

UNIVERSITY OF COLORADO AT BOULDER

**REPORT OF THE FLAGSHIP 2030 TASK FORCE
ON RESEARCH, SCHOLARSHIP, AND CREATIVE WORK**

2 September 2008

REPORT OF THE FLAGSHIP 2030 TASK FORCE
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REPORT OF THE FLAGSHIP 2030 TASK FORCE ON RESEARCH, SCHOLARSHIP, AND CREATIVE WORK

INTRODUCTION

Membership. The Research, Scholarship, and Creative Work Task Force was co-chaired by Associate Vice Chancellor for Research Russell Moore (Integrative Physiology) and Fred Anderson (History), with administrative support from Linda Morris (Export Controls Coordinator in the Office of the Vice Chancellor for Research). The committee members were Bud Coleman (Theatre and Dance), Randy Draper (Director, Office of Contracts and Grants), Darna Dufour (Anthropology), Valerio Ferme (French and Italian), James Goodrich (Chemistry and Biochemistry), Robert Guralnick (Ecology and Evolutionary Biology/University Museum), Merlyn Holmes (the Graduate School), Faye Kleeman (East Asian Languages and Civilizations), Michael Lightner (Electrical and Computer Engineering), Kamran Mohseni (Aerospace Engineering Sciences), Bradley Olwin (Molecular, Cellular, and Developmental Biology), Cora Randall (Atmospheric and Oceanic Sciences/Laboratory for Atmospheric and Space Physics), Jerry Rudy (Psychology), Douglas Sicker (Computer Science), Bryan Taylor (Communication), and Alexey Wolfson (Chemistry and Biochemistry).

Initiatives assigned and work plan. The initiatives assigned the RSCW task force consisted of one Core initiative, Research Excellence; and three Flagship initiatives: Research Diamond, Global Crossroads, and Year-Round Learning. Following our initial meeting on 16 February 2008, the members were divided into four subcommittees, each charged with investigating and reporting on one of the initiatives. The subcommittees met frequently thereafter, assembling information from external sources, inviting and interviewing guests with expertise relevant to their work, and developing reports and recommendations. The Task Force as a whole met twice monthly through the Spring term and the summer to hear and discuss subcommittee findings, generate further assignments and action plans, and formulate reports. Task Force committee and subcommittee documents, along with minutes of various meetings, were posted on our WIKI, at <https://itswiki.colorado.edu/display/FL2030Research/Research%2C+Scholarship+and+Creative+Works>.

PART I

Findings, Proposals, and Implementation

The Flagship 2030 document sets lofty goals for the University: to become an international leader in collaborative research, scholarship, and creative work through the Global Crossroads Initiative; to project leadership at the state and regional levels through the Research Diamond Initiative; to position its individual scholars, researchers, and creative artists at the leading edge of their disciplines in accordance with the Research Excellence Initiative. This task force finds that the University can realize these goals, but only if it significantly alters its approach to the support of research, scholarly, and creative work, increases the level at which it invests in these endeavors, and reconfigures the structures responsible for research administration. Together these changes will amount to nothing less than a transformation in the institutional culture of the University of Colorado at Boulder. The Vice Chancellor for Research (VCR) must take the lead in this transformation. To do so will require an elevation of the Office of the Vice Chancellor for Research (OVCR) within the formal organizational structure of the Boulder campus, and at least a tripling of its budget over the next five years.

Over the last six decades the University of Colorado at Boulder has been the scene of impressive accomplishments in research, scholarship, and creative work, even as it has invested far more modestly in research infrastructure and administration than such peer institutions as the University of California, Berkeley, and the University of Michigan, Ann Arbor. These advances in knowledge and technique have come about largely because the campus administration has encouraged the entrepreneurial instincts of faculty members and reacted favorably when opportunities for institutional collaboration – for example, with the National Institute of Standards and Technology or the National Center for Atmospheric Research – have presented themselves. Little sustained planning and strategic investment has accompanied this reactive, largely opportunistic, approach.

