CHAPTER 1

Project Management for the Construction of Conservation Laboratories

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The construction of a new library with a conservation lab, or even the renovation of an existing lab, can be a very daunting endeavor. Approaching the project in a structured, organized manner can help alleviate much stress and prevent costly overruns or a poorly functioning lab. Breaking down the undertaking into specific routines and tasks can make the experience manageable. The project management field exists to manage complicated jobs and will help a conservator or library administrator to divide the processes into understandable tasks. Understanding the language and practice of project management will also help to gain insight on how the venture is being run by the project manager and where the conservation lab fits into the grander scheme.

Project management is regularly used in many industries in the corporate sector, primarily in manufacturing and information technology. The practice is beginning to grow in libraries to help manage large, complex library endeavors even though there is little in the library literature that addresses project management in issues such as a major grant and reformatting or migration projects.[1] The processes outlined in project management can be useful to be aware of, and to practice, in the construction or

renovation of a conservation lab. Knowing the basics of project management will help conservation or preservation professionals (hereafter referred to simply as conservators) communicate better with the project manager and contractors and help in the planning and completion of a lab that meets the conservator's and/or institution's needs and specifications.

There are many articles on specific topics relating to the design and construction of labs but very little on the full process of how to manage these projects from start to finish. This introductory chapter will provide the conservator with an overview of project management processes and terminology as well as the skills and steps necessary for managing differing scales of construction projects. Because the focus of this chapter is process, please consult the rest of the chapters in this book for details on specific issues alluded to herein.

BASIC PROJECT MANAGEMENT

"Project management is the application of knowledge, skills, tools, and techniques to project activities to meet project requirements. Project management is accomplished through processes, using project management knowledge, skills, tools, and techniques that receive inputs and generate outputs."[2]

Conservation laboratory construction comes in many shapes and sizes from a new design to specific updates of existing spaces. Regardless of the size of project, the processes associated with project management can be scaled to fit the needs of the project. Although the conservator will not be the lead on the construction project, the language and processes should be learned to support the construction process and to ensure that outcomes for the project are met. Through an understanding of the project management process, the conservator will have a better sense of what needs to be done at what stage and by whom.

KEY ELEMENTS

A project, at its core, has a definite starting and ending point and is undertaken to create a new product, service, or deliverable.[3] To ensure fulfillment, project management processes focus on distinct elements flowing and interacting in a logical manner. These elements include initiation, planning, executing, monitoring and controlling, and closing and they interact with each other on a continual basis. For example, monitoring and controlling will occur with every process to ensure efficiency and prevent over-expenditure due to errors. The

use of project management ensures that any size project is not only executed, but also managed, in the most efficient way possible.[4]

In addition to the core processes, project management also incorporates other concepts that are key to success. These include the management of scope, risks, human resources, communication, procurement, and integration.[5] For conservators working on a building project, the management of scope, risks, and procurement will be the most important because these concepts will define the size, shape, and layout of the lab.

SOFTWARE

Project management software comes designed for various types and sizes of projects. It includes scheduling, cost control and budget management, resource allocation, and communication elements, which help keep the complexity of large projects organized and under control. Some programs to consider include Microsoft Project (micosoft.com/project) and the open source option Redmine (www.redmine.org). There are larger software lists available at www.web-based-software.com/project-management and www.cyberciti.boz/open-source-project-managment-software.html. For most conservators, the software can be helpful for creating and managing schedules and budgets on the scale needed for a construction project and for those in larger institutions, some software may already be licensed to your organization and freely available.

The following sections will lay out each individual process and how each relates to what the conservator needs to do to ensure the satisfactory completion of the lab space.

INITIATION

For large, institution-wide projects, conservation staff will not necessarily be involved in the early stages of the initiation process. However, it is in the best interest of the lab to be aware of planning on the institutional level to be able to become involved as early as possible. It is during the initiation stage that the full scope of the project is determined and the relationship of the project to the institution's strategic plan is identified. It is also during this step that the budget is set.

