Reclaiming Valuable Research Laboratory Space: Measuring the Cost of Renewal

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Laboratory space is expensive to design, build, and maintain in research-performing universities. The National Science Foundation (NSF) conducts a biennial survey of research space and publishes this information in terms of net assignable square feet (NASF). For the most current reporting period, NSF reported that science and engineering space in the United States totaled 220 million NASF (NSF 2019). Over the past decade, most of this growth was in the biological and biomedical sciences.

The cost of new research space varies by type, purpose, geographic location, and other variables (e.g., utilities, ventilation, security, and complex controls). At Northwestern, $700 per square foot is the planning estimate used by our Facilities Management team.

Poorly utilized space may cost the institution more than it realizes in lost indirect cost recovery associated with sponsored research. In turn, this creates a greater need for research space and disadvantages those faculty who are successful. Successful faculty and their labs often face serious space compression as more scientists look to join their labs. The need for more space creates greater demand on capital budgets. All of this may, in turn, increase borrowing and debit service to build new facilities or renovate out-of-date labs. This undesirable cycle creates more lab space to finance, power, and maintain—further burdening operational budgets.

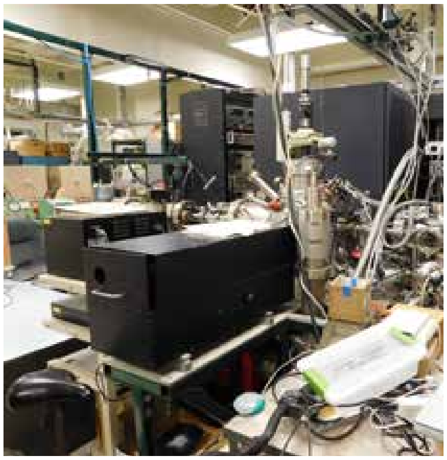
The real culprit in poorly utilized space is junk. Abandoned, obsolete, or broken equipment (junk) without a viable use takes up essential space. Universities and research institutions benefit when they develop effective management and operational approaches to preventing "stranded" space and making it as easy as possible to remove equipment that is no longer useful.

Junk represents an unbooked financial liability that inhibits new, productive science. Seeing this as an opportunity and challenge at Northwestern University, its Research Safety program designed and carried out a proof of concept project that resoundingly demonstrated how laboratory space filled with unused equipment could be renewed and made ready for new science. As it turned out, this also be could be done with dramatic savings.

Working with the principal investigator and staff, we were able to renew nearly 750 sq. ft. of laboratory space and approximately 200 sq. ft. of shelf space for just a fraction of the cost of new construction by the university.

OBJECTIVES IN THE NORTHWESTERN PROOF OF CONCEPT PROJECT

1. Identify a successful lab with a vision of "what comes next" in their work.
2. Partner with qualified vendors who could ensure safe, proper disposal of surplus equipment, scrap metal, and regulated wastes (hazardous and universal).
3. Determine the necessary enabling work (grounding, discharge, disassembly, fluids, and segregation) required by the lab to disconnect and make ready for the disposal of complex equipment.
4. Establish criteria for success and metrics.
5. Develop a project plan that encompassed the work from start to finish.
6. Decide how to report on the project.



From left to right: Specialized scientific equipment requiring disassembly by the lab; Extruder machine (extremely heavy); Valuable shelf space occupied by out of date power supplies.

ABOUT THE LABORATORY

David Seidman is the Walter P. Murphy Professor of Materials Science and Engineering at Northwestern University and the founding director of the Northwestern University Center for Atom-Probe Tomography. A distinguished scientist, Professor Seidman found that a portion of his research space eventually filled up with heavy, complex, and outmoded equipment that represented his work a generation earlier (Photos 1-3).

Since then, Professor Seidman's research activities had moved into adjacent space so he could use instrumentation with current technology. Like scientists in a similar predicament, he needed support to make room for what would become the next phase of research in his field. Professor Seidman's lab was an ideal candidate for our proof of concept project, as he was already developing a proposal for the next generation of his research and equipment—both of which required new (or renewed) space.

