Report of the Science & Engineering Library Task Force
Fall 2003

I. Introduction

In June 2002 a comprehensive strategic planning document for the future of USC's Library and Information Technology Services (http://www.usc.edu/isd/strategicplan) was completed. This document, which takes as its starting point the strategic plan for the University as a whole, identifies six “information pathways" critical to the success of USC's academic missions. Committees were assembled in Fall 2002 to develop recommendations for implementing the information pathways, and in January 2003 nine specific projects were identified as particularly urgent. The present task force was assembled in Summer 2003 to conduct a detailed study of one of these projects, the renovation and expansion of the Science & Engineering Library. This project was identified as crucial for the implementation of Pathway Six (renewal of strategic facilities) and Pathway Two (development of interdisciplinary centers).

This task force was charged with two functions: (i) examining the role of the Science & Engineering Library in advancing USC's institutional goals in the near and long term; and (ii) making recommendations for improvements to the library based on academic considerations. We emphasize at the outset that all university libraries are in a period of technology-driven transition, as searchable digital archives begin to displace print media. Long-term planning is therefore inherently difficult. Nevertheless we believe the principal conclusions and recommendations of this report are independent of shifting trends in information delivery.

We believe the Science & Engineering Library's principal role should be to serve as a **common research and learning environment**, which provides seamless access to both digital and print collections. The notion of a common environment is crucial to this report. While desktop accessibility of information will become increasingly prevalent in coming years, we believe a library's role as the central academic hub in a research university will evolve, but not diminish.

In one sense the task of planning the future of the Science & Engineering Library could not be more timely. A key pathway in the University's Strategic Plan is the advancement of research in the life sciences and related fields. In addition the University has recently placed increased emphasis on improving the recruitment and retention of excellent graduate students in the College of Letters, Arts, and Sciences. Both these efforts would be strongly supported by improvements to the Science & Engineering Library.

We emphasize that while the scale of USC's funded research in the sciences and engineering has grown at a rapid pace during recent years, the library serving these fields has not kept pace. During the past decade twelve members of USC's faculty have been elected to membership in the National Academies of Science and Engineering; USC's graduate engineering program has risen to a ranking of eighth in the nation in the annual survey by US News & World Report; Professor George Olah has been recognized with the Nobel Prize in Chemistry; two National Science Foundation Engineering Research Centers have been established on campus; and external research funding in the sciences and engineering has grown to more than $150M per year. Despite the clear centrality of the sciences and engineering to USC's efforts, the library serving these fields, at 27,000 square feet, remains among the smallest at any US research university, and minimal improvements have been made during the last thirty years.

The Science & Engineering Library has an especially important role to play in the recruitment and retention of excellent graduate students, who are critical to advancing the University's goals in the years ahead. At present the Library largely fails in this role. Indeed our interviews and focus groups with graduate students in both the College and the School of Engineering have consistently identified the existing Library as a “weak link" in their research and learning experience. The University has worked hard to improve the compensation and health benefit packages for teaching and research assistants in recent years, and the changes have benefited

all graduate programs. We believe that improvements to the research environment, particularly the Science & Engineering Library, have a complementary role to play in attracting and retaining the very best students.

In establishing the rationale for refurbishment and expansion, we identify four separate but interconnecting roles to be played by the Library:

> (i) providing access and technical support from librarians and staff for digital resources, including journals, databases, and other publications;
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> (ii) providing continued access to conventional printed monographs, journals, and conference proceedings not available in digital format;
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> (iii) providing a common research and learning environment which enhances the productivity of faculty, graduate students, and undergraduates in the sciences and engineering;
> and
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> (iv) enhancing the overall sense of intellectual community in an urban campus setting.

We elaborate on these roles in Section II, then outline the components we consider essential in an updated Science & Engineering Library in Section III.