When an institution initiates a project, it is extremely important to create a scope statement. In project management terms, the statement comprises: the job name; stakeholders (institutions, collections); goals and objectives; requirements (staffing, equipment, space); deliverables (what the lab will look like and how it will function); milestones (what will happen when); and cost

estimates. What this means for a conservation lab is to create a statement that details the background and future goals of who, what, how, and when it will be used. It includes statistics on workflow, workload, staffing, whether the work is project-based or use-based, and any specialized equipment currently in use to complete these projects. It should also include structural and technical information on the space occupied and how this space is used. The more specific the statement of scope can be on what the conservation lab will look like, the better the chance for the appropriate budget and square footage needs to be allocated. Think of the statement as a very detailed and delineated white paper. When thinking about the scope of the lab, also consider whether its use will be specifically for collections conservation, special collections conservation, or a hybrid lab doing both. Each of these scopes is going to have its own unique considerations in terms of space, equipment, staffing, and so on. For a discussion of hybrid conservation labs and their own unique requirements, see chapter 3, "Special Collections, General Collections, and Hybrid Conservation Laboratories."

Regardless of the project size, it is in this early stage that the lab should begin working with the institution's development office to begin fund-raising efforts if funding is readily available. The focus should be on the capital campaign but the conservator should also push for endowments to pay salaries beyond the life of the project, especially if funds are not in the overall library budget for staffing. Endowments can also be set up for extraordinary equipment purchases and special conservation treatments beyond the life of the construction project. Fund-raising will extend beyond the initiation stage, but a set goal to be raised by the start date helps to ensure full funds are raised to complete the project.

PLANNING

The planning process involves gathering information from many sources to develop, identify, define, and mature the scope, costs, and schedule for the project.[6] The project manager should involve all the appropriate stakeholders, including conservation staff, regardless of whether a new lab is planned or the project is a renovation. This is the most critical aspect of the whole project for conservation to be intimately involved in.

As the conservator begins working on the specific plan for lab construction, it is helpful to dissect the project into its component parts. Breaking down the plan into scheduling, research, specifications, and budgeting phases makes each stage more manageable and promotes more accurate and thoughtful planning.

Scheduling

Using either existing project management software or an Excel spreadsheet, create a checklist of tasks with a schedule for completion. When planning, be sure to factor in time for training in issues such as reading architectural drawings, electrical schematics, ventilation, and ducting to better understand and evaluate building plans. A regular schedule of meetings with the project manager is also an important task to include in any schedule. Do not forget to factor in time for risk assessment and planning in the event of disasters or otherwise. Finally, in the interest of the collections, staff, and patrons, research building materials to allow time for off-gassing of building materials and the return to pre-construction air quality.

If using project management software, the ability to create a Gantt chart is built in. A Gantt chart is a floating bar chart illustrating a project schedule. or time line of events. Gantt charts include the initiation and completion dates of the major tasks in a project. If project management software is not being used, a Gantt chart can be created in Excel. For directions for Excel 2010, see www.youtube.com/watch?v=sA67g6zaKOE. See figure 1 for an example.

When scheduling, be realistic with the days allotted to complete each facet of the project and be sure to build in flexibility to allow for staff absences, holidays, and delays. A good benchmark for flexibility is to build in 10 percent for each step of the process. For questions regarding how much time to allot to tasks, think about experience in similar tasks, speak with colleagues, or, for those involving construction, speak to the project manager.

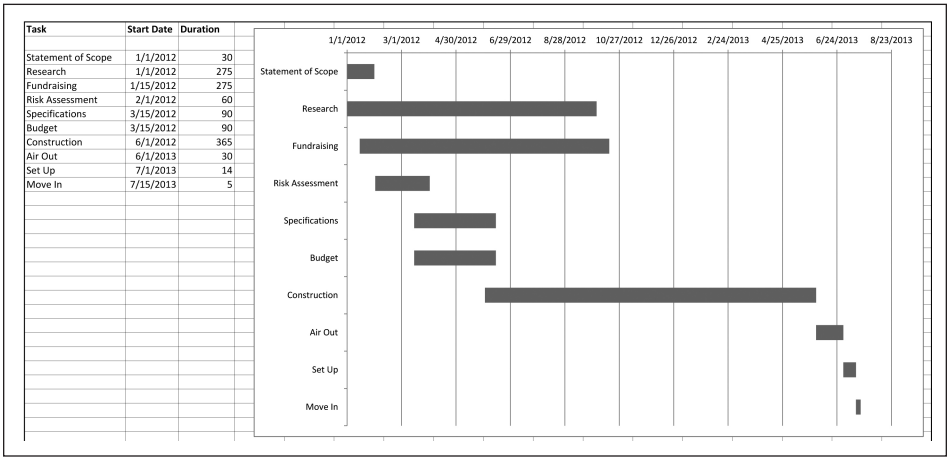

FIGURE 1

Example of a very basic Gantt chart created in Excel for a lab construction project.