Today CU-Boulder stands at a crossroads. Competition for the external resources necessary for the University to function as a center of research and scholarly excellence is ferocious, and will only become more so. Library and laboratory facilities are barely adequate to meet present needs; office space is perpetually in crisis; large-scale funding opportunities are missed for lack of institutional support; budgets for facilities maintenance, support staff, and fellowship funding all stand at levels that place CU on the lowest tier of AAU Research I institutions. Under these conditions the retention of young and mid-career colleagues has become a problem so acute that faculty members commonly joke that the Ivy League has no better farm team than the University of Colorado. Yet CU regularly loses scholars not just to Harvard, Princeton, and Brown – or even to Berkeley, Chapel Hill, and Ann Arbor – but to the Universities of Kansas, New Mexico, and British Columbia. Faculty members who leave Boulder often do so because their new institutions hold out more reliable support for research, more competitive funding for graduate students, and better facilities in which to conduct their research, scholarly, and creative work. If CU continues to rely on its current, under-funded, unsystematic approach, it will surely continue to lose talented faculty in whose work and careers it has made large investments, to other institutions. As CU loses valuable scholars it loses ground *vis à vis* its peer institutions – ground that will be increasingly difficult, perhaps impossible, to regain. The changes necessary to secure our place as a research university of the first rank are broad and far-reaching. In the interest of realizing them, we propose the following measures.

Proposal 1: Reorganization and Elevation of the Office of the Vice Chancellor for Research. To achieve the goals of the Flagship 2030 plan the Vice Chancellor for Research should be elevated in the formal organizational structure of the Boulder campus and report to the Chancellor. The funding of the Office of the Vice Chancellor for Research should be dramatically increased, and the office itself reorganized to oversee new and existing functions in support of the research, creative, and scholarly mission of the campus. These changes will enable the VCR to respond quickly and flexibly to the opportunities and challenges the University will face in the next 20 years, and to oversee such new initiatives as the Global Crossroads and the Research Diamond outlined below. In recognition of the broad responsibilities that this administrator will perform, the importance of the various functions within the purview of the office, and the need to recognize the contributions of faculty in all disciplines, the committee recommends that the title of the position be changed to Vice Chancellor for Research and Creative Work. (For simplicity's sake, the familiar acronym VCR will be used throughout the following report and the attached subcommittee reports.)

The *Report of the Subcommittee on Research, Scholarship, and Creative Work* (Appendix 1) describes in detail a proposed organizational scheme by which the VCR is elevated

to the status of an executive vice chancellor, occupying the same plane as the Provost/Executive Vice Chancellor for Academic Affairs, and hence is made administratively responsible directly to the Chancellor. The new executive VCR would be responsible for policy and strategy relating to the promotion and administration of research, scholarship, and creative work on campus. He or she would define strategic priorities with the advice of a large faculty committee made up of knowledgeable senior members drawn from the various colleges and distributed across academic disciplines – the Vice Chancellor’s Strategic Planning Committee (VCSPC), an advisory body comparable in stature and consequence to the current Vice Chancellor’s Advisory Committee (VCAC). The VCR would have direct budgetary authority within his office’s area of responsibility, would work collaboratively with the Provost on issues regarding the strategic allocation of tenure-track faculty lines, and would have budgetary discretion to assign monies to implement and sustain research initiatives. In this way the VCR would be equally responsible for promoting *all* research, scholarly, and creative activities across the campus, and would be an advocate for *all* faculty researchers, whether assigned to regular departmental lines or working within the structures of interdisciplinary institutes. The administrative responsibilities of the VCR would be divided functionally between the following principal officers who would report to him or her:

- Dean of the Graduate School. The duties of the DGS would remain as currently constituted, with responsibility for the supervision of graduate student support, discipline, etc. She or he would be a full member of the Council of Deans, and have a status commensurate with those of the chief administrative officers of the colleges.
- Dean of the Institutes. The DI would function as dean of the Institutes and interdisciplinary centers, representing their interests and coordinating their activities. He or she would have a status equal to that of the DGS and a seat on the Council of Deans.
- Associate Vice Chancellor for Research Administration. The AVCRA would superintend a staff organized into six directorates, each responsible for a functional component of the research enterprise. She or he would be responsible for the coordination of a centralized, fully supported staff to which all researchers on campus would have equal access. The benefits of centralizing functions such as support for grant writing, regulatory compliance, and the creation and monitoring of contractual relationships with businesses and other entities sponsoring research will be considerable. Savings can be expected in the elimination of duplicated effort while benefits will accrue because individual faculty, as well as smaller institutes and centers, will enjoy greater ease of access to research infrastructure such as the “Proposal Machine” described in Appendix 1.1. The AVCRA will have a permanent seat on the VCSPC.