II. Roles of an updated Science & Engineering Library

II.i. Support for digital resources

Within the last decade the availability of immense quantities of information in a searchable digital format has changed the face of research in the sciences and engineering. At USC's Norris Medical Library, a decline of 75% in total usage of printed journals is reported in the last three years. At Caltech the usage of all printed journals in science and engineering is reported down by roughly 40% in the last six years. In addition on-line databases in the biological sciences, in geoscience, and in some branches of physics and chemistry have enabled long-distance collaborations and increased the efficiency of individual research groups. It is clear that access and support for on-line research are primary concerns for any twenty-first century university library.

Since a digital library functions as a distributed object, the continued importance of a central university research facility might at first seem counterintuitive. Arguments in the same vein have, of course, been made to question the lasting relevance of research universities themselves in a digital age. We believe, however, that sweeping generalizations in favor of either cyber-universities or cyber-libraries fail on multiple grounds. In the case of libraries, arguments against a physical facility are fallacious for at least two reasons: First it appears unlikely that print collections (particularly monographs) will be completely displaced by on-line resources in the foreseeable future (see Section II.ii). Consequently it becomes essential for a physical library to provide what we would term “seamless access" to both on-line and paper resources in a single space. Second, and of equal importance, a library functions as more than an information depository. In a research university setting the role of a library is to aid in the assimilation and interpretation of information. In many cases this requires access to experts who can aid in identifying and correlating information sources. The presence of well-trained reference librarians with knowledge of the full range of resources will continue to be crucial to any research university library.

With regard to support by librarians and technical staff, the present Science & Engineering Library is seriously underserved. Internet statistics indicate that the number of science subject specialists

in libraries at peer institutions ranges from five at Notre Dame and Columbia to nine at the University of Maryland and sixteen at Caltech. In comparison only two science specialists are now employed at USC to handle queries from users in the full range of science and engineering fields. Non-professional and student workers cannot fulfill the interpretive role played by trained area specialists. It would be highly desirable to increase current staffing by adding area specialists in chemistry, biology, engineering, and web services. The need for a web services specialist will become increasingly acute as usage of on-line journals and databases continues to increase.

Besides providing improved on-site support by technical personnel, a redesigned library should allow contiguous access to both essential print-collection stacks (see Section II.ii) and electronic terminals. This means either pervasive Ethernet connectivity or wireless access for personal laptop computers. The existing Science & Engineering Library has extremely limited computer access except on its ground floor, far from the stacks. The second and third floors are served by only one terminal each for on-line reference searches.

In this regard it is necessary to update the concept of reader spaces to take digital capability into account. The present Science & Engineering Library nominally provides 243 reader spaces. In comparison with the potential user population of roughly 400 faculty and 5000 graduate and advanced undergraduate students, this number is already unacceptably small. It is more significant, however, that at present only sixteen computer terminals are available in the entire library. An updated library should provide Internet capability at every reader space and at least fifty public-use computer terminals (either hard-wired terminals or laptops for temporary loan within the library).

II.ii. Access to printed journals and monographs

Striking the correct balance between support of emerging digital resources and support of conventional print resources (journals, monographs, and conference proceedings) is perhaps the most difficult task for a library planning document of this sort. The argument in favor of digital resources is at first glance compelling. Indeed studies show that when journals are made available in both paper and digital formats, digital usage rapidly dominates. Since in most fields a small number of journals are preferred venues for publication, total journal usage has begun to shift decisively toward the digital format in recent years, as noted in the previous section.

While this evolution in journal usage patterns will undoubtedly continue, the value of print collections must not be underestimated. The long-term future of digital journals is in some respects difficult to predict. In particular the hardware systems for electronic storage and delivery are in a constant state of flux. While paper collections can in some cases be expected to last for centuries, digital storage media rapidly become obsolete. For this reason, most electronic journals do not provide universities with a permanent “product" (such as CD's), but instead sell annual subscriptions for web-based access. One can imagine several potential problems with this process: For example, what happens when a journal ceases publication or transfers copyright to a new agent? (Exactly this problem emerged in recent years when Academic Press was bought out by Elsevier.)

