

**THE UNIVERSITY OF CALIFORNIA DIGITAL LIBRARY:  
A FRAMEWORK FOR PLANNING AND STRATEGIC INITIATIVES**

**Endorsed by  
LIBRARY COUNCIL  
October 31, 1996**

*“Perhaps the only prediction that can be made with confidence is that scholarly publishing is in the early part of a turbulent era unlike anything it has experienced since the invention of movable type. The turbulence is not likely to abate soon, for technological innovation will suggest alternative ways of doing things. Which innovations will be adopted or adapted probably depends on how well they fit established academic ways, and on such factors as cost, ease of use, retrievability of information, and durability of storage...**on such matters there is simply not enough experience.**”*

Henry Reicken  
Council on Library Resources

**UNIVERSITY OF CALIFORNIA DIGITAL LIBRARY  
EXECUTIVE WORKING GROUP  
OCTOBER 1996**

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**THE UNIVERSITY OF CALIFORNIA DIGITAL LIBRARY:  
A FRAMEWORK FOR PLANNING AND STRATEGIC INITIATIVES  
REPORT OF THE EXECUTIVE WORKING GROUP**

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**THE UNIVERSITY OF CALIFORNIA DIGITAL LIBRARY:  
A FRAMEWORK FOR PLANNING AND STRATEGIC INITIATIVES**

**REPORT TO THE LIBRARY COUNCIL  
and  
COMMITTEE ON INTERCAMPUS NETWORKING AND INFORMATION  
TECHNOLOGY FOR ACADEMIC PURPOSES**

**Executive Summary  
and  
Recommendations**

**A. BACKGROUND**

In response to user needs and demands, as well as changing technologies, libraries are moving beyond the automation of access tools such as on-line catalogs and abstracting and indexing databases towards an era in which substantial amounts of primary source material are directly accessible on-line for the user community. These digital materials range from electronic versions of books and journals offered by traditional publishers to manuscripts, photographs, maps, sound recordings and similar materials digitized from libraries' own special collections to new electronic scholarly and scientific databases developed through the collaboration of researchers, computer and information scientists, and librarians.

There is growing national and international recognition that digital libraries will be a key research and development area for the next decade, and they will form an increasingly essential part of the broad information infrastructure supporting the research and education community. ARPA, NASA and the National Science Foundation are sponsoring a major research funding program that currently supports six major Digital Library Research Projects (at UC Berkeley, UC Santa Barbara, Stanford, the University of Illinois at Urbana-Champaign, Carnegie-Mellon University, and the University of Michigan), each of which involve many collaborating institutions. The Library of Congress has initiated a National Digital Library Project, and some 15 of the nation's largest research libraries and the Commission on Preservation and Access have joined together to establish a National Digital Library Federation. The Joint Information Systems Committee (JISC) has created and funded the Electronic Libraries Programme in the United Kingdom, and the European Commission has established an effort across the European Community.

The University Librarians of the nine UC campuses assumed a leadership role in launching a major initiative to define the scope of a UC digital library program. In October 1994, they proposed a UC Digital Library planning effort to UC's Library Council, with a time horizon for planning extending to the year 2000. They identified six priority strategies:

- (1) Conceptualize a variety of models for building and accessing networked information resources and services;
- (2) Undertake pilot projects that realize and test these models;
- (3) Redesign UC-wide information delivery services;
- (4) Develop policies and procedures for acquiring information resources in digital formats;
- (5) Review and reshape the mutual relationship between the UC libraries and the Office of the President to focus efforts on the UC Digital Library; and
- (6) Generate financial resources to support investment in the development of the UC Digital Library.

In response to this proposal, Library Council created an Ad Hoc Task Force on UC Digital Library Planning to develop a plan-to-plan. The Task force, which consisted of several faculty representatives as well as members of the UC library community, met several times and prepared a report that was approved in February 1995 (University of California Digital Library: Report and Recommendations of the Ad Hoc Task Force).

The report recommended the establishment of a more rigorous planning process. To lead that planning process, a Digital Library Executive Working Group was appointed by Library Council. The Executive Working Group reports jointly to Library Council and the Committee on Inter-campus Networking and Information Technology for Academic Purposes (CINITAP, a system-wide committee composed of representatives in the field of information technology drawn from the nine UC campuses and the Office of the President). The Executive Working Group has spent the past 10 months deliberating and preparing the attached 'plan', which is, rather, a framework and set of potential strategies to deal with the human, technical, organizational and financial issues which are critical to the development of a UC Digital Library.

## B. SUMMARY

*The UC Libraries are in a multi-faceted financial crisis.* The UC DL Executive Working Group believes that new technologies capable of leveraging institutional and external investments offer an important and necessary means by which the University of California will be able to maintain the quality and scope of information resources required to support its teaching, research, and public service missions. The UC DL's potential to manage unprecedented quantities of knowledge and information in an integrated system of access, service, and dissemination will enable it to meet emerging and expanding needs, while making the cost of such an undertaking affordable to UC.

To maintain a library system capable of supporting a great research university, UC must:

- develop a shared *vision* for a digital library, which meets the evolving needs of the academic community;
- build an *organizational structure* to implement that vision; and
- create a *funding* model to sustain it.

This report contains no easy answers and promises no quick solutions to the problems the UC libraries face; it does articulate a vision of the UC DL, along with strategic initiatives to move the vision forward to reality. Many of the key issues and demonstrable benefits will not emerge until we implement these initiatives. In this context, two conclusions stand out with particular clarity:

(1) Organizational, policy, and financial elements in the design of the UC DL are more challenging than technical ones and will ultimately determine whether this effort succeeds or fails. It is essential that technologies not obscure the continuing goals and purposes of the research library as a central component of the University's academic mission.

(2) The UC DL represents an opportunity by which UC can enhance the quality of its library system and provide national leadership in establishing a new model to sustain scholarly and scientific communication for decades to come. We believe that the UC DL has the potential to reduce the *rate* at which information resource costs increase and to spread those costs across a larger constituency through potential revenue sources. *It is also our belief that overall library costs will not diminish in the short-term and substantial new capital investment is needed now.*

It is important to note that planning for the UCDL in the mid-1990s follows the precedent established nearly twenty years ago, when UC pioneered a solution to crises of space and accelerating demand for information resources with *The University of California Libraries: A Plan for Development 1978-1988* (July 1977), commonly known as the "Salmon Plan." Development of the Melvyl system made it possible for three new campuses to augment their collections with access to libraries throughout UC, and construction of the Northern and Southern Regional Library Facilities eased space constraints. The Salmon Plan served UC well, but its fiscal underpinnings have eroded in recent years; it is clear that it can no longer secure the future.

In the current round of planning, the detailed operational design embodied in the Salmon Plan is neither possible nor appropriate because the technical, institutional, and economic environments in which universities exist are so fluid. Current experience simply has not provided sufficient data for the kind of detailed operational planning in the Salmon Plan. We have also learned a great deal about planning since then. In fact, our experience with the Salmon Plan is that the most detailed parts of the plan have been the least accurate and useful.

Instead, we propose that the UCDL will unfold more organically, with an extended period of continuous innovation in organizational, financial, and technical structures. In many respects, this report is intended to identify challenges, issues, and tensions and to provoke interest and discussion across university constituencies.

In September 1996, the University initiated a broad nine-campus Library Planning and Action Initiative. It is the hope of the Executive Working Group that its work will be folded into that effort as a key information input, and that the momentum established in the Digital Library planning effort will be leveraged for initiating several strategic initiatives over the next eighteen months.

## C. RECOMMENDATIONS

The Executive Working Group believes that it is essential to reach agreement now on the organizational, policy, and financial frameworks which will enable strategic initiatives. The vision will continue to evolve organically as: (1) more faculty and students interact with implementations of components of the digital library; and (2) technology advances. (Please note that specific report references are included with those recommendations where such background is critical to an understanding of the recommendation.)

### **Recommendation 1:**

It is not possible to move forward expeditiously within the current organizational structure. A UCDL organizational structure, with the responsibility, authority and resources to implement strategic initiatives, should be established by the University in early 1997. This report describes three alternatives. The Executive Working Group believes that the most appropriate framework at this time is that of co-library. The Library and Planning and Action Initiative staff and Advisory Task Force should review these alternatives carefully and put forward a specific recommendation for action by early 1997. (See: Report, pp. 4-6; Appendix C.)

### **Recommendation 2:**

Strategic initiatives serve as rich sources of learning; they provide UC with: a valuable laboratory; a source for data critical to policy, financial, organizational, and operational decisions; and practically advance the reality of a UCDL. One strategic initiative, the EAD Project, has already been put forward and partially funded by the University. This project lays the foundation for building and making accessible an electronic collection of the 100 million pages of original material contained in UC's special collections. The Executive Working Group recommends that the next strategic

initiative focus on building the University of California Digital Library's Science, Technology, and Industry Collection. (See Report, pp. 12-16.) It further recommends that a formal proposal be developed for this initiative by the Library Planning and Action Initiative, for University action in early 1997.

**Recommendation 3:**

The UC libraries lack the resources and budgetary flexibility necessary to make progress in implementing strategic initiatives and building the Digital Library. The University should provide annual special budgetary appropriations, over the next three years, for the funding of a Digital Library organization (Recommendation 1) and strategic initiatives emerging from UCDL planning and the Library Planning and Action Initiative. (See Report, pp. 12-16.)

**Recommendation 4:**

The UCDL will take shape in an environment in which State funding alone will not adequately support building and maintaining it. The Library Planning and Action Initiative should convene a special Finance Task Force which will not only thoroughly review current UC library funding models for appropriateness and adequacy with respect to current library services, but also make recommendations for new, sustainable models to the President and Chancellors for support of the UCDL. (See Report, pp. 6-7.)