At present the financing of research administrative and graduate student support through the Graduate School and Office of the VCR approximates \$13,500,000 annually. (For a detailed breakdown of the components of this budget, see the table and commentary in Appendix 1, at page 18.) In Fiscal Year 2009 nearly 70% of the combined OVCR and Graduate School budget will consist of continuing funds for personnel and operations, leaving less than \$4,400,000 to invest in the promotion of research – monies for seed grants and matching funds, new initiatives, faculty fellowships, and the like. Of that \$4.4 million, only slightly over \$2.7 million is continuously budgeted for purposes of research support; the remainder represents a deficit that must be covered from other temporary funds. This situation is obviously unsustainable financially. It also places us far behind our peers, and even our competitors from outside the

ranks of AAU Research I institutions. At Colorado State University, for example, the Office of the Vice President for Research (the nearest institutional equivalent to our OVCR/DGS) has an annual budget on the order of \$30 million, about 220% of CU's annual funding level. CSU's larger budgetary commitment is, moreover, predictable in ways that CU's deficit-prone system is not, because fully half of its annual funds come from indirect cost-recovery money that is redistributed to the Office of the Vice President for Research according to a consistent formula.

In short the VCR, as currently constituted, routinely lacks the funds to support promising initiatives, and in some cases has been unable to provide even a modest level of matching funds that would permit CU researchers to take advantage of grants they might otherwise have received. To eliminate these problems, and particularly to prevent external grant monies being "left on table" for want of matching funds availability, the Task Force strongly recommends that the current budget of the OVCR be tripled over the course of the first five years after the reorganization of the office has been completed, i.e., by the academic year 2015-16. To maintain access to this level of funding as a baseline for all future budgets, a memorandum of understanding should be drawn up apportioning some adequate and predictable percentage of the campus budget for discretionary use of the VCR's office.

The Task Force further recommends that the creation of an Endowment for Research Excellence be made a priority of the coming capital campaign, with the goal of placing a permanent fund for the promotion of research on the order of \$5,000,000 annually at the disposal of the VCR *in addition to* the annual baseline budget. The Task Force recognizes that this is an ambitious goal, representing a donation on the order of \$125,000,000 to underwrite an Endowment for Research Excellence. Presumably this will require a major corporate sponsor or sponsors whose name (or names) would be permanently associated with the Research Excellence endowment. Yet the Task Force also believes that there could be no more significant use to which such money could be put if CU truly is to function at the highest possible sustained level of excellence in research, scholarship, and creative work.

Once implemented, the recommendations of the Task Force will create a platform on which faculty can pursue research, scholarly, and creative projects at levels that will enhance CU's reputation for excellence and promote both regional and international leadership. The *Report of the Subcommittee on the Colorado Research Diamond* (Appendix 2) and the *Report of the Global Crossroads Subcommittee* (Appendix 3) describe initiatives that can help secure that position of leadership. It is crucial to recognize that these are not blue-sky musings, but detailed programs aimed at harnessing the anticipated advance in CU's standing to further, future growth. *Virtually every measure described in these reports depends on implementing the changes in the OVCR detailed in Appendix 1.* These reports, therefore, should be read as underscoring the urgency of the recommendations of the *Report of the Subcommittee on Research, Scholarship, and Creative Work.*

The Task Force members recognize that the reorganization of the OVCR is complex and that the resulting changes that will be far-reaching. Nevertheless, the Task Force emphatically recommends that these changes take place as quickly as possible. While it is crucial to anticipate potential consequences, and while careful planning will be necessary to insure a seamless transition from the present organization to the new configuration, any delay in implementation will cost CU critical momentum. Once lost, that momentum may be difficult or even impossible to regain, particularly if key administrators were to leave their positions before the necessary changes have been accomplished.

Proposal 2: Creation of the Colorado Research Diamond. Our vision for achieving research excellence includes a fundamental change in the institutional culture of the University, from that of an ivory tower to one of an integrated, collaborative research enterprise. A vital aspect of this change is establishing the Colorado Research Diamond (CRD), a trans-institutional consortium that will engage leaders of business and industry, non-profit organizations, government and federal laboratories in entrepreneurial collaborations. As one critical vertex of the diamond, CU-Boulder will be a regional center of intellectual leadership and technological innovation. CU will evolve new approaches to conceptualizing and developing technology, building on interactions between the arts and humanities, social sciences, business, law, and natural sciences and engineering to encompass the social, political, and economic dimensions of the advances. Realizing the CRD vision will require substantial commitment of financial resources. Interdisciplinary and inter-institutional research and creative work must become a primary focal point of the CU-Boulder operating philosophy and administrative infrastructure. This will not be cheap, and should not be attempted without the allocation of new funds to the OVCR. These will be used to establish CRD policies and procedures, to expand interdisciplinary research and development, and to integrate CU research into the regional community and economy. Such investments will be substantial, but if made in a responsible and thoughtful way can confidently be expected to produce enormous returns in years to come.