An equally important question concerns the digital conversion of back issues. Some leading journals, such as Physical Review, have already undertaken the task of converting all back issues to digital format. It is unclear, however, when (or even if) such a conversion will take place for many lesser journals. In some fields (computer science and electrical engineering, for instance) papers more than five or ten years old quickly become irrelevant. In other fields, such as mathematics and earth science, papers more than forty years old may still be of importance for current research. It would certainly not be prudent to predicate a policy on the hope that most material of this sort will eventually be available on-line. Furthermore differences between

disciplines must be recognized from the outset.

In the case of monographs the digital future is even less certain. Rosy predictions for increases in e-book sales have repeatedly come up short in the overall consumer market, and the number of scientific monographs available in digital format is correspondingly small. This is at least in part because journals and monographs are used in quite different ways. It is often necessary to locate a specific piece of information in a journal article. The ability to conduct wide-ranging digital searches makes electronic storage preferable in this case. On the other hand monographs are most often used to gain mastery of complex new subject matter. (Monographs are, for this reason, particularly important in the research training of graduate students.) Monograph users frequently find the need to leaf back and forth, and browsing, rather than searching, is also common. It is unclear whether a digital format offers the user any advantages over the printed page in this case.

For these reasons we believe monographs in printed format will continue to play a leading role in research for many years to come, even as printed journal usage declines. The plan for an updated library must acknowledge this fact, providing ready access to existing volumes, as well as space for future acquisitions. In saying this we do not mean to question the value of off-campus archival storage. The University has prudently created the Grand Avenue Library and Book Depository, a space of more than 81,000 square feet which currently houses more than one million volumes. The Depository is ideal for the storage of science journals which are also available in digital format and for monographs which have become outdated or underused. It is inappropriate, however, for use by research students and faculty on a daily basis, since it is far-removed from the center of campus and does not provide an environment conducive to long-term study (see Sections II.iii and II.iv).

The space required to maintain a print collection in a central campus location can be significantly reduced by making use of high-density, or compact, shelving. A compact shelving system, which employs electronically operated sliding units, increases the storage density of journals and monographs by a factor between two and three, but allows an essentially unchanged ability to browse. This technology has been adopted with great success by Caltech in its Sherman Fairchild Library of Engineering, completed in 1997. The new science library at Princeton University, scheduled for groundbreaking next year, will rely exclusively on compact shelving for its print collection. While the price for installation and maintenance of such a system is significantly higher than for conventional shelving, the savings in floor space and overall construction costs argue strongly in its favor.

Our committee is by no means alone in urging continued strong support for the collection of conventional printed journals and monographs. Recent faculty planning documents for the expansion of science and engineering libraries at MIT and the University of Maryland both affirm the importance of providing central campus access to existing print collections, as well as strong support for continued growth of these collections.

II.iii. Enhancement of the common research and learning environment

To this point we have concentrated primarily on the library's function as a center for the dissemination of information to the campus community. An effective university library serves a second and equally important function, however, as a common space for study and creative work. In this sense the library extends and complements laboratories and personal offices, filling a role that cannot be provided digitally. We feel this point is essential: Even if all the promises of digital information storage are realized, effective twenty-first century research libraries will not be displaced by cyberspace. This is because libraries allow for research in a shared environment which encourages the transfer of information between individuals.

In this regard the present Science & Engineering Library has particularly glaring weaknesses. There is no reading room with comfortable furniture and lighting for visitors who wish to browse through new books or to relax in a quiet setting. There are no soundproof group study rooms for undergraduates and graduate students who wish to work together on a project or to prepare for an examination. There is no multimedia room available for holding small colloquia, research group meetings, and classes. Such features are common in most new university science and engineering libraries, and they are essential for establishing the common research environment that USC needs for advancing its programs.

An updated library study space can help foster graduate and advanced undergraduate programs in the same way that Leavey Library has improved the early-year undergraduate experience. This is a particularly opportune time for making long-overdue improvements, since the university has also begun to devote increased funds to graduate fellowship support. Many candidates for a master's degree in the School of Engineering have no dedicated space provided by the university. Doctoral students in the sciences and engineering generally share communal offices or spaces within a laboratory. Such environments are frequently not conducive to quiet and uninterrupted study. The Science & Engineering Library becomes an essential support system, extending the facilities provided to students by their schools and departments.

