working with the owners to help manage the uncertainties of the construction process and associated costs and to advise them regarding actions

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placed. This method has certain advantages, allowing a scientist to wait until late in the construction process to purchase the latest technology. However, it also poses a challenge for the architect to design spaces to accommodate sophisticated technologies, such as imaging and high-resolution analysis equipment or electron microscopes, without the benefit of precise equipment specifications and information.

Ideally, by conducting scenario planning to consider all likely iterations with the owner and the equipment vendor, the project design team will be able to anticipate the range of equipment configurations even though the specific equipment and technology requirements are not yet fully known. Analyses may then be developed to design building systems' capacities for a range of electrical, mechanical, plumbing, and structural, vibration, and space requirements to accommodate such equipment. This sequencing of design decisions—allowing construction to proceed, and allocating costs for equipment purchase and its subsequent installation and testing—gives an owner the greatest flexibility to purchase the latest technology while bringing the laboratory on-line in sequence with the opening of the building.

The best laid plans, however, do not always anticipate all possibilities. When a scientist purchases an old cleanroom tool on e-Bay for which there are no specifications or manufacturer's operations manual, the mechanical support for the tool may be adjusted in the field. Responding to a request of a newly arrived faculty member for laboratory specifications that exceed the building system's capacities may require adapting equipment so that it is accommodated within the building's metrics. If the vendor is designing new equipment to meet a scientist's requirements, and the design criteria are evolving during the manufacturing sequence, the architect may craft an allowance to anticipate overall costs for fitting out the lab at a later date.

Working with the owner to anticipate such "what-if's" during the design phases will help to set expectations that there may be late decisions, to discuss how the design team will deal with them, and to allow the owner to manage the risks of increasing construction costs to accommodate work that is out of sequence. The owner can play a central role here; open communication among all members of the owner's team throughout the design process can help both owner and architect anticipate staff requirements and expectations.

CONSTRUCTION SCHEDULING UNCERTAINTIES

Construction schedule delays are frequent and may be unpredictable. While they are not unique to laboratory construction, their impact on these projects' sophisticated and myriad technologies and complex sequencing pose particular problems, including the risk to the owner of further construction costs. Additionally, it is important to evaluate the potential impact of construction delays on research grants and donor funding.

It is particularly worthwhile to focus on scenario planning for the construction of special elements because of the potential for encountering the unexpected when coordinating the work of multiple vendors. Whether the greenhouse superstructure is fabricated late or the artist-in-residence cannot deliver the etched glass for the stair railing in time to meet the construction schedule, it is essential for architects to work closely with owners and vendors to develop interim solutions to ensure the successful delivery of the project in such situations. An interim solution may allow the building to be enclosed or the certifi-



Delays in delivering an air handling unit meant that this structural support had to be temporarily removed to permit the unit's installation.



While not eliminating the unanticipated during construction, scenario planning and communication among the project team and with vendors will direct the most satisfactory resolution.

cate of occupancy obtained without undue delay. Regular communication with vendors is a wise investment of time to avoid last-minute surprises, as is discussing installation methods with contractors, including the need to create temporary access and signage around unexpectedly delayed construction.

That said, construction delays may offer their own silver lining. Architects and owners may be able to transform the post-occupancy installation of special elements in a lab building into learning opportunities for the building's occupants, using the installation as a teaching tool to focus on both the elements themselves and aspects of the science of their construction and connections to building systems and controls.

SITE AND UTILITIES COORDINATION

On a dense urban or campus site, "getting out of the ground" may be the most difficult aspect of construction. Subsurface investigations before the start of construction help the design team anticipate the unseen and unforeseen aspects of site and utilities preparation. In cases when site contamination is suspected, it pays to develop scenarios that anticipate the discovery of contaminated soil or long-buried construction debris. Occasionally a persistent leak in municipal subsurface piping may fill a construction site with water, requiring special dewatering construction.

It pays to be a good neighbor. By anticipating the possibility of requiring distant tie-backs for deep excavations, the owner and architect can coordinate with abutting property owners or local authorities in advance. At the same time, scenarios can be developed to plan the logistical requirements of construction implementation, ensuring the uninterrupted operations of adjacent properties during construction.

APPROVALS FROM AUTHORITIES HAVING JURISDICTION

Anticipating timely reviews and approvals from local, state, and federal agencies that may have jurisdiction for permitting the project is critical to meeting the project schedule. Identifying and sequencing the process for obtaining approvals from overlapping or conflicting jurisdictions and building the time for approvals into the project schedule aids the design team as well as the owner.

It is a valuable investment of time to brief authorities early in the process and keep them apprised of developments. Doing so helps orient officials to the project's scope and requirements. Establishing an open channel of communication between code officials, architect, and owner makes securing approvals at the end of construction more straight-forward. Ensuring that owner and architect speak with one voice is of particular importance when coordinating with regulatory authorities.

Informative meetings and site inspections are all the more important when a building official is not familiar with the complexities of a lab building and the various codes that address the construction and ventilation of elements such as chemical storage rooms and vivarium facilities. Be prepared to address the impact of unforeseen changes that authorities may require upon site inspection. Some items may be anticipated; for instance, authorities' need to add exit signs may be met in advance by purchasing extra signs to be on-site and available for installation without delay. In other cases, the established relationship with authorities and their understanding of the architect's commitment to meet the new requirement are valuable in avoiding both further delay and any adversarial relationship.

LONG-LEAD ITEMS

It is customary for contractors and construction managers to anticipate the long-lead delivery time requirements when ordering air handling units, elevators, electric switchgear, fire shutters, and other large building system equipment, so these are less frequently an issue. Near the end of the construction process, other finish items may entail long-lead delivery times as well. To avoid unanticipated delays in completing construction, these finish items may be purchased well in advance. This includes such items as specialty lighting fixtures, building and donor signage, special hardware, custom art, certain stone or decorative materials, and toilet accessories. Special attention should be given to those critical items that can delay or adversely impact occupancy, such as railings, signage, and lighting.

Another aspect of timely delivery is the loading dock—which may actually be one of the most critical aspects of creating a new lab building. All operational systems intersect at the dock, including staging for move-in, deliveries, trash and hazardous waste, recycling, and building provisioning. Thus the loading dock location and condition warrant special attention. Anticipating the scenarios that occupancy will require, such as sequencing the move-in of scientific experiments already in progress, will prepare a smooth transition for the owner to the new facility.

OPERATIONAL SEQUENCING

The advanced technology in today's complex laboratory buildings requires training for the facilities staff members who will operate and support the building and lab systems. Existing infrastructure evaluations will determine whether the existing campus systems have the capacity to support the new building's operational requirements. Public safety requirements and responses change when the new building—particularly one which may house potentially hazardous components—comes on-line. The new operations and maintenance procedures required for the new equipment may be challenging to the existing facilities staff members.

Never underestimate the time required for training. Anticipating the schedule for training, debugging new systems, adjusting building controls, and commissioning and certification of piped gases, instrumentation, and imaging technology will allow the architect to inform the owner of requirements in advance of move-in dates.

In summary, the opportunities for scenario planning are myriad in any construction project, but are essential for the successful and timely completion of a laboratory project due to the complex and sophisticated systems and technology that lab design requires. By taking the opportunity to develop scenarios for the design and construction of the building, and to assist the owner in managing the risks of delayed construction and its increased cost, the architect can proactively establish expectations with the owner for unanticipated events.

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