**Recommendation 5:**

As part of its public service mission, the University, through the Library Planning and Action Initiative, should actively explore the potential of intersegmental collaboration among educational institutions in California and outreach to the California business community as opportunities for UCDL funding.

**Recommendation 6:**

A robust technological infrastructure is an essential prerequisite for the UCDL. The Office of the President and the nine campuses should not only continue but also expand their investment in IT networking infrastructure and faculty/student/staff access and know-how for state-of-the-art hardware and software. (See: Report, p. 10; Appendix E.)

**Recommendation 7:**

The University should explore the development of network access capabilities beyond the physical boundaries of the University, with particular attention to moving beyond modem access in the classroom and off campus. Working with the systemwide Communications Planning Group, opportunities should be sought to conduct pilot projects in cooperation with communications companies, from local cable firms to global enterprises.

**Recommendation 8:**

As a critical component of one of the UCDL strategic initiatives, distributed printing and charging capabilities should be designed and implemented.

**Recommendation 9:**

The campuses should define and adopt a Universitywide authentication system, as currently being proposed through the systemwide Communications Planning Group.

**Recommendation 10:**

The University should convene a systemwide task force on copyright to review and make recommendations regarding the role and implications of University copyright policy in sustaining cost-effective access to scholarly information. This should proceed in parallel with strategic initiatives, which will provide the necessary laboratory in which to explore, test, and evaluate alternatives.

**Recommendation 11:**

A Universitywide human resources program that acknowledges increased demand for user services in the digital environment and recognizes that library staff need equipment and time to deliver the required services should be developed collaboratively across the nine campuses.

**Recommendation 12:**

The Library Planning and Action Initiative should appoint a Digital Library Task Force, with significant faculty participation, to advise ongoing UCDL planning and strategic initiative implementation.

**THE UNIVERSITY OF CALIFORNIA DIGITAL LIBRARY:  
A FRAMEWORK FOR PLANNING AND STRATEGIC INITIATIVES**

**A. THE CHALLENGE**

Along with their national and international peers, the libraries of the University of California (UC) approach the twenty-first century in a state of financial crisis. In the acceleration of a process that began in the 1960s, the past decade has seen a compounding differential between needs and capacities push the library system--which stands at the core of the University's research, teaching, and public service missions--beyond the limits of its present operating model. The accompanying chart details some of the more critical challenges faced by all nine campus libraries, challenges which are currently preventing the libraries from meeting the information resource and service needs of faculty and students.

<b>CHALLENGES FACING UC LIBRARIES</b>	
<i>Scholarly and scientific communication</i>	<ul style="list-style-type: none"> <li>• New ways of communicating new knowledge using advanced information technologies</li> <li>• Potential of significant changes in publication process using the World Wide Web</li> <li>• Need to support parallel paper and electronic methods of knowledge dissemination</li> </ul>
<i>Change in higher education</i>	<ul style="list-style-type: none"> <li>• Continuing, sustained economic pressure on the entire University</li> <li>• Pressures to increase distance education and the blurring of geographic boundaries</li> <li>• Political pressure to work beyond traditional UC boundaries</li> <li>• Changing needs for long-term learning</li> <li>• Move to managed care, with significant effects on professional education and healthcare delivery</li> </ul>
<i>Technology infrastructure</i>	<ul style="list-style-type: none"> <li>• New infrastructure needed for electronic resources</li> <li>• UC libraries have received no capital or operations funding for technical infrastructure or automation</li> </ul>
<i>Increased cost and amounts of information</i>	<ul style="list-style-type: none"> <li>• Scientific information inflation rate: 12% annually for the past decade</li> <li>• Rising costs and decrease in publication of scholarly monographs</li> </ul>

<p><i>Increased cost and amounts of information (Cont'd)</i></p>	<ul style="list-style-type: none"> <li>• Scholarly print publications have been increasing at an annual rate of 7%</li> <li>• Libraries are acquiring a decreasing % of the published literature</li> <li>• New forms of electronic information are available, needed, and heavily used--and do not necessarily replace paper</li> <li>• Information needed by faculty and students is increasing exponentially in the sciences</li> <li>• Interdisciplinary research/new fields of research have increased faculty need for new information</li> </ul>
<p><i>Organizational culture</i></p>	<ul style="list-style-type: none"> <li>• Library, academic, and technological planning in isolation from each other</li> <li>• Rewards based on incremental change rather than collaborative risk-taking and innovation</li> <li>• Tension between campus autonomy and "One University, One Library"</li> <li>• Diversity of library users</li> </ul>
<p><i>Funding</i></p>	<ul style="list-style-type: none"> <li>• Current funding model abandoned in late 1980's</li> <li>• UC has not funded inflation for libraries since 1989</li> <li>• UC library allocation funding model does not reflect changes in library functions and responsibilities nor academic program expansion on any of the campuses</li> </ul>
<p><i>Human Resources</i></p>	<ul style="list-style-type: none"> <li>• Lack of widespread expertise in areas critical to instituting change and adopting new technologies</li> <li>• Recruitment hampered by 25-30% staff cuts</li> </ul>
<p><i>Information Market Place</i></p>	<ul style="list-style-type: none"> <li>• No new business model has emerged for digital information costs</li> <li>• Increasing tendency to price by transaction</li> <li>• Rapid pace of technology and business change</li> <li>• Intellectual property law shifting away from 'fair use' and in favor of the publisher</li> <li>• Content providers experiencing difficulty absorbing enormous change into their business practices</li> <li>• Lack of standards for content</li> </ul>

## B. THE UNIVERSITY OF CALIFORNIA DIGITAL LIBRARY: A VISION

President Atkinson has described a Cyberlibrary of California that “can be explored by all with access to the Internet” and that “will link together digital collections of knowledge and information, not just at UC but across the state and beyond” (Appendix A). It will, he said, be created by joining “the talents and resources of our colleges and universities, and our public libraries, in a momentous partnership with the corporate sector...” By simultaneously expanding sources of support and communities of users, this bold vision offers a means to break the cycle of rising costs and declining resources that threatens the University’s, indeed California’s, ‘knowledge commons’. Innovative human, financial, organizational, and technical systems will make the Cyberlibrary possible and sustainable.

The Executive Working Group is excited by President Atkinson’s vision, and encouraged that the highest levels of UC administration are focused on this opportunity. In fact, the most salient reason for moving ahead with the UCDL is that it represents a unique opportunity to:

- (1) provide equality of access to information, supported by appropriate business models, to all UC faculty and students, independent of time and place;
- (2) provide access to new and valuable types of information which are available only in electronic form;
- (3) partner with other segments of the California educational system, and the business community, for mutual benefit;
- (4) develop new economic models which distribute costs across a larger user population, making information resources and services more affordable within UC as well as newly-available to other communities;
- (5) influence changes in scholarly and scientific communication for the benefit of the international scholarly community; and
- (6) assume leadership and influence national policy in an emerging area critical to society at large as we move towards the 21st century.

The Executive Working Group’s vision of the UCDL is consistent with President Atkinson’s ‘Cyberlibrary’; indeed, it is an essential building block of that larger superstructure. Rooted in more than a decade of thought and experimentation by leaders in the field, the specifics of the vision we present are neither an impossible dream nor a quick fix. Much of what the UCDL will be remains to be discovered and invented in a process guided by a strong commitment to sustaining California’s research libraries.

The UCDL should be much more than an automated version of the existing paper library. From a functional perspective, we view the UCDL as the point of entry to a growing corpus of high quality digital content and services. Personal communication tools will allow users to create, share, manipulate, store, and use information. An effortless network interface will permit easy dissemination of and access to the world’s knowledge.

Existing in symbiosis with paper-based library resources and services, the UCDL complements, and does not replace, the existing paper-based resource system, which is recognized as one of the best in the world. The UCDL is expected to grow rapidly supported by a combination of internal and external resources.

From an organizational perspective, we view the UCDL as a set of human, financial, and technological systems which *enable knowledge generation, access, and use*, with four primary roles:

- (1) information preservation, storage, and retrieval;
- (2) information access and delivery via electronic communications;

- (3) the on-line publishing of the scholarly and scientific knowledge base, or knowledge management; and
- (4) information management consultation and training.

It is important to note that these roles are viable only in the context of new business models which are scalable with an exponential growth in digital information.

The UCDL is involved in all activities of the information transfer cycle. The UCDL is not necessarily the exclusive performer of these roles; indeed in many functions, it may play a minor role, while other collaborators, e.g., publishers and individual scholars and scientists, are more significant in terms of the breadth and depth of their contribution. However, in all cases, the UCDL adds *value*, in *partnership* with others, through every step of this cycle. For example, the UCDL will broker access to and delivery of information from content owners and creators around the world, as well as make available its own content. The UCDL will work in partnership with others, ranging from individual faculty members to scholarly publishers and commercial information vendors. The technology with which it operates will serve as a tool for the management of content in ways that enhance its accessibility and usefulness to all members of the University community. Both face-to-face and network-mediated service will be a hallmark of the UCDL, enabling users throughout the University to find the most appropriate and effective ways of accomplishing a wide range of tasks.

The Executive Working Group strongly believes that there is a significant new role for the UCDL in the digital publishing of the scholarly and scientific knowledge base. Indeed, herein lies a special opportunity for long-term transformation of the current modes of communication, namely the scholarly monograph and the scientific journal, which are breaking down for economic and other reasons. Examples of UC libraries supporting faculty knowledge dissemination efforts exist on several campuses already. A systemwide initiative to re-examine intellectual property rights is relevant to efforts in this area. Of course, the relationship of the libraries to the UC Press would need to be further explored as well.