Research

As an early part of the planning stage, visit, talk to, or get images from other labs—mostly those more recently constructed or renovated—and places of work that have similar functions. The phrase has become cliché, but thinking outside the box can be very beneficial. Create a list of functions such as transporting large flat items or moving trays of water and think of other places that perform similar tasks (restaurant kitchens) to think about features and tools that help improve efficiency (hands free sliding pocket doors) and safety within the lab. Traveling to other labs and work places is also good for researching layout, lighting, storage, materials, ventilation, accessories, and equipment. Taking notes and, more importantly, pictures or video is critical if visiting different sites; these become invaluable aids when communicating with architects who are unfamiliar with conservation's esoteric tools and heavy equipment. Wherever possible, gather technical manuals for newer equipment to provide wiring diagrams, weights and measurements, specifications, and operator clearances. After making visits, be sure to create a spreadsheet or document listing all features desired for incorporation into the current construction project.

Features and issues to consider in the planning stage include:

- freight elevator;
- ceiling height;
- plumbing and floor drains;
- ventilation (fume hood, elephant trunk system);
- floor loading;
- lighting (localized, overhead, specific temperature or wavelength, natural);
- windows (light filtering, location, sizes, type);
- door size;
- storage room(s);
- clean/dirty room;
- mold work room (negative airflow, special ventilation);
- chemical treatment room;
- humidity control room;
- isolation/quarantine room;
- photodocumentation room;
- matting and framing space;

- current and anticipated staffing levels;
- safety and security (access, fire suppression);
- electrical needs (outlets, hardwiring, portable, etc.);
- equipment specs (optional features—i.e., explosion-proof motor);
- compressor (noise); and
- work surfaces (color, material, built-in or moveable, uniform, chemical resistant).

Once a list of features and equipment is created, the difficult job of selection and prioritization begins. Analyzing the scope statement and the budget will assist in the decision-making process. Prioritization will not be a one-time activity but will occur continuously as budgets, plans, and institutional support develop.

Specifications

As the lab plan starts to take shape, initiate communication with any needed consultants, some of whom may be contracted for the overall project. Conservators are not well-versed in construction issues and will not have the time to become so during a construction project. Topics for which consultants may assist with expert advice include:

- electrical (special wiring for equipment);
- HVAC (special duct work, special units or zones, control);
- lighting;
- OSHA (Occupational Safety and Health Administration) and chemical safety;
- fire suppression (water based or chemical based);
- ergonomics; and
- efficient layout.

The skill to be able to influence administration is crucial for the whole project, but is most important at this stage to ensure the money is forthcoming for consultants. By using professional, experienced design and specialty consultants, the lab will be better designed, more efficient, and, most importantly, as envisioned by the stakeholders. In addition to consultants, work with the architect, structural engineer, and project manager to establish specifications for flooring, counter height, adjustability of work surfaces (see chapter 8, "Ergonomic Considerations for Furniture and Equipment in Book and Paper

Conservation Laboratories" for more information), sink dimensions, fume hood/exhaust system locations, and locations of specialty rooms in order to meet regulatory compliance and preserve the desired specifications.

As the project develops and building plans are solidified, an accurate rendering of the space with square footage will become available. At this stage, begin working with existing and planned equipment, furniture, and work space requirements to define the layout of the space that optimizes workflow, ergonomics, and safety. If there is access to CAD or other layout program, use this to assist in creating the final lab design. Enlist the help of a design consultant if the space will be large and complicated. It may be discovered at this stage that there is not enough space to accommodate all of the desired equipment purchases. Another round of prioritization might be warranted to adjust needs to lab dimensions.

Budget

Once research specifications are complete, revisit the scope statement and break out the details to assist in creating a list of equipment, consultants, and new staffing needs. Put this information into project management software or an Excel spreadsheet. Create a means to deduct these items from the allocated budget to determine if there are funds to cover all the priorities.

Creating an accurate and realistic budget is necessary for a successful project. An important aspect of construction to remember is that over the life of the project, costs will increase. Be sure to build a cost cushion in the budget to cover these increases with assistance from the project manager. More might be needed if the project completion date is more than two years from the point of the planning stage.

As the development and refinement of the budget and the plan continue, be sure to keep all notes, e-mails, memos, and phone messages no matter how small or seemingly unimportant they seem. Maintaining a document trail will ensure that agreements and modifications are in writing and will show how the project has evolved to prevent wasted time in rehashing ideas already rejected. Written documentation will also be useful in the negotiations surrounding project trade-offs, changes, or delays that will crop up during the executing phase. No matter how careful the plans, there will be changes to the project or unexpected problems that are unavoidable and need to be remedied. Once again, there may need to be changes in the plan requiring more refinement of the priorities and agreement from all parties on how to proceed.