A detailed exposition of CU's role in the structure and functioning of the Research Diamond, with a suggested timeline for implementation of initiatives, will be found at Appendix 2. A discussion of two exemplary components of the CRD – a model for facilitating interactions and transmitting knowledge among members of the Diamond community through a Multi-functional Service Center, and a model for incubating start-up industries in the life sciences with university support – can be found in Appendixes 2.1 and 2.2 respectively.

Proposal 3: Establishing the University of Colorado as a Global Crossroads. Making CU-Boulder a Global Crossroads in research and education is essential to furthering the University's mission under the Flagship 2030 Core Initiative "Fostering Research Excellence." The United States can no longer safely assume its position as a leader in graduate education and research around the world, and there is a very real danger of being passed over altogether and stagnating institutionally and intellectually if CU fails to embrace internationalization. Crucial to the project of internationalization is making CU a magnet for researchers around the world. Reaching out to them, facilitating interactions across institutional boundaries and national frontiers, and providing facilities at which researchers from around the world can operate, will all be critical dimensions of the global crossroads that CU must become. Only in this way can the University become a leader among institutions of higher education internationally. Fostering intellectual exchanges, interconnections, and collaborative relationships will be essential to the larger project of marshalling the resources required to address the great issues that we will face on the road to 2030. To establish CU-Boulder's position in this way, therefore, we recommend that the University:

- Implement the six "best practices for internationalization" as identified by the American Council on Education.
- Establish a Colorado Center for Global Studies to provide critical infrastructure for supporting internationalization and a platform for the Office of the Vice Chancellor for Research to expand its international partnerships.
- Increase the number of international scholars and students on campus. To meet the current Institute of International Education's (IIE) benchmarks for excellence (and thus

gain visibility as a true global crossroads), we should add *at least* an additional 208 international scholars, a number that would place CU among the "Top 40 Leading Institutions Hosting International Scholars," and add, as well, an additional 2,227 international students (graduate and undergraduate), which would situate us among the "Top 25 Institutions Hosting International Students."

- Create a vibrant international presence by establishing our own standards for breadth, depth, and distribution of scholars and students across departments and by making students and researchers from abroad feel valued. In this way CU's status as an international institution will become self-sustaining, perpetuated by word-of-mouth as well as by more formal measures of institutional reputation.
- Facilitate and support faculty participation in international endeavors, particularly in those fields where internationalization has yet to become common.
- Create residential centers for research and education abroad.
- In cooperation with the Vice Chancellor for Academic Affairs, internationalize our curriculum at the undergraduate and graduate levels.
- Utilize cyberinfrastructure to support internationalization.
- Create a communications strategy to promote important concepts related to international research and education.
- Create clear policies and procedures to govern outsourcing.
- Develop evaluation methods for assessing and rewarding success.

See Appendix 3 below for a detailed discussion of these initiatives and a timeline for implementation. Appendix 3.1 presents information on the present state of internationalization among students and faculty at CU-Boulder.

Proposal 4: Recommendation against a year-round instructional schedule as a Flagship initiative. The Subcommittee on Year-Round Learning advises against implementing a three-semester schedule. After reviewing the literature and holding numerous discussions with faculty at CU and comparable institutions such as the Universities of Michigan and Florida, the subcommittee concluded that potential damages to the majority of our research units far outweigh the advantages that year-round learning might bring to the campus. While a shift to a three-semester calendar might theoretically well serve a small number of faculty and campus units (e.g., in most Humanities disciplines, Geography, and Environmental Sciences) by allowing them to perform research at times of the year and in parts of the globe that the current schedule makes less available for such purposes, the reality is that most colleagues would be hurt professionally and even financially by such a shift. Indeed, because the majority of professional conferences in scientific fields take place during the summer; because the shift to year-round learning produces, albeit involuntarily, an emphasis on year-round teaching instead of favoring research; and because the strain on campus facilities and human resources would far outweigh any potential financial benefits; it is our belief that to move toward year-round learning would produce a mass exodus of our research and tenured faculty toward other schools with a more traditional academic approach to teaching, learning and especially research.