Appendix B describes and defines in more detail the Executive Working Group's thinking and discussions regarding the UCDL. It can serve as a useful backdrop to future discussions of roles, functions, and services of the UCDL.

### **C. ORGANIZATIONAL FRAMEWORK**

New organizational frameworks and enhanced links among existing structures will be necessary to make the UCDL a reality. Specifically, the UCDL will require an organization that is:

- (1) closely linked to the University;
- (2) responsive to academic planning;
- (3) linked to academic programs as well as collecting units such as libraries and museums;
- (4) capable of brokering relationships with external entities, such as forming overlapping consortia for: leveraging buying power for specialized or unusually costly content; incorporation of unique collections, some belonging to other institutions; and enabling other California constituencies, including K-12 to higher education, to access and use information.
- (5) entrepreneurial;
- (6) technologically sophisticated and robust;

- (7) staffed by a multidisciplinary team of library and information professionals, as well as subject specialists;
- (8) capable of leveraging resources across the UC system; and
- (9) capable of acting with speed and flexibility.

Decisions about how and when and with what degree of formality to embed the UCDL in larger entities must be made at the highest levels in the UC governance structure. UC must remain sensitive to decisions at the State level that may determine whether, as suggested by the President's Cyberlibrary of California concept, funding will be extended to include among the primary users of the UCDL such constituencies as CSU, the California Community Colleges, and K-12. UC could seek to lead intersegmental coalitions in seeking state funding for the Cyberlibrary--whether through bond issues like Proposition 203, through appropriations for operating costs, or through project allocations.

Appendix C describes three possible alternative organizational structures: UCDL as co-library; UCDL as an extension of the existing library structure; and UCDL as a non-profit. Viewing organization as a problem-solving technique, the Executive Working Group believes that the real issue at this stage is to determine the next step, not necessarily the final step. It seems probable that experience may well dictate an evolutionary progression from one organizational framework to another and yet another.

In selecting the initial UCDL framework, the following are key considerations:

- (1) the potential to serve the needs of faculty and other members of the UC community ;
- (2) the feasibility of rapid start-up;
- (3) the ability to evolve as conditions change and understanding increases; and
- (4) the ability to move near-term special initiatives forward and provide the venue for collecting information and assessing the implications of different kinds of relationships.

Our consensus is that the UCDL as co-library is most appropriate at this time. One of our assumptions is that a multi-institutional California digital library will become a feasible goal only if a functional UCDL has first been developed within UC as Phase One. A University of California DL would move aggressively towards providing access to a larger population of users, as described in this document, but would be managed as a University-wide entity. This is an inside-structure. To move President Atkinson's Cyberlibrary forward, it may be necessary to have an outside-structure. Thus, a not-for-profit might very well be appropriate within 3 years, either as a free-standing organization or one component of the co-library. If UC were to follow this path, several actions would need to be taken in 1997:

- (1) appoint UCDL management and governance structures;
- (2) develop a budgetary model that will underwrite the co-library as a "common good" for the entire University
- (3) develop an acquisitions mechanism that will provide digital content to which all University of California faculty, students, and staff have equal access;
- (4) develop mechanisms for setting digital acquisition priorities on the basis of academic program needs; and
- (5) develop mechanisms for improving coordination between information technology units and libraries on a systemwide basis.

## D. FINANCIAL FRAMEWORK

Several assumptions serve as the foundation for the Executive Working Group's thinking on the development of a sustainable financial model to support the UCDL.

- (1) the UCDL will take shape in an environment in which State funding will not adequately support building and operating the UCDL;
- (2) new capital budgetary resources will be necessary to build the UCDL;
- (3) UCDL access and services to CSU, the California Community Colleges, K-12, California business, and the general population present a unique opportunity to develop a new statewide model for funding the UCDL;
- (4) Mechanisms for generating revenue from operations are likely to be a component of the UCDL funding model; and
- (5) Significant direct savings from the traditional library are not likely in the near-term; however, it is possible and necessary to construct future financial models which reprogram some savings to maintaining the long-term growth of the UCDL.

The Executive Working Group does not have sufficient information to suggest a funding formula at this time. However, it does advocate the discussion and potential adoption of key principles:

- (1) financial arrangements for the UCDL should encourage UC users to seek the information they need;
- (2) revenues generated by the UCDL must not be treated as replacements for State funding;
- (3) firm commitments must be made across the UC system to funding 'common good' elements of the UCDL, regardless of the source of funds;
- (4) the principle of "One University, One Library" should be upheld in developing funding mechanisms for the UCDL despite conflicting tendencies that will inevitably arise from campus-based budgeting;
- (5) academic need must be paramount in establishing priorities for investment in the UCDL.

The UCDL offers both a significant resource for UC alumni and a potential opportunity to increase alumni support of UC and its libraries. A sustainable business model would need to be developed for this to become a reality. Moreover, while this is an attractive notion, there are several problems which would need to be solved relative to content licensing and scalability.

Principles must be established for determining what costs are assigned to the UCDL and which belong to general infrastructure. UCDL bandwidth and connectivity requirements may be drivers for campus and Universitywide infrastructure and should not be separated from general infrastructure investments.

Many other issues remain open to discussion and can be resolved only with the agreement of high level decisionmakers. The choices they entail will influence the University of California's knowledge management for decades to come. Among them:

- What kind of funding mechanism should replace formulas based on student FTE for access and services provided by the UCDL to all nine campuses ? How should local and

central functions be integrated in the context of campus-based budgeting ? What incentives will induce chancellors to contribute to the UCDL ? How should funding be distributed, and who will be responsible for different levels of service and content ?

- What principles should determine which functions and users should be subsidized and which should be based on cost-recovery financing ? How should the primacy of academic priorities be assured in a system that combines subsidized and revenue generating activities ? How should subsidies be accounted for and where should the responsibility for them lie ?
- What principles should determine how budgetary obligations should be distributed between the UCDL and Universitywide infrastructure (e.g., bandwidth, user work stations, productivity software vs. databases, specialized user support services, expert systems development) ?
- How should the balance be struck between external project funding and ongoing operations funding ? When should external fundseeking be constrained by downstream impacts on continuing operations ?
- What should distinguish capital and operating expenses in the context of continuing needs to upgrade infrastructure and operating platforms ?
- How should costs be recovered for services and information delivered beyond UC ? How should revenue opportunities be identified and developed ?
- Should alternatives to the tradition of "free" access to the library for members of the University be considered ? Might access to digital information be treated like a ubiquitous utility ? If so, should it be charged to organizational units or individuals ? If fees are necessary, would flat fees be more efficient than metered usage fees ?
- Should the University pass on the cost of fee-for-use licensing agreements to end users ? If so, should all end users be treated the same way ?

The low marginal cost of making electronic content and automated services available to additional users and the possibility of charging for customized services to the external community suggest that the UCDL may be able to deliver substantial information services to the private sector and the general public on a cost-recovery or revenue basis. Commercial vendors successfully market intellectual property created in subsidized university environments. Careful exploration--including some pilot projects--will be needed to determine how the UCDL might enter this market and whether it can or should compete with the private sector in providing information services. Potential products include content published through the UCDL, sophisticated data retrieval and organization services, and instruction in UCDL use. Versions of the last are currently offered through some units of UC Extension, and campus data archives perform services on a contract basis to non-UC entities including state agencies. It may be appropriate to create self-supporting organizational structures like University Extension to broker services. Another approach might be to license commercial vendors to provide access to the UCDL. In so doing, the University would need to be sensitive to the implications of competing with private sector vendors while seeking to capture some of the revenues generated by the resources it manages.

## **E. CONTENT: COLLECTION, ACCESS, AND MANAGEMENT**

In the digital library, content and its management remains the single most important component of the library. The UCDL should comprise a three-tiered array of resources developed in a process integrated with academic program planning. Access should range from core content available for use anywhere, any time in the University of California to material that can be used “at your own risk,” “as is,” or for a privately paid fee by those who choose to explore cyberspace beyond the UCDL. In between should be material for which the UCDL takes only partial responsibility because the user base is limited or the owner cannot provide full access or support.

For paper-based libraries, core collections are defined in terms of material that is considered to be essential for academic reasons; they comprise materials that are purchased, and choices about what to acquire are made on the basis of academic priority within budgetary constraints. In the digital environment, licensing and electronic document delivery mechanisms allow the additional possibility of providing access to academically important content by permitting users to pay for it on more favorable terms than individual users could obtain for themselves. Incorporating capabilities created by such unbundling, the UCDL should develop a core collection of fully subsidized, quality-filtered content available for uninhibited use by all UC users. An intermediate tier should consist of content for which the UCDL and users share responsibility for selection, payment, or both. Thus, content that is recognized as valuable but very expensive or needed by only a small group of users may be available on a fee basis, or content with lower academic priority may be available to those who wish to construct their own search and retrieval strategies. In addition, the UCDL should facilitate access to content residing outside its scope of responsibility.

Criteria for designating what content should belong to the core and partially-supported tiers should be established with faculty and student guidance to serve the teaching, research, and public service priorities of the University. These criteria should include the likely number and distribution of University users and the importance of specific material for the field in which it is used.

Content defined as belonging to the core collection should be maintained to the same standards as core paper collections, where appropriate. This would include appropriate cataloging, archival maintenance, uninhibited use for UC users, and printing capability.

The UCDL should span print and non-print domains with links between the existing infrastructure of bibliographic access systems, such as Melvyl, and systems that provide bibliographic access to dynamic digital materials. In making collection decisions to allocate finite resources to the greatest institutional advantage, the UCDL should treat faculty and student time as the resource that must be most carefully conserved: access, support services, and preservation should be organized to enable faculty and students to find and use the information they must have most efficiently.

Appendix D documents further substantial discussions by the Executive Working Group regarding complex content management issues.