Estimate the expenses to complete the project, being as accurate as possible and remembering that they will include not only the cost of the equipment

itself, but also shipping (especially for any large, heavy, or international orders), installation, warranties, maintenance, or repair contracts that may be added. Other items to include in the budget beyond equipment include new staff, consultants (if the institution does not pay for them), and special construction costs not covered by the institution, such as equipment installation outside the scope of the construction project itself. To help cover these extraneous costs, consider working them into fund-raising activities.

A schedule for purchases needs to be created. By planning when orders will occur, costs are spread across the budget duration as well as the construction project. How the schedule gets designed can depend on how the budget is designed (fiscal year– or calendar year–based). Purchase distribution planning can prevent large items arriving at periods in the project when there is no location for safe storage. When setting the budget schedule, plan for any needed specialized contractors (such as designers who specialize in chemical room ventilation or professional layout) as accurately as possible. This may be difficult to do too far in advance but should be possible if there is a good working relationship with the project manager.

Throughout the planning process, continue to take advantage of the excellent public relations opportunity by working with the institution's donor base and community to secure funds for equipment purchases, endowment funds for staff, and special projects. The establishment of a board, trustee, or friends fund for external conservation projects, special equipment purchases after the project is complete, special in-house projects, or internships can have long-lasting benefits for the lab and the institution. When working with potential donors, use of the scope statement will demonstrate to donors the history and importance of conservation at the institution and how services will build upon the legacy to impact the continued growth and expansion of the very specialized services that an in-house conservation lab offers.

EXECUTION

Once the planning is done and the schedule in place, it is time to start executing that plan. For a conservation lab project, this will primarily take the form of ordering equipment, continuing fund-raising initiatives and public relations, searching for new staff (if part of the project plan), and monitoring the progress of the construction. The overall management will be the responsibility of the project manager but the conservator should ensure regular means of communication through scheduled meetings. It will help at this step to understand that the project manager will be coordinating people and resources, as well as integrating and performing the activities laid out in the

overall construction project plan.[7] The project manager will be determining what tasks are required for each stage and may be calling on the conservator to accomplish some of these tasks.

It should be noted that during the execution process, issues will come up that will require replanning. These could include changes in the project schedule due to material availability or staffing problems, among others. Such issues do not always require a change in the overall project plan but do often require analysis. Problems brought to the conservator may require changes in the lab plan that impact overall lab size and layout. For example, a decision was made by the administration to change the exterior of the building to full brick rather than brick accents. This increased the cost of construction, which required an adjustment in overall square footage. The conservation lab square footage went from 2,500 square feet to 1,000 square feet. Will all the planned equipment fit? Will there be space for the dirty and quarantine rooms that were planned? Will this have an effect on the storage space planned? All of these changes need to be integrated into not only the lab plan but also the overall project plan.

COMMUNICATION DURING EXECUTION

Relationships are crucial during construction. Effective communication is the means to promote healthy dialogue during the project's time frame. Learn to work with and influence institution administrators, the project manager, and contractors without pushing or being unreasonable. People have long memories and the conservator does not want to develop a poor reputation during a lengthy project that is challenging for all parties. Be reasonable but firm—be able to explain the special needs of the lab and why these needs are important to fulfill the needs of the institution. It is in this activity that research and training in the planning stage will result in a better lab and better overall relationships within the institution. With a good working relationship between the facilities manager, conservator, and project manager, communication as construction progresses will flow more smoothly.

During the executing phase, equipment will begin arriving. Ideally, the pieces will be assembled and tested. Testing is important; if something doesn't function, send it back to get a replacement quickly to avoid any downtime due to lack of equipment. There is often a time limit for replacements so inspect upon delivery if there is no space for assembly and testing. At this stage the purchase schedule created during the planning stage comes into play. If there is not enough space to assemble and test equipment during construction,

ensure those large items are ordered toward the end of the project to have the time and space to do quality control. However, if the pieces of equipment are very large, purchase and assembly may need to be coordinated with the project manager if this equipment needs special wiring or plumbing or is so large that it needs to be installed before doors are framed out, windows are installed, or craned to the roof deck.