METHODS

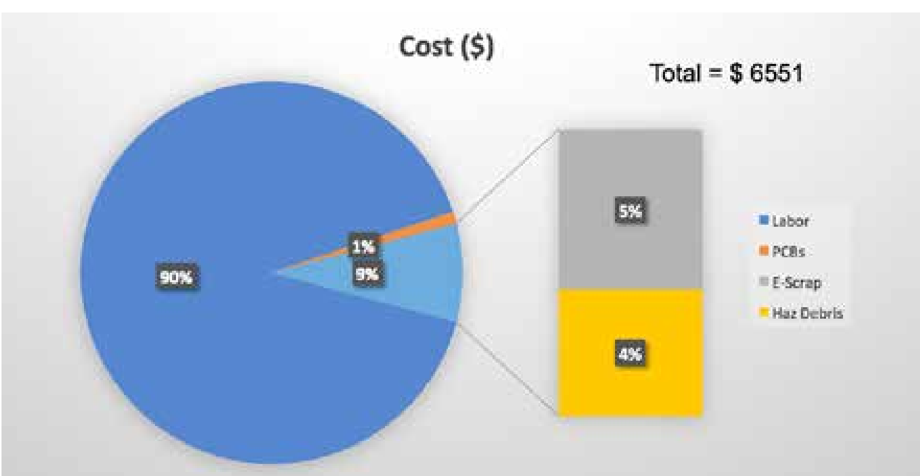
Working in partnership with Heritage Environmental Services, appropriate recycling and disposal outlets were identified for the equipment. The work plan called for the lifting, movement, containerization, and transport of the material in the shortest period of time. To accomplish this project, 30 percent of the nearest loading-dock space would be needed for nearly three days. The project was estimated to cost approximately $9,000. It was known at the outset that labor would be the largest expense.

RESULTS

All equipment in the Seidman lab was inspected to ensure that it would conform to the recycling waste streams ("waste stream" refers to the life cycle of waste from source to final destination). This included removing any liquids or polychlorinated biphenyl (PCB)-containing devices from the equipment. Hydraulic oil was drained from an old compressor and the compressor was decontaminated. Numerous PCB capacitors were removed. Some of the equipment was grossly contaminated and required additional cleaning.

The equipment was sorted into three different recycling waste streams: 1) scrap metal, 2) stainless steel, and 3) electronics. The scrap metal filled a 30-yd. roll-off box consisting of various metal tables, metal slabs, motors, shelving, large pieces of equipment, and some of the laboratory's

FUGURE 1: Project cost in dollars



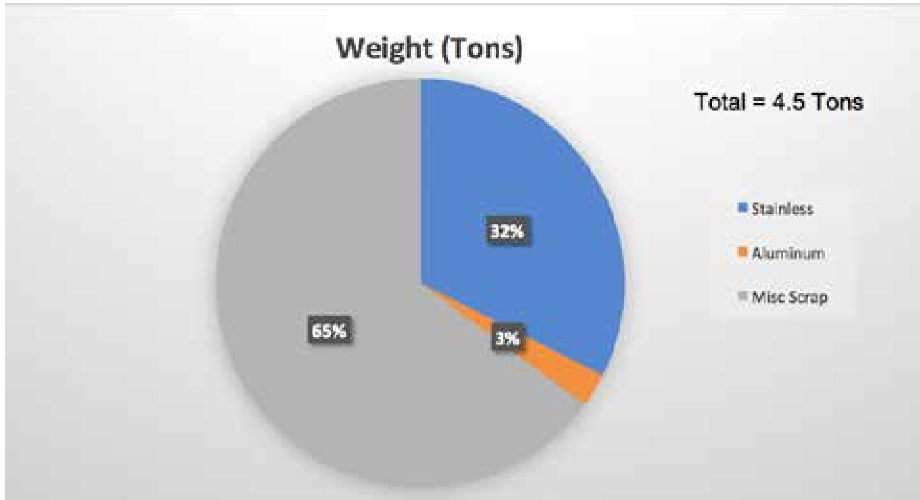
older electronic equipment. The stainless steel was separated, allowing for a significant rebate. One pallet of electronic scrap was generated, which contained items such as radios, televisions, and computers.

There was also some nonrecyclable waste generated from this project that included a 1-gal. pail of PCB capacitors (for incineration). The hydraulic oil was sent for fuel blending. Any contaminated lab debris was sent for incineration. Lastly, any garbage items, such as plastic and uncontaminated debris, were disposed of as general trash.

The final cost of the project was $6,551. Ninety percent (90%) of the total cost was labor (Figure 1). Thirty-two percent (32%) of the total weight (4.5 tons) was stainless steel (Figure 2). The significant amount of stainless steel helped offset and lower the anticipated bill by nearly one-third. We recognize the benefit of this unique windfall.

Photographs 4 and 5 are the "before and after" floor stripping and waxing done just a day or two after the equipment removal. The results are obvious; not so obvious was the immediate positive feeling that followed from having clean space for science.

FUGURE 2: Material weight in tons



From left to right: Immediately after equipment removal; Floors freshly cleaned and waxed

DISCUSSION/CONCLUSION

Laboratory space is expensive to design, build, and maintain. Existing laboratory space may become nonproductive as it fills with equipment that is no longer in routine use. Given the significant expense to build (or renovate) laboratory space, the development of an effective means to help identify and carry out "renewal" makes sense.

REFERENCES

National Science Foundation (2019). "University Research Space Increased by 5.5 Million Square Feet between FY 2015 and FY 2017." InfoBrief NSF 19-313, National Center for Science and Engineering Statistics.

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