## **F. INFORMATION POLICIES AND PROCEDURES**

Two fundamental principles of traditional university library management must migrate from the print to the digital environment:

- (1) users must be able to access information while maintaining their own privacy; and
- (2) works contained in the library must be intended for open use.

Under the doctrine of first sale, traditional libraries own the materials they lend and do not report individual usage to third parties. In the digital world, where much end-user access is mediated through library license agreements and every use is electronically noted, arrangements must be made to protect that right to privacy. In concluding license agreements that base fees on usage, the UCDL must develop mechanisms for metering use that permit individual identities to be masked.

The principle of open use is equally fundamental in keeping with the provision in the Academic Personnel Manual that research results must be available for publication:

All such [sponsored] research shall be conducted so as to be as generally useful as possible. To this end, the right of publication is reserved by the University. The University may itself publish the material or may authorize, in any specific case, a member or members of the faculty to publish it through some recognized scientific or professional medium of publication. A report detailing the essential data and presenting the final results must be filed with the University. Notebooks and other original records of the research are the property of the University.<sup>1</sup>

Materials may be deposited in special collections with restrictions on use (e.g., correspondence that cannot be examined during the lifetimes of its creators or data that is restricted prior to filing a patent application), but it is presumed that these are temporary. The UCDL should adopt the principle that, although material may be placed in its collection with access restrictions, the intent should be that the information would eventually be made public. Similarly, the intent in selecting storage media and software should be to enable migration as technologies evolve so that information may be effectively preserved for future use.

Informing all functions of the UCDL should be the intent to support and enhance the free flow of information and scholarly discourse. For materials unique to UC, that principle should be implemented by licensing the right to use them beyond the University. The terms of license agreements are a policy-driven decision the University will need to make. In crafting license agreements, it will be essential to promote principles of reciprocity with other institutions. Specific instances may vary widely according to circumstances, but in every case, the agreement should enhance rather than constrict information exchange. At the same time, if licensees seek commercial gain from their use of UC materials, UC will have a fiduciary responsibility to obtain a reasonable share for reinvestment in the UCDL. Competition between the requirements of free knowledge sharing and the revenue potential of proprietary information will drive a persistent balancing effort.

The development of dissemination functions in digital libraries has been imagined to provide an answer to the cost-driven journal crisis that is perceived to be strangling scientific communication. In this context, extensive discussions of copyright have produced suggestions that universities or individual faculty members retain copyright to scholarly works rather than relinquishing it to external publishers. Such decisions are far from simple and must be made at the institutional level.

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APM-020 Special Services to Individuals and Organizations, 6/3/58 (University of California University Regulations Revised No. 1)  
i. Publicity of results.

## **G. TECHNOLOGY INFRASTRUCTURE**

A sophisticated and robust inter- and intra-campus technological infrastructure is an essential prerequisite to the UC DL. *Without such an infrastructure, the UC DL cannot exist.*

At this early stage of UC DL planning, discussion of technology architecture and infrastructure is a discussion of context and design principles intended to remove barriers to policy choices regarding content, access, and/or functionality. Appendix E describes what must be accomplished but leaves to a future system design team the task of specifying the technical means to achieve these goals. It is important to emphasize that the system must be designed with the understanding that content will outlive generations of access, storage, and retrieval technology and data formats and must migrate repeatedly without loss or distortion.

It is important, however, to recognize that for the intermediate term continued infrastructure development will require incremental investment centrally and by the campuses, and that the services envisioned as part of the UC DL, including remote access, will require more bandwidth than UC currently has planned. The Office of the President and the nine campuses should continue and expand their investment in IT networking infrastructure and faculty/student/staff access and know-how for state-of-the-art hardware and software.

The University should explore the development of network access capabilities beyond the physical boundaries of the University, with particular attention to moving beyond modem access in the classroom and off campus. Working with the system-wide Communications Planning Group, opportunities should be sought to conduct pilot projects in cooperation with communications companies, from local cable firms to global enterprises.

Critical improvements are necessary in two functional areas: (1) print-on-demand infrastructure for electronic materials which are printable; (2) mechanisms for variable charging; and (3) an effective and rational authentication structure. Printing facilities offering cost, convenience, and quality options should be widely available.

## **H. USER TRAINING SUPPORT SERVICES**

### **(1) Varieties of users**

User training support services for the UC DL must be responsive to two very different clusters of needs among the primary user population (UC faculty, students, and staff). Undergraduate students, who comprise the numerically dominant portion of the University community, are a population in constant transition: every year, approximately one-quarter are newcomers who require instruction in the most basic functions of search and retrieval and socialization into information management in the University setting. Conditioned by the commercial market to expect attractive and transparent interfaces, and perhaps familiar with a variety of object manipulation techniques, they bring little knowledge of the content they seek to use and turn to library staff more often than to faculty for guidance not only in **how** to look for something but also in **what** to look. For the most part, faculty and graduate students comprise the other major component of the user community. They bring deep content knowledge, proficiency with search and retrieval procedures that were in place in the print environment, and varying degrees of awareness of the new material to which they wish to gain access and how to do that. Teaching strategies that are effective for undergraduates are unlikely to serve faculty, who may need complex one-on-one help in data retrieval and manipulation and who frequently know precisely what they want but not how to find it. Both constituencies will make increasingly heavy demands for support

services. Survey data collected at selected campuses clearly indicates that faculty view the lack of appropriate training as the major barrier in using electronic information systems.

Given President Atkinson's "Cyberlibrary" vision, the UCDL may become a powerful vehicle for outreach to communities far beyond traditional University boundaries. In so doing, it will expand the numbers of users as well as the range of needs and abilities. Aspects of this function may take place in direct relationships between individual campuses and external constituencies or a unique UCDL training arm. In developing user training and support services, UCDL policy should examine creating service categories for which user fees may be charged. Services such as UCDL consulting and training might, for example, be made available on cost-recovery basis to K-12, California Community College, and CSU educators and on a revenue-generating fee-for-service basis to alumni and perhaps all California citizens. Training and support services might also be offered on a contract basis to Internet service providers or employers. Alternatively or in addition, UC could ask its partners to develop their own user training support services tailored to the needs of their own constituents. Thus, for example, CSU and California Community College librarians could provide search, reference and introductory training services on their own campuses, while UC would take on the role of training these trainers.

## **(2) Varieties of information**

User training support services should be adequately supported to respond to additional needs dictated by the changing nature of digital content. Coherent and logical access methodologies and regular monitoring of access paths are essential for making content mounted at distributed sites available to users as needed. Lack of support for these functions would seriously compromise the ability of the UCDL to deliver the quality information management required by a research university. In addition, digital content may represent an unlimited variety of information objects and formats, requiring sophisticated techniques to search and analyze. As users explore knowledge frontiers, they will need help in managing the data they find. Moreover, the UCDL offers the possibility of mounting primary data for others to analyze, which will require at the least the kind of assistance now offered in data archives. The digital library environment is projected to continue in flux into the foreseeable future, with enormous increases in volume, diversity of collections, and varieties of search tools. Search tools, currently in their infancy, will be especially fluid as approaches now at the research stage become useful tools over the next few years. Such conditions will require continuous education for UCDL staff in order to maintain their ability to train and support users. The challenge is generic, affecting all campuses and requiring coordination to minimize duplication and deploy distributed specialization in the most effective ways possible.

## **I. HUMAN RESOURCES**

The human resource needs for the UCDL will be satisfied by a combination of today's library staff and individuals from a multitude of other areas including collecting, communications, technology, and academic units that are not now formally linked to library entities. How existing roles will transition and change is unknown, and a flexible and open approach to identifying and solving issues and tensions will need to be adopted.

The transition and evolution should be managed in ways that build on and leverage the current competencies in dozens of units across the nine campuses. It should also be acknowledged that core information management functions of the UCDL will continue to require skilled professional, technical and paraprofessional staff. The UCDL should develop a structure that fosters advancement and increased payback for individual efforts and that

provides for the continuous acquisition of new skills and competencies, in order that current staff might grow with the changing environment. Evolution toward a growing digital environment will require flexibility, creativity, responsiveness, and continuous acquisition of new skills in parallel and interdependent paper and digital libraries. To achieve these goals, Universitywide UCDL organization should focus on strong coordination, facilitation, and communication functions among the individuals providing direct service throughout the University. Centrally-administered training in areas of common need can be highly cost-effective.

On-line communications technologies and distributed gateways will enable users to seek an increased level of assistance from remote sites. At the same time, it can be anticipated that face-to-face interactions between students and UCDL staff will continue to be driven by the students' need for instruction in negotiating a challenging and unfamiliar environment. Experience indicates that, despite the availability of intelligent systems, increasing remote access will also increase demands for service, both online and face-to-face. To meet user expectations, campus libraries will need to provide general user support staff capable of assisting a wide range of students and other users. At the same time, UCDL staff should be alert to opportunities to develop specialties in, for example, data forms or subject areas that effectively serve the entire UCDL. UCDL information management functions should be integrated with research and instruction, in active collaboration with faculty. The development of specialized staff competencies can be expected to enhance the level of services available to users entering through every gateway, but this promise can be realized only if staff are familiar with and cooperate across the UCDL's widely distributed network and are able to provide transparent referral services. It should also be anticipated that the UCDL will require increased user support staff to manage such aspects of 24 hour remote access, even if real-time help is available only during business hours. Inter- and intra-campus partnerships for providing service should be actively fostered.

## **J. STRATEGIC INITIATIVES: THE TRANSITION TO THE FUTURE**

The development, implementation, and evaluation of strategic initiatives *must* be a key component of any UCDL plan and planning process. These initiatives serve as guides during the difficult transition from the current library system to a new library system of which the UCDL will be a growing component. UC should implement a series of such initiatives that are formally designated and coordinated as UCDL efforts.