Anecdotes abound from graduate students who regularly commute to Caltech or UCLA to make use of the study space (rather than just the books) in their library facilities. This is a case where it is definitely not possible to say that improving USC's libraries would inefficiently duplicate resources available elsewhere. Every world-class university provides an environment conducive to interactive research. Even though it may not be feasible (or perhaps arguably even desirable) to replicate the superior collections of some other universities, it is important that USC provide an excellent common research and learning environment, including improved space for group study, as well as undisturbed individual study.

II.iv. Enhancement of the sense of intellectual community on campus

The preceding comments lead naturally into the fourth consideration identified by this committee, namely the need to advance the general sense of intellectual community among faculty, graduate students, and undergraduates within the sciences and engineering. Community building is particularly difficult on an urban campus, since many faculty and students commute large distances from home. Here at USC the Academic Culture Initiative, directed by Mark Kann and funded by the Provost's Office, has as its goal fostering the sense of a shared intellectual experience both inside and outside the classroom. The need for progress in this direction has been identified on other urban campuses as well. A recent MIT faculty white paper outlines the arguments for a new central science and engineering library, and a compelling argument in favor of that project is the perceived need to reinforce the sense of community on campus.

Perhaps no building project can more effectively aid the development of intellectual community than a well-designed library. Such a space gives students a reason to stay on campus during evenings and weekends, even when they are not specifically setting aside time to use library reference materials. It provides a welcoming base for study between classes and allows an escape from the distractions of freeway commuting and urban life. We note that both effective libraries and successful bookstores offer their patrons the ability to browse through an excellent book collection and to read in a pleasant environment.

These features simply cannot be duplicated in a digital setting, whether it be an on-line information depository or Amazon.com.

An excellent local example of a library which aids in building intellectual community, as well as providing essential research support, is the Sherman Fairchild Library of Engineering on the

Caltech campus (http://library.caltech.edu/sherman/default.htm). The Fairchild Library provides an attractively designed and comfortable setting for research, browsing, group study, and classroom learning. The library enhances academic life on the Caltech campus for both students and faculty, contributing to a sense of shared intellectual experience.

With regard to intellectual community building in USC's urban setting, we believe a library expansion project should also pay close attention to off-hours access. Late-night study opportunities for graduate and advanced undergraduate students are presently severely limited at USC. In our opinion an optimal solution to this problem is twenty-four hour access to the Science & Engineering Library. The same level of service is currently provided to early-year undergraduates in the Leavey Library.

If such a solution is deemed impractical, a secure twenty-four hour study space would be highly desirable either inside or adjacent to the Science & Engineering Library. Such a space should include restrooms and access to refreshments. Twenty-four hour study spaces are now available at the majority of Ivy League universities, at MIT, and at the University of Chicago. The Exposition Park side of the USC campus is currently particularly under- served in terms of late-night study space, and an adjunct to the Science & Engineering Library would be used by undergraduate as well as graduate students. Creative examples of the possibilities for such a space are the cybercafe at Cornell University and the cyber- cafe/atrium currently under construction at Washington University's Olin Library in St. Louis (http://library.wustl.edu/renovation).

III. Recommendations for features in an improved library

The current location of the Science & Engineering Library is relatively central to the departments and schools served. It is the committee's consensus that either (a) the existing library building should be refurbished and expanded; or (b) a new building should be erected in a nearby space adjoining the Engineering Quad and buildings housing science faculty.