MONITORING AND CONTROLLING

The monitoring and controlling phase includes those processes performed to observe project execution so that potential problems can be identified in a timely manner and corrective action can be taken. The key benefit is that performance is observed and measured regularly throughout the project to provide feedback and identify variances from the plan.[8] This phase of the project is usually carried out by people outside of the physical construction project and hence considered to be a separate process.

The conservator can take an active role in this phase by setting up regular meetings and site visits of the developing space with the project manager to ensure that the specifications created during the planning stage are being followed. It is much easier to change counter height or sink location during construction than after construction is complete. Gaining permission to perform walkthroughs of the construction site may be difficult but it is very important. To facilitate this, the conservator should work with the project manager to comply with all the personnel safety precautions required for a construction site visit.

All inspections will occur during this integrative monitoring phase. Al-- though the conservator will not be involved or initiate most of these, it is the responsibility of the conservator to ensure that inspections related to specialized equipment or spaces are scheduled. For example, labs that have fume hoods and chemical storage areas on a university campus will need to be inspected by OSHA or the university's office of research safety (or other related department) to ensure that all safety regulations are met. All of these specialized inspections should have been researched and included in the lab's project checklist and schedule.

CLOSEOUT

After a long construction project, closeout is what every person involved waits for. Closeout will formally terminate the project and hand over the building or space to the institution or conservator. Moving in may occur at this stage

or at the end of the execution phase depending on whether the project is new construction or a renovation, and if lab staff or contractors will be doing the moving. Be aware that move in is a project in itself.

The conservator may want to ensure that supplementary construction project materials are archived at this stage. If this was an institution-wide project, the more important materials, such as blueprints and budgets, will be archived in appropriate institutional offices. Materials such as memos and preliminary drawings and plans should be archived to ensure the history as well as the availability of these documents for research, reference, or training.

CASE STUDY

A case study of working on a complicated conservation lab construction project was written by Brian B. Considine and published in the *Postprints of the Wooden Artifacts Group*.[9] In his article, Considine describes the planning, design, and construction of a conservation lab dedicated to decorative arts and sculpture.

There are some very good features in his article that will be of assistance to anyone involved in the construction of a new or renovated lab. First, it is clear that the history of the lab and the program were thoroughly considered and profiled as an initial step. Negotiations with the administration for facilities and staffing were also included at this point.

Considine goes into great detail on the different phases of drawing review, schematic, development, and construction. These sections should be studied, not only for the information on reading architectural drawings, but also for the real-life examples of the level of planning needed in a construction project on the part of the conservator. He talks about compromise, trade-offs, and risk assessment in this case study.

The discussion on materials off-gassing and pollutants is useful because of the fact that there was no time for this institution to allow the building to sit before move-in. Considine's frank discussion of off-gassing and the problems with moving in and with environmental controls is enlightening and helpful for anyone finding themselves involved in a construction project.

Finally, the discussion about the punch-list, retrofit phase, and exhaust system is essential reading. This section describes the large and small issues that are found upon moving in and actually utilizing the new lab. Through this phase, it is shown that the smallest detail, such as the quality of the drawer glides, can have a greater impact than expected. It also helps to quantify the

flexibility needed in planning—i.e., bench heights needed to be changed to accommodate new staff (see chapter 8, "Ergonomic Considerations for Furniture and Equipment in Book and Paper Conservation Laboratories" for more information).

The focus of the final section, however, is the major modification to the exhaust and return air duct systems due to the noise level. The retrofit section helps to underscore the importance of research and visiting existing labs with features and equipment you are interested in to learn more about the functionality in a full, working lab.

CONCLUSION

Breaking down the construction, or any large project for that matter, into specific processes and tasks such as initiation, planning, executing, monitoring and controlling, and closing makes the experience manageable and straightforward. Taking the opportunity to initially focus on the scope statement sets the project in motion and lays the groundwork for planning. Breaking down the planning stage into scheduling, research, specifications, and budgeting phases makes the often overwhelming planning process more controllable. A structured, organized approach helps alleviate much of the project-related stress and helps to prevent costly overruns or a poorly functioning lab. By following these processes of project management, the construction of a conservation lab, or even the renovation of an existing lab, can be made manageable.

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5. Kinkus, "Project Management Skills: A Literature Review," 353.

6. Project Management Institute, *Project Management Body of Knowledge,* 46.

7. Ibid., 55.

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9. Brian B. Considine, "The Design of the Decorative Arts and Sculpture Conservation Laboratory at the Getty Center" in *Wooden Artifacts Group Postprints* (Washington, D.C.: American Institute for Conservation of Historic and Artistic Works,Wooden Artifacts Group, 1998): 26–33.