Any strategic initiative should meet most of the following criteria:

- (1) build on existing initiatives, which have demonstrated feasibility;
- (2) be scalable, replicable, and practical (able to be paid for);
- (3) serve a diverse and substantial University constituency;
- (4) solve real problems;
- (5) push development of necessary conditions for the Digital Library;
- (6) be distributed across disciplines and focus on both services and collections;
- (7) generate strategic experience, particularly in the areas of cost modelling and human factors.

Such initiatives will become rich sources of data on the potential for the UCDL to provide services that are not constrained by campus boundaries, and they will identify organizational, staffing, and financial resources that will be necessary to implement the full vision. These projects should be considered as experimental first nodes in an expanding UCDL organizational entity rather than as one-time efforts.

Early on, the Executive Working Group was directed by CINITAP to prepare proposals for strategic initiatives which could be brought forward early in 1996. The Executive Working Group identified four strategic areas for prototypes:

- (1) digitization;
- (2) scholarly and scientific communication;
- (3) digital content in support of undergraduate instruction (local and remote); and
- (4) community service, including healthcare and University outreach activities.

In a review of digital library work going on across the nine campuses, the Executive Working Group chose the Encoded Archival Description (EAD) work that had begun at Berkeley, the electronic journals experiment (Red Sage Project) at San Francisco, and the digital content work in support of undergraduate instruction at Berkeley, San Diego and Santa Cruz as fundamental to the foundation of the UCDL. These choices were highly constrained by time, and the intention was not to ignore the many other important projects going on around the University. Nonetheless, the Executive Working Group also strongly felt that the work it singled out met the criteria it had established and its potential for success in the immediate timeframe was high.

Brief descriptions of three initiatives follow. The EAD project is co-funded by OP and the campus libraries and is proceeding forward. The UC Digital Library Science, Technology, and Industry Collection is proceeding through further conceptualization and planning. The undergraduate instruction project has been outlined in detail and could go forward for funding.

### **(1) Digitization: EAD Project**

Anyone who has ever done research in special collections and archives knows the frustration of traveling to a distant site and examining the contents of dozens of boxes only to find that nothing relevant to the project at hand is contained there. University of California special collections, including both archival materials and images, encompass as many as 100 million pages of original material that cannot be accommodated under standard cataloging protocols for print matter.

Although some of these materials have been cataloged electronically by author and title, there is currently no accepted practice for providing information about content. Over the years, individual collection managers have created extensive descriptions of many of their contents, following formats and conventions adapted to the peculiar characteristics of the material being described. However, the new standard, known as Encoded Archival Description (EAD), enables standardized incorporation of the finding aids generated by individual collections into a single database.

This initiative will benefit greatly students, as well as faculty doing research. It will make it easier for students, both graduate and undergraduate, to make use of primary source materials in a broad range of disciplines, from the humanities and social sciences to public policy and environmental issues. In the context of President Atkinson's Cyberlibrary, the EAD work will provide the foundation for these enormously valuable materials to be available to all of California.

The EAD had endorsements from a range of collection heads within UC as well as by such national bodies as the Society of American Archivists, the Commission on Preservation and Access, and the Library of Congress. It seemed logical and productive to extend this work across the campuses; indeed, efforts in that regard had already begun successfully.

The Executive Working Group solicited a formal proposal from a group of UC librarians, and worked with them in their preparation of a proposal in the context of the UCDL. The Executive Working Group brought this proposal to CINITAP and the Library Council, which in turn both recommended UCOP funding. UCOP funded 50% of the requested funds, and the University Librarians were directed to raise matching funds, which they are currently in the process of doing.

This UCDL strategic initiative will pursue four objectives: (1) create an implementation toolkit and training package for EAD for use at any UC site; (2) devise policies and procedures for decentralized creation and maintenance of encoded finding aids; (3) devise mechanisms to link and integrate related collections contributed by different institutions; and (4) explore intellectual and technical access, description, and control issues that arise from combining materials from different institutions in a single database. This support for a networked collection of EAD finding aids will enable the implementation of a pioneering concept that can be expected to become a lasting component of the UCDL. Further, it lays the foundation for then digitizing the collections themselves.

## **(2) Scholarly and Scientific Communication: The UC Digital Library Science, Technology, and Industry Collection**

The center of the library funding crisis is directly related to continuous high inflation in scientific, technical, and medical publishing. Digital journals are potentially a way out of this crisis, with lower costs for electronic production and delivery methods which produce economies through scaling. Importantly, electronic journals also hold many rich possibilities in equality of access, access independent of time and space, and added value through significant increases in functionality such as linkages to primary data sets. There are also a host of problems remaining to be solved, as well, including archiving, infrastructure, and human factors issues.

UC has participated in a number of electronic journal projects including TULIP Project (Elsevier materials science journals), the Red Sage Project (health sciences journals of 20 major commercial, university, and society publishers), and IEEE and IEE (electronic publications including journals from these societies). Faculty and students also have experience with electronic journals through use of the many full-text files currently available through Melvyl.

The Executive Working Group feels that it is logical for UC to build a Science, Technology, and Industry Collection as the next phase of the UCDL. Much of the electronic content that we have begun to amass and is likely to be available over the next 3 years is in the areas of science, technology, and medicine; many early electronic journal experiments have concluded that a critical mass of titles is an essential ingredient of success. A UCDL Science, Technology, and Industry Collection would provide an important laboratory for us to deal with the organizational, technical, financial, policy, human resource, and training issues in a real life setting. Solving the fiscal crisis in the sciences through the development of a new and more sustainable business model for scientific communication will go a substantial way in solving the general funding crisis in libraries, and help to restore stability to funding for humanities materials. It is important to note that President Atkinson has recently identified new areas of outreach to the business community, beyond the initial area of biotechnology. They are information technology and manufacturing engineering. Certainly, all three of these outreach areas would find a logical home within this strategic initiative.

The UCDL Science, Technology, and Industry Collection is also an opportunity to explore the potential leverage of the nine campuses in purchasing electronic journals as part of a consortium rather than individually. Guided by the University Librarians and principles developed by the UC Libraries collection development officers, and encouraged by the

Executive Working Group as an important initiative, UC has been involved in negotiations with several major publishers to provide electronic journals. These negotiations are now coming to a close, and there is a valuable opportunity emerging. These electronic journals would form the

core of the UCDL Science, Technology, and Industry Collection. Initially, they would supplement paper copies; targets would be set so that they would selectively replace paper wherever possible; parallel systems of paper and electronic would allow campuses to plan infrastructure enhancements effectively and deal with human factors issues. Business and institutional arrangements would pose more of a challenge than technical demands, and this project will permit feasibility tests of scenarios generated in conjunction with publishers that would provide an alternative to the present non-sustainable price spiral for scientific journals. One such scenario would be the availability of this UCDL Science, Technology, and Industry Collection to other segments of the California educational system and to business and industry in California, with appropriate payment from those sectors, potentially lessening the costs to UC. Indeed, such an initiative would allow us to put in place Phase One of President Atkinson's Cyberlibrary of California.

### **(3) Digital Library Projects in support of undergraduate instruction**

Increasingly, students need to access course materials from remote locations, either due to complex personal lives or to involvement in cross-campus distance learning. In response both to needs and to the possibilities presented by new technologies, many of the general campus libraries in the UC system have experimented with some kind of small-scale electronic reserve in support of an undergraduate course, while faculty have experimented with making course materials available on-line, often doing so from private or departmental homepages. What is missing and needed is a series of faculty-library collaborative projects, which rise from the intellectual imperatives of particular courses but are supported by staff expertise both in administration and technology and can be documented, publicized, evaluated, refined, and replicated.

The Executive Working Group developed a proposal for a competitive process in which faculty and library/information management staff apply jointly for funding to support undergraduate instruction through targeted delivery of electronic information. Several different projects will be selected, implemented, and evaluated as models for cost-effective enhancement of UC instruction. Successful projects will be integrated into the daily operations of UC libraries and other UC information repositories.

This is not an electronic publication or authorship project, but rather focuses on the historical expertise of library staff in identifying, controlling, organizing, and providing consistent, equitable access to existing electronic content. It also builds on the UC libraries' traditional strength in intercampus cooperation and resource sharing.

CINITAP would issue a call for joint faculty-library proposals for electronic information projects in support of undergraduate instruction. Proposals would focus on a particular course and originate with course faculty, who would be responsible for identifying electronic content and justifying how digital format would enhance the educational experience. Faculty would work closely with library staff, who would be responsible for developing a budget, plan of work, and time line and implementing the project accordingly. Funds would be allocated to the libraries, which could use them, both within and outside the library setting, to subsidize additional dedicated staffing, new equipment and infrastructure improvements, copyright and licensing fees, etc. Library staff would be responsible for tracking and analyzing project costs and projecting the potential for cost-effective re-use of content and infrastructure. Library staff would also be responsible both for ensuring that the faculty-librarian partnership includes

other campus information professionals, as appropriate, and for ensuring that local projects are or become available on the broadest possible systemwide basis. Over time, the base of content would increase and be shared across campuses, content totally directed by faculty and student needs.

#### **(4) Other strategic initiatives**

Near the close of its deliberations, the Executive Working Group began to explore additional prototype opportunities. We would like to mention two here. Considerable thought should be given to additional strategic initiatives which could move the eventual implementation of the UCDL forward.

##### ***(a) Digital library support for online Extension courses***

Currently, the Center for Media and Independent Learning, a Universitywide Extension unit, is experimenting with a partnership with America Online to offer online courses on an anywhere, anytime basis. They offer improved versions of correspondence courses, augmented with access to a substantial body of online resources for student research. A UCDL project could increase both the range and depth of available materials and might be eligible for external funding. As UC begins to explore the notion of the Cyberlibrary of California, the population served through Extension is a new and growing constituency for the University.