The total number of printed volumes in the existing 27,000 square foot library is 250,000, while roughly 100,000 volumes are in off-campus storage at the Grand Avenue Depository. While we fully perceive the expense in maintaining a large print collection in a centralized location, we consider the maintenance and continued growth of the on-campus collection essential. In general we believe that paper journals which are available in digital format, as well as journals whose contents have clearly become outdated, should be transferred to the Depository. The choice of journals to displace must be made by library staff in consultation with individual departments (and in some cases individual users). We have discussed in Section II.ii the rationale for maintaining strong support for the university's monograph collection, which will remain essential to research for many years to come. Space must be reserved in an updated library for continued growth of the monograph collection, through acquisition both of new releases and of older volumes identified as important to an excellent collection. The faculty-centered Acquisitions Committee being put into place by ISD should aid in improving the selectivity of new monograph purchases in the future.

- As a compromise which respects the need to house a large number of essential journals unavailable in digital format, as well as a growing collection of monographs, we recommend that an expanded library have at minimum the capacity to store roughly 200,000 journals and 150,000 monographs. (For comparison, the present capacity is 160,000 journals and 90,000 monographs. The Library has operated at full capacity for many years as books have been removed to archival storage to make room for new additions.) It is important that flexibility be maintained so that space may be readily reallocated in the future based on emerging trends.

- For journals available in digital and paper format, we recommend that, as a default, subscriptions to both formats be maintained. Paper subscriptions should be terminated when

faculty and library staff are in agreement that a journal is obsolete or that the availability of a digital version can be guaranteed. We recommend that the paper copies of high-use journals available in digital format (e.g., Physical Review) be moved to off-campus storage to make room for other journals and monographs not currently available in digital format. (This is the prevailing practice at Caltech, for example.)

- Recognizing that the satisfaction of users requiring off-campus materials must be safeguarded, we recommend that a quality control system be implemented to monitor the turnaround time for interlibrary loans and requests from USC's own archive at the Grand Avenue Depository.

- We recommend that strong consideration be given to the use of electronic compact shelving for the storage of all or part of the central-campus print collection. Compact shelving minimizes the space required for print journals and monographs, while maintaining the user's ability to browse. Any library addition should be built with load bearing strength sufficient to support compact shelving (300 pounds per square foot).

- We recommend that 500 reading spaces of roughly twenty square feet each be provided. Each reading space should be equipped with Ethernet and/or wireless access.

- We recommend that fifty public-use computer work stations and/or laptops be provided, with at least a fraction maintained in a computational commons area.

- We recommend that the library incorporate twenty small (four persons maximum) and four large (ten persons maximum) soundproof group study rooms, available for extended periods to both graduate and undergraduate students.

- We recommend that the library incorporate a multimedia room appropriate for small colloquia, group meetings, and classes (thirty persons maximum).

- We recommend that the library incorporate an auditorium for large colloquia or meetings. The library's previous auditorium space was removed at the time of the Doheny earthquake retrofit, and this space has not been recovered.

- We recommend that the library incorporate a technical support room for high-end graphics applications and visualization tools.

- We recommend that the library provide a “comfortable" reading room for use by faculty and students who wish to browse or relax in a quiet setting.

- We recommend that library access be provided on a twenty-four hour basis. If this is not practical, we recommend that a secure twenty-four hour study space be provided either within the library building itself or immediately adjacent to the entrance.

- We recommend that the number of science and engineering librarians be increased by the addition of specialists in chemistry, biology, engineering, and web services. (Even with these additions the library staffing will remain “lean" in comparison with that at peer universities.)

- Recognizing that service and support will be as essential to the long-term success of the Library as improved facilities, we recommend that an endowment be established to shelter the Library's acquisition and staffing needs from the inevitable pressures which arise in the annual budgeting process.

- Finally we urge that an architectural planning and feasibility study be carried out as soon as possible to follow through on the implementation of these recommendations.

In our opinion a refurbished and expanded Science & Engineering Library would present a superb naming opportunity for a patron seeking to improve USC's overall standing as a research university. Further advances in USC's standing will rely to an increasing extent on the quality of graduate programs, including those in the School of Engineering and in the Natural Science departments of the College. We can think of no more effective means of improving graduate student recruitment and retention, as well as research productivity, than the building of a first-rate library, which serves both as a center for dissemination of information and as a common research environment and intellectual gathering place.