For a detailed report on the subcommittee's findings, see Appendix 4.

CONCLUSION

Not long ago, the University of Colorado could fulfill its statutory responsibilities as a “comprehensive graduate research university with selective admissions standards” merely by “offer[ing] a comprehensive array of undergraduate, master, and doctoral degree programs” and awarding the attendant degrees. Now, however, if CU is to offer the kind of world-class education that only an AAU Research I university can provide, it must engage in the creation and propagation of knowledge with greater strategic focus and institutional support than ever before. Faculty, acting individually and collaboratively as researchers, scholars, and artists, will be as always the resource essential to this endeavor. Unless they remain engaged in their disciplines at the highest levels they can attain, however, CU will become no more than a venue where lectures may be heard, examinations given, and degrees conferred – in truth no more than a simulacrum of a research university. This report outlines a program by which CU’s faculty members and students can continue to create academic knowledge and artistic works in accordance with the most rigorous standards of their disciplines: a program by which CU can attain a higher and more consistent level of distinction in research, scholarly, and creative work than it has yet achieved.

PART II

Information for the Use of the Accreditation Panel

1) Describe how your recommendations help advance the mission of the University of Colorado at Boulder as a comprehensive graduate research institution with selective admission standards.

The implementation of these recommendations will increase the overall institutional capacity to engage in scholarship and research at the highest possible levels across all disciplines. This will greatly enhance the ability of the University to attract and retain an outstanding faculty and to attract the highest caliber of graduate students.

2) Discuss how your recommendations affect the allocation of campus resources (personnel, financial, facilities, etc.) in order to allow us to fulfill our mission, improve the quality of education, and respond to future challenges and opportunities.

The quality of education at the University of Colorado depends on attracting and retaining world-class scholars and first-rate students. Implementing the recommendations of this report will establish a coherent infrastructure that will support this outcome. It will also provide the means for the University to anticipate the opportunities in the future and to react quickly and in a flexible manner to the challenges that these opportunities create.

3) Describe how your recommendations improve student learning and effective teaching.

The University aspires to increase the opportunity for experiential learning at all levels of instruction, from freshman to advanced post-doctoral study. One of the major advantages of a major research university is that it provides students an opportunity to work closely on research and creative work projects with world-class scholars, artists, and researchers. Implementing our recommendations will greatly enhance the number of opportunities the University can make available to its students and ensure that these opportunities are associated with the work of outstanding scholars and researchers.

4) Describe how your recommendations help foster the acquisition, discovery and application of knowledge and promote a life of learning for faculty, staff and students.

The acquisition, discovery, and application of knowledge depend entirely on the ability of the University to attract and retain the best possible faculty; that in turn depends upon the institution's capacity to support the research, scholarship, and creative work of those faculty members. Our recommendations provide the roadmap for expanding and sustaining the University's research creative-work infrastructure. The natural consequence of this endeavor should be to enhance the culture of learning on the campus.

5) Discuss how your recommendations impact the University's internal and external constituencies and serve their needs and expectations.

Students, faculty and staff are the University's major internal constituents. Implementing our recommendations will enhance the Universities ability (a) to provide experientially based learning experiences to its students; (b) to support the ability of its faculty to achieve their highest goals as scholars, artists, and researchers; and (c) to provide staff with increased opportunities for training and career advancement. As the University's immediate external constituency, the citizens of Colorado rightly expect CU to meet the educational needs of the state and to sustain a national and international reputation as a place where the arts flourish and knowledge is discovered and applied across the full spectrum of disciplines. They also have the right to expect that their major research university will be an economic driving force in the State. Our recommendations provide guidelines that will enable the University to meet all of these expectations.

APPENDIX 1
**REPORT OF THE SUBCOMMITTEE ON EXCELLENCE IN RESEARCH, SCHOLARSHIP, AND
CREATIVE WORK**

Subcommittee members: Jerry Rudy (Chair), Fred Anderson, Randy Draper, Michael Lightner,
Russell Moore, Bradley Olwin.

15 August 2008

THE UNIVERSITY OF COLORADO AS A RESEARCH AND SCHOLARLY ENTERPRISE

Introduction

The University of Colorado has a remarkable record of research, scholarly, and creative excellence. Two factors account for this success: (a) the extraordinary achievements of individual faculty members and (b) the creation of world-class Research Institutes that have embraced and modeled the value of interdisciplinary research. This has been achieved with minimal support from the state and *ad hoc* commitments of resources by the University, which has tended to react to opportunities as they have presented themselves rather than to invest strategically in research infrastructure and administration.