##### ***(b) Project Alexandria***

Project Alexandria is an NSF/ARPA/NASA-funded digital library project at Santa Barbara. The goal of the Alexandria Project is to build a distributed digital library (DL) for geographically-referenced materials. A central function of Alexandria DL is to provide users with access to a large range of digital materials-ranging from maps and images to text to multimedia-in terms of geographical reference. An important type of query is "What information is there in the library about some phenomenon at a particular set of places?". From the Internet, both users and librarians can access various components of ADL, such as its catalog and, through powerful, graphical interfaces without having to know where these different components are located on the Internet. Alexandria is nationally-recognized for the unique relationship between computer science researchers and the library, and it has emphasized the need to actually build a working digital library. Further, Alexandria builds on a long-standing commitment that the Santa Barbara library has in collecting information in this area, and it represents continuity with established programs which have been place for some time. Alexandria has potential to move beyond geographic data to spatial data, and thus have potential applications in medicine and science. It should be carefully looked at in the context of a UC Digital Library Science, Technology, and Industry Collection.

## **APPENDIX A**

### **The Cyberlibrary**

#### **CALIFORNIA'S LIBRARY WITHOUT LIMITS**

By Richard C. Atkinson

San Diego Union-Tribune, July 5, 1996

Desiderius Erasmus, the 16th century father of Western humanism, dreamed of "a library with no limits other than the world itself." His dream was prompted by the invention of the printing press.

Today, digital computer and Internet technologies are bringing his ambitious dream within reach. Instead of only seeking out knowledge in place-bound libraries, limited by what is locally available, we can range across the worldwide Internet to connect with digital versions of books or of other creative works. The rapid growth of the Worldwide Web has given us a foretaste of things to come: a future when our libraries, at the press of a button, can come to us, wherever we are, whenever we wish.

#### **Profound implications**

This has profound implications for the citizens of California, as we wrestle with how to educate our youth and provide continuous opportunities for lifelong learning. If we do it right, we can take an important step toward lowering the economic and other barriers to access that divide people of different backgrounds and provide opportunities for all, independent of geography and local condition.

In short, we must build the Cyberlibrary of California, echoing the call of Kevin Starr, the state librarian. This will be a "virtual" library that can be explored by all with access to the Internet. It will link together digital collections of knowledge and information distributed across the state and beyond.

Our libraries, museums and archives -- public and those of academe -- house compelling collections that tell of California's heritage in all its richness and diversity and that are storehouses of accumulated knowledge about science, art, engineering, history and literature. Collectively, we are among the best in the nation. Creating digital texts and facsimiles of the most important of these collections -- and even enlivening them with multimedia technologies -- opens exciting new pathways to knowledge.

Important starts have already been made. Many of the University of California's libraries, museums and archives have digitized parts of their collections and made them available on the Web. UC Berkeley, for example, exhibits an extraordinary selection of digitized photographs from the Bancroft Library's extensive holdings documenting the history of California; UC Santa Barbara provides access to its collection of maps; and the California Museum of Photography at UC Riverside displays many of its rich store of photographs. And not just images, but full texts of important works are made available on-line.

And beyond UC, examples abound: on-line images of paintings and other artifacts from the Getty Museum; excerpts from the Mount Shasta Collection at the College of the Siskiyous, including portions of John Muir's diaries; and photographs of the San Francisco Public Library's glorious new building.

But much more remains to be done. We must not only link these digitized collections into an integral whole, but find the means to expand them by several orders of magnitude.

There has been much focus on building the information superhighway reaching to every corner of the state. Projects such as Netday '96 have unleashed volunteer enthusiasm and corporate partnerships to wire up California's schoolhouses. Shortly, new technologies will be deployed that will speed access to every home. In less time than cynics think possible, Internet connections will be as ubiquitous as the telephone and television.

There are many difficulties to be overcome. There are critical problems of access, of delivery vehicles, of developing new forms of navigational aids to locate content and of content creation -- making electronic facsimiles of our library holdings. There are problems of making the right licensing arrangements with copyright holders, although important segments of our holdings are out of copyright or are under our control.

We will need to create new works -- multimedia works -- that graphically bring alive our collections to audiences both new and old. And there are significant problems of how to fund this great undertaking.

These problems can be solved. California is the nexus of developments that pave the information superhighway, thanks to our research and development laboratories and the entrepreneurial energies of the private sector. We can join the talents and resources of our colleges and universities and our public libraries in a momentous partnership with corporate California. The University of California stands ready to help in any way.

### **Young minds will be ignited**

California's Cyberlibrary can ignite young minds with the fires of discovery. And not only the young. The Cyberlibrary can unfold intellectual resources across the state to help all those who wish to seek new directions in their lives, expand their visions, or prepare themselves for unknown futures, or just kindle a love of learning.

The Cyberlibrary can help us think in new ways about how to share collections among the universities and campuses of the California State University, community colleges and University of California systems, to avoid wasteful duplication. It also will make our holdings digitally reachable by high school students and others studying to enter our institutions and by our alumni.

As we cross into a new millennium, our great libraries, museums, archives and industrial forces must join hands to complete California's part of Erasmus' dream -- five centuries later -- by creating the Cyberlibrary of California.

And, we can call it Erasmus!

## APPENDIX B

### A Vision of the University of California Digital Library

There are several additional characteristics to the UC DL which the Executive Working Group envisions:

- The UC DL will be *content-based*.

Managing content--not media or technology--will be its primary role. For users, containers and formats should appear to be incidental, although their variety will make an unprecedented range of content accessible. The UC DL will contain or provide access to: electronic versions of existing published literature; new literature created solely in electronic form; specialized data bases such as image collections, scientific data, and text corpora; primary source data such as archival materials, manuscripts and newspapers; formal and informal network communications. New forms of scholarly communication in the humanities and sciences will no doubt generate new kinds of content. We expect the UC DL to have *one* collection, with little or no duplication and with links to paper collections, but this will not reside in a single location or organizational unit. For this potential to be realized, academic and collecting communities around the world must cooperate to establish standards of quality and significance.

- The UC DL will be *user-centered*.

Campus-based user interfaces will facilitate easy interaction with content across UC. User interfaces will serve as a framework for the integration of on-line productivity tools from the commercial sector as well as other parts of the University involved in software development. Some examples are tools for browsing, information retrieval, visualization, statistical analysis, authoring, communication, and multimedia instructional materials. Users will be able to customize the toolset and content base for their own needs regardless of their operating platforms.

- The UC DL will *integrate human services with digital content and tools*.

Experience has demonstrated that the proliferation of information sources and formats creates a rising demand for expert assistance. At the same time, the regular entry of large numbers of new users into the University community requires repeated instruction in fundamental skills--as well as human guidance to induct newcomers into the University's knowledge community. To meet these needs, services will be interactive, personal, and available at many sites. They will support research, electronic publishing, personal information management, distance learning, instructional development, and community service.

- The UC DL will be *ubiquitous in UC*.

Content and many services will be available on a 24x7 basis, over networks which serve not only campuses but remote sites such as homes and offices. Achievement of this goal requires institution-wide provision of robust and regularly updated communications and technical infrastructure and sufficient human resources to respond to complex and evolving needs.

## APPENDIX C

### Organizational Frameworks for the University of California Digital Library

#### Alternatives

The Executive Working Group has identified the following potential organizational forms as an initial framework for the UCDL. Brief sketches appear here. Should UC decide to move forward with a new structure, far more detailed planning would be necessary.

There may be a natural tendency on the part of some to simply suggest that the Division of Library Automation (DLA) evolve into the Digital Library or that the Digital Library be a part of DLA. In this regard, the Executive Working Group would like to assert that while robust technical capabilities, such as those possessed by DLA, are essential to the success of any library today, whether it be paper-based, digital or some combination thereof, the UCDL is not a technological entity. The Digital Library's primary role focuses on scholarly content management, with technology serving the role of tool and enabler, but not driver. DLA's mission and expertise has been in technology implementation and support and not in content management.

#### *UCDL as "co-library"*

The UCDL would be created as a separate organizational entity, equal in status to the nine campus libraries. Its primary responsibilities would be the licensing and acquisition of an electronic content core which it would make available to all faculty and students as well as appropriate services which could best be handled centrally rather than duplicated across the nine campuses. The UCDL would be the framework and nexus for the redirection and coordination of a variety of distributed initiatives for the 'common good'.

The President and the Chancellors, would determine how to allocate resources between campus libraries and participation in the UCDL, and UCOP, in consultation with the Council of Chancellors would determine a UCDL budget ('common good' budget). An all-campus advisory body would be created to guide budgetary, policy, and collecting/licensing decisions for digital content to be used on all campuses. Many individual content objects would be housed in existing campus units, whether in libraries or elsewhere, which would also serve as primary service points. The central advisory body would develop standards for access and use and provide a framework for developing and exchanging support services.

A UCDL co-library could be launched in phases as a series of discipline-based collections, beginning in areas in which digital content is most prevalent and scholarly communication is most conducive to the application of electronic technologies. New disciplines would be incorporated as academic program development required. Criteria would need to be developed for weighting the needs of various academic fields against each other, but such a structure would embed allocation of resources for UCDL purposes in planning for academic programs. A disciplinary starting point would allow differential assessment of the importance of digitization and digitalization and might provide a means of establishing priorities for shifting the print-digital mix of different collections. It is likely that the imperative to move toward digital collections will be strongest for academic programs that exist on every campus.

#### *Potential Advantages:*

Elimination of duplicative content. Institutional strength in negotiating with external vendors. Consistency in operations and resources across campuses. Easily-identified high profile. Potential for "one-stop shopping." Potential to overcome intercampus barriers to effective resource coordination. Direct budgetary allocations that would facilitate state-of-

the-art collections. Ability to develop a critical mass for knowledge dissemination. Efficiencies in developing support services tailored to disciplinary requirements across locations. Ability to launch quickly in heavily digital disciplines.

*Potential Challenges:*

Complex transactional relationships with campus libraries. Potentially confusing lines of authority for UCDL and campus units. Competition with campus units for budgetary resources. Difficulty of integrating systemwide UCDL planning into campus academic planning. Potentially high financial and organizational start-up costs.

***UCDL as an extension of the existing organizational structure***

Operating within a budgeting structure that subsumes library funding under block allocations to individual campuses, chancellors and librarians would identify areas in which collaboration would yield obvious benefits and develop appropriate relationships across and beyond campuses. These might include nine-campus agreements to share specified databases or bilateral partnerships to develop specialized on-line help services or single-campus contracts with specific content creators or user groups outside UC. Such efforts could be driven at different times by chancellors' assessments of budgetary, research, or instructional support priorities, by library identification of opportunities, or by pressure from constituencies outside UC.

*Potential Advantages:*

Builds on existing organization with least disruption. Maximizes local decision-making power. Allows flexibility for voluntary case-by-case contractual relationships in which participants identify and maximize their own interests. Builds on-campus ties between library and administration, with potential for linking to non-library units in locally appropriate ways. May encourage entrepreneurship at the campus level.

*Potential Challenges:*

Universitywide coordination and participation will be difficult to orchestrate when campus administrations operate under incentives to off-load cost centers. Local administrations may be reluctant to provide funds for activities that are not contained on the home campus. Potential to generate intercampus inequities in access to information. Potentially destructive intercampus competition. Lack of critical mass for innovation. Difficulty of achieving unified UC stance for leadership in developing business models and technical standards. Funding stability dependent upon financial decisions made on each campus.

***UCDL as freestanding not-for-profit.***

A UC-owned not-for-profit would be established to provide coordination and brokering services between UC and external providers and users. It would manage a seamless collection that would include both UC and external content. Relationships with campus units would be by contract. Not-for-profit organizational structure would facilitate revenue generation from customer populations.

*Potential Advantages:*

Potentially more flexible than University administration. Capacity to enter markets on competitive terms. Enhanced ability to enter consortial agreements with other institutions.

*Potential Challenges:*

Suggestion that a core University function is being spun off with corresponding diminution of commitment. Complexity of relationship with campus and Universitywide units. Potential lack of accountability to core academic missions. Dilution of UC identification. Difficulty of predicting unintended consequences in an unstable environment. High set-up and overhead costs.

## **Organizing principles**

Operating authority for the UCDL should be distributed organizationally rather than geographically and should be delimited by functional rather than physical boundaries. The UCDL should overlaid and link present library operating structures while possibly extending beyond them to include, for example, museums and laboratory-based data collections. The most viable UCDL structure is likely to contain many nodes, with a central or "main" node through which core collections of digital content are licensed and distributed. Relations between nodes and the coordinating body may be more contractual than hierarchical, although they are likely to evolve in a hybrid form incorporating complex relationships of cost sharing, reciprocity, and exchange.

In all of its operations, the UCDL should be driven by the principle that no member of the University of California should be deprived of access to information as a consequence of his or her physical or organizational location within the UC system. Further, the UCDL should operate on the corollary principle that UC alumni deserve special access to its resources as a means of maintaining professional currency and closer ties to the UC system; access should also be extended as far as possible to the California public, although collection development should be driven by the needs of a research university. The coordinating body should adopt generalizable principles and policies for determining which content and services and which categories of users should be underwritten by the UCDL and which will require provisions for cost recovery.

Functions of the UCDL should be located where they can be most effectively performed, with careful attention to the degree and quality of intellectual oversight required to manage them. In contrast to the Salmon plan, which defined appropriate collecting levels by the speed with which materials could be retrieved, information management levels within the UCDL should be determined by the degree of specialization associated with various kinds of content. Examples of how this principle might be implemented include:

- **Collecting authority**

UCDL should negotiate Universitywide licenses for an agreed-upon body of general-purpose materials, such as full-text major journals, abstracting and document delivery services, and databases used in many disciplines. Identification of materials that should belong to this "core collection" should involve librarians, other information managers, and faculty. Selection principles should be applicable at all levels and guide collecting decisions made in specialized nodes. They should incorporate ways to make choices between competing needs. As material to be acquired or licensed becomes more specialized, selection should move closer to faculty users and librarians or other knowledge managers (e.g., museum curators and laboratory directors) who are able to judge quality and significance and set priorities. Such authority may reside in campus libraries, multicampus research units, or other entities now existing or created for this purpose.

- **Standards**

UCDL staff should recommend technical standards for interoperability. It should continuously seek out and publicize examples of "best practices" in campus and other decentralized units in an effort to create a climate in which *de facto* standards prevail.

- **Phase-in**

The coordinating body should identify the content or categories of content whose centralized management in a core collection will contribute most substantially to collaboration in pursuit of the knowledge mission. At the same time, it should begin identifying campus-based content that could migrate into the UCDL, create incentives for migration, and establish threshold standards that should serve as criteria for incorporating new nodes and facilitate communication and sharing between nodes. Individual nodes

should be responsible for maintaining standards and meeting obligations to provide access and content. The coordinating body will face significant challenges in assisting nodes begun with grant funding to find resources for ongoing operations. Ultimately, success in this arena will depend on a shared sense of mission and benefit. Among the issues the coordinating body is likely to encounter is whether and on what terms non-UC units may be included in the UCDL and the terms on which non-UC users may have access to its collections.

- **Access**

Although the coordinating body should establish minimum access standards according to the principle of non-deprivation, campus libraries and appropriate other units should be the gateways to UCDL collections. Such responsibility includes provision of 24 X 7 machine access with adequate bandwidth to accommodate on-campus and remote users, provision of technical assistance in using specialized material, and provision of on-demand printing capability adequate to meet demand for materials that are not collected in paper form. Responsibility for creating finding aids should be shared between central and local units, with specific tasks distributed in ways that support accuracy, completeness, and interoperability.

- **Digitization**

The coordinating body may establish priorities for determining what kinds of paper material should be digitized. Holders of physical collections should be responsible for making specific decisions about what to digitize and for accomplishing digitization according to technical standards that ensure maximum feasible functionality, interoperability, and longevity. These efforts should be centrally coordinated to avoid duplication. If there is agreement that a "core collection" of existing texts should be digitized, provision should be made for accomplishing this in a way that is equitable, efficient, and non-duplicative.

- **Storage**

The UCDL should require links to physically stored originals from which digitized materials have been created as well as to electronically stored data that exists only in digital form. The coordinating body should establish standards for archival preservation across generations of technology and in duplicate sites; these will inevitably generate new requirements for electronic storage on servers and in stand-alone forms such as CD-ROMs. Some storage functions should be managed offsite by external vendors, with which the UCDL should maintain necessary contracts, software, and gateway bandwidth to guarantee that UC users are able to access remote archives. Performance of this function will involve cooperation between the coordinating body and local units.

- **Publishing**

As a repository for original works and data created by UC faculty, the UCDL's distribution function should be linked in a complementary way to the traditional publishing process. Such linkage is likely to begin with small-circulation monographs and working papers, but it may soon extend to on-line journals. The coordinating body should establish criteria and principles for UCDL publishing activity. The appropriate level at which publication decisions should be made, the formality with which publications should be endorsed as products of the University of California, appropriate editorial procedures, and partnering with other UC or non-UC entities should differ with various kinds of content. As this function evolves, it is certain to involve complex and challenging negotiations between individual nodes and the coordinating body as well as experiments that will create the knowledge from which new organizational forms should be derived.

## **APPENDIX D**

### **Content: Collection, Access, and Management**

#### **Copies and Intellectual Property**

In the digital environment, access to content will often be secured by licensing the right to use and archive the intellectual property contained in a work rather than, as in the paper environment, purchasing a copy of a work. Content should be mounted in a variety of locations, including local servers, central campus servers, central UC servers, and remote servers. Content owned by UC should be mounted on University servers with clearly established conditions and terms on which it may be used within and beyond the University. Management of intellectual property will complement the acquisition of physical copies as the primary mechanism for operationalizing a library's mission. For the UCDL, this transition should mean that ownership will focus on unique objects ranging from manuscripts and art objects housed in UC special collections and museums to new scientific knowledge created in UC laboratories. Ownership should carry all the obligations now embedded in ownership of paper collections: preservation across technological platforms, organization for access, cataloging and provision of finding aids, support for users. Ownership will also require new kinds of agreements between the UCDL and faculty creators of intellectual property. For content representing intellectual property held elsewhere, the preferred mode of access will likely be licensing in perpetuity, including either a guarantee that the owner will archive the licensed material or the right to archive it locally. Hybrid arrangements will mean that collection quality is no longer meaningfully measured by traditional research library indicators: the UCDL should be measured on the satisfaction of faculty and student needs rather than the "size" of its "collection."

As in the paper environment, organizing access to content should be a significant part of collection management, with the probability that the organizing structure may eventually drive "collecting" priorities by creating categories of information in which more or less completeness is sought. It will be necessary to develop pathways to content created and held elsewhere that are consistent with the organization of UC material but that do not require significant UC intervention. By creating an orderly information system and guaranteeing archival and service support, the UCDL will construct a collection which is clearly demarcated from the undifferentiated content of the Internet. The metadata that describes content to which the UCDL provides access should become a prominent element in its collection for which skilled staff or reliable vendors should be employed. One of the essential characteristics of the DL's core collection should be its provision of finding aids that are accurate and contain enough information to assist users in making reasonable choices about what items to pursue. Without such indicators, the time cost of seeking information in an expanding universe of electronic materials will be excessive, and researchers will be faced with the choice of restricting themselves to content with which they are familiar or engaging armies of graduate students to do their searches for them.

Developing improved search tools that enable individual users to discover and negotiate their access to externally held content should become an important aspect of "collection development," as should licensing access to remote content in frequent demand at UC. Determination of when reasonable access requires a UC license or the provision of multiple copies on more than one server should be driven by the volume and nature of demand and the advantages to be gained by incorporating specific content into the collection that UC manages. This includes assurance that the material will be archived and that access paths and storage media will be maintained and refreshed. In principle, access licenses should provide for users from every campus, with technical issues related to bandwidth and cost issues related to the level of use governing the choice between one and many servers. It should be affirmed that the UCDL will collect primarily for the research, instruction, and public service needs of the University and that, although public access will be facilitated to the extent economically feasible, it may be the

responsibility of others to create organizing viewers and links to those parts of the UCDL that are most valuable to other users, such as K-12 educators, industry researchers, health practitioners, and public policy makers.

### **Digitization**

In establishing a balance between paper and digital "collecting," efficient access and cost should be determining factors. Costs must be calculated to include acquisition, cataloging, storage, circulation, and user support services. Despite a growing preference for acquiring new works in digital form, paper collecting should continue until on-demand printing is convenient, cheap, and reliable since paper containers of information (books and journals) are more portable than digital ones. Provision should be made for meeting the challenge of creating a seamless interface for digital and paper content; these formats require different maintenance and retrieval functions and present different cataloging requirements. Currently, it is also important to consider the distinction between digitized and digital material, especially textual, although this distinction is likely to become less important in the future. The former are works originally held in paper or other tangible format and translated to electronic media but with varying levels of functionality, e.g. bitmapped images of journal pages placed on a server that can be viewed and downloaded but are not fully searchable or manipulable vs. searchable texts. Digitization may be carried out for ease of delivery or preservation as well as improved functionality. Digital material, on the other hand, originates in digital formats and makes possible the inclusion of many kinds of data besides text and images; it may be executable as well as manipulable and searchable. On functional grounds, higher priority should be placed on incorporating digital content into the UCDL than on digitizing paper content in limited-function formats--despite the appeal of using a single format for all collections. Why this is so may be understood by considering that the reader of a digital article may be able to retrieve the raw data underlying it, rerun the author's analysis, and even conduct new analyses; a digital article may include or be linked to software as well as data. Digitization should be employed when it offers an efficient form of access, particularly to unique material, and when it is the most appropriate way to deliver content to academic programs. The Mellon Foundation's experimental JSTOR project to digitize and license the entire corpus of ten leading journals, may provide some insights into the feasibility and value of large-scale digitization for existing paper material.

### **Archiving**

It is important to state up front that no one yet understands how to archive digital materials. It is critical for UC to participate fully in the national debates currently underway in this area. Nonetheless, certain principles can be articulated which appear reasonable at this time.

Priority in archiving should be given to materials that are unique to UC, and standards should be equivalent to those already prevalent in managing special collections. Additional unique materials should enter the UCDL through cooperation with other institutions: some of these will be small and lack the capacity to mount their own archiving operations, while others may be large but will contain special collections that complement those at UC. Archiving decisions for non-unique materials should be made with reference to archiving activities elsewhere in such a way that academic libraries as a collective body assure the survival of significant works created in digital formats, with access assured to users at any location. The UCDL should also retain the right to archive any material it has purchased. The ability to print single copies on acid-free paper, where digital materials are printable, should be part of UC contracts and licenses. The UCDL system should be designed for distributed storage of content at sites both within and outside UC. Digital content should be stored in duplicate at multiple sites to secure against system failure or destruction of data in single-site disasters like earthquakes, fires, and floods.

## **Partnerships**

Developing a collection by licensing access to information will necessarily involve the UCDL in an expanding network of partnerships. Partnerships should link UC to other institutions that are developing their own digital libraries, to national university and professional associations, to international creators and holders of information, to government agencies, and to local entities. All should have content to share and needs for the content that UC controls as well as contributions to make in developing standards and formats. In particular, the UCDL should rely on the national library community, which will continue to nurture systems, standards, and techniques as well as looking to UC for contributions. Close contact with alumni and other corporate affiliations are also likely lead to cooperative agreements to share the information resources held by many corporations in California.

## **Dissemination**

Providing digital access to unique materials controlled by UC will sometimes blur the distinction between library and publisher functions and should offer opportunities for the UCDL to play a proactive role in making information available to University and public users. On a small scale, libraries have been performing some of these functions as they manage course reserves that combine traditional library material with original works created by course instructors or students. For at least some sets of data, the UCDL should facilitate peer review and information organization functions similar to those now associated with journals.

Virtually all content created at UC should be considered as potentially a part of the UCDL, regardless of the organizational nature of the unit in which it is created and held. With this possibility, it will be necessary to develop demarcations between content for which the UCDL is responsible and that to which it merely provides links. Faculty should necessarily play a continuous and strong role in developing criteria of quality and significance, with consultation taking place at all levels from research and instructional units to campus-wide and University-wide committees empowered to set priorities between competing demands for limited resources.

## **APPENDIX E**

### **Technology Architecture and Infrastructure**

Planning for the UC DL necessarily rests on the premise that every member of the University of California should have access on campus to necessary hardware, network connectivity, and instruction in how to access and manipulate digital objects that include text and multimedia, applications, and databases. If this condition cannot be met, the UC DL will necessarily be limited to a staged phase-in beginning in those campuses and disciplines that are already well equipped with communications and digital infrastructure. Ultimately, this infrastructure must be provided on a universal basis. UC DL needs should be a significant driver for campus infrastructure decisions and should be incorporated within general campus planning processes. In choosing the mechanism by which infrastructure will be financed, care must be taken not to create barriers to use or inequities between campuses and disciplines.

Campus and UC-wide network infrastructure and connectivity should link on-campus and remote users to local campus servers, all other campuses, and the entire Internet. They must be adequate to support: access to any local server or Internet gateway; access to on-line catalogs and help; and downloading and printing files in a robust and dependable manner, 24 hours per day, 7 days a week. Real time help must also be available during a reasonable number of specified hours daily.

Human-to-human interactions--for support services and collaborative research and teaching--will be supported with software protocols that allow simultaneous access to data and other human beings. Every campus should maintain a limited library of connectivity tools. Policy decisions regarding access to the UC DL will determine the number of users to be supported, but connectivity should be built on standard components that can be extended or duplicated as necessary to respond to rising demand. Recent initiatives to improve network infrastructure on and between campuses have produced substantial progress, but it will be essential that UC DL administrators work closely with chief information officers, network and systems administrators, and capital planners to monitor and match mainstream state-of-the-art network designs and data formats. Continuous system upgrades and maintenance--with attention to cross-platform and backward compatibility--must characterize the environment in which the UC DL develops.

Great effort should be taken to ensure an appropriate balance between the lowest common denominator for access and what can be achieved should users possess high end technology. The UC DL should be designed to be accessible to users whose bandwidth and hardware do not surpass mass market standards. However, some UC DL content and use will demand higher bandwidth and more powerful CPUs than "ordinary" private users can be expected to possess, and this should be accessible from at least some campus work stations available to the general University community.

The UC DL should be based on current Internet software protocols and should build on commercial off-the-shelf solutions whenever possible. As a matter of principle, UC DL software design should depend on the innovative uses of robust technologies, leaving to academic departments exploration of what is new and considered leading edge. The UC DL should actively collaborate with academic researchers in making operational what has been developed through research projects. When UC DL requirements exceed commercially-available options, solutions should be designed that allow for the incorporation or substitution of commercial applications as they become available. It should be recognized at times the UC DL should lead or collaborate with others in establishing industry standards. UC DL commitment to standards in advance of market developments should be driven by content requirements and by the determination that a non-standardized environment will have damaging long-term effects on the UC DL. Such decisions should also be based on the recognition that content must be managed to transcend generations of software and should attempt to position the UC DL to influence the market choice of standards.

Software development partnerships with commercial interests represent an important strategy; the UC DL, however, should exercise care in ensuring that the delivery of services rather than the creation of commercial products drives its actions. Existing mechanisms for collaboration with other state, national, and international institutions on technologies and standards should be used and extended to facilitate access and resource sharing.

Critical improvements are necessary in two functional areas: (1) print-on-demand infrastructure for electronic materials; and (2) an effective and rational authentication structure. Printing facilities offering cost, convenience, and quality options should be widely available. Software and license agreements should ensure that users at any site may acquire print versions of material stored or transmitted in a wide range of formats. All campus service centers for the UC DL, whether housed in traditional libraries or elsewhere, should include printing facilities that meet performance standards at least equivalent to those of today's high-speed copy machines. At least one center on each campus should provide full-featured printing capability with appropriate software and technical support.

Similarly, the University must develop an authentication structure that makes it possible to acquire licenses with full confidence that contract terms will be upheld and legitimate proprietary interests protected while maintaining legitimate privacy for users. Such capabilities will be critical to guaranteeing maximum access to material whose reproduction or retransmission is restricted. Intellectual property management will involve substantial technical issues in identifying or creating software to conform to license agreements and protect content to which UC or UC faculty hold copyright. The range of functions that must be supported will, however, depend on a complex legal and economic environment and technology needs to support policy resolution in those areas.

The Executive Working Group believes that the UC DL will have implications for future space planning, and that digital library planning efforts should be closely coordinated with space planning. However, caution must be exercised by those who would assume that the UC DL obviates the need for new buildings and building renovations.