A comparatively casual approach to research, scholarly, and artistic excellence stood the University in good stead from the 1950s and 1960s (when the first Institutes were founded) through the late years of the twentieth century. In the last decade, however, the competition for external resources has increased tremendously. It will only become fiercer. To compete in this environment, CU must recognize itself not simply as a place where research and scholarship occurs, but as a *research and scholarly enterprise*. This will require both significant organizational adjustments and a cultural transformation, a fundamental shift in the way the University understands itself and does business, with research and scholarship at its core.

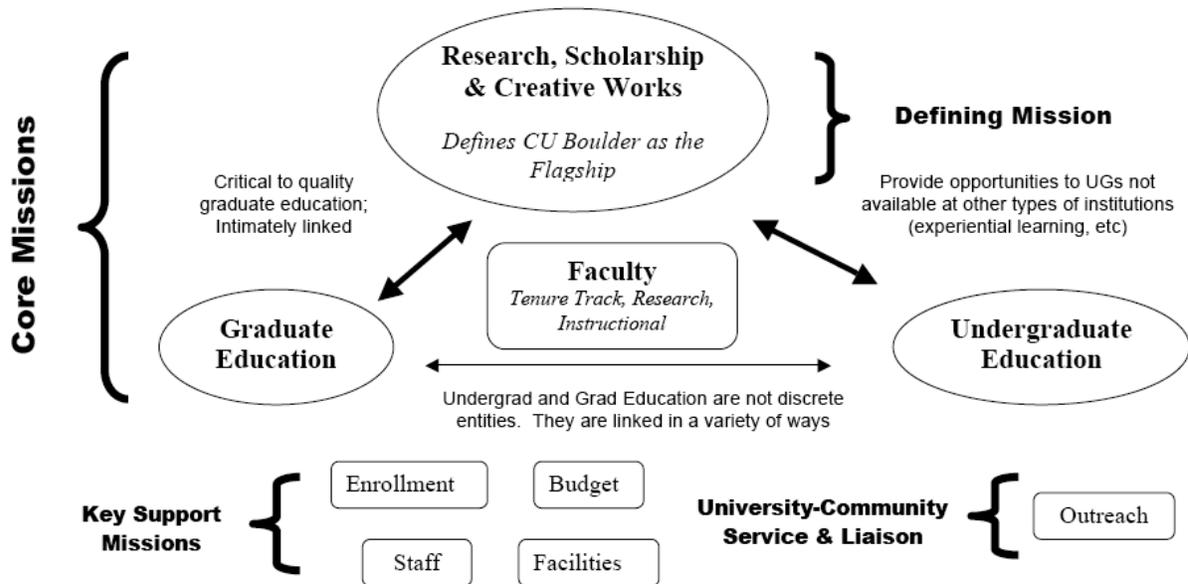


Figure 1. The core academic missions of CU-Boulder are undergraduate and graduate education, and research, scholarship, and creative works. The ability to accomplish these core missions is dependent on the efforts of a faculty of the very highest caliber. Moving forward to 2030, the ability of CU-Boulder to assume a prominent role at the regional, national, and international levels will require that it raise Research, Scholarship, and Creative Works to its defining core mission.

Orchestrating the Cultural Transformation

Excellence in research, scholarship, and creative work defines the finest modern AAU Research I universities. To secure CU-Boulder’s position among these peers and to establish its leadership at the local, regional and international levels, the Flagship 2030 document calls for positioning the University’s scholars, researchers and creative artists at the leading edge of their disciplines. At present, however, the University lacks the resources, facilities, and organization it needs to do this. If CU is to achieve these goals over the next 20 years, therefore, it will need to create a physical and administrative infrastructure capable of stimulating and sustaining faculty creativity at the highest levels. The Office of the Vice Chancellor for Research (OVCR) is the only administrative organization on campus that has the potential to accomplish this task.

This RSCW Task Force has concluded that creating such an infrastructure for excellence will require nothing less than a transformation in the institutional culture in support of significant and sustained investment in the research enterprise. Such a cultural transformation must begin in the recognition that not all campus priorities as articulated in the Flagship 2030 document are equal; rather they can be classed as *central* (the core initiatives) or *derivative* missions, as depicted in Figure 1 above. The administrative structure best suited to achieve these aims is one in which the principal advocates for the core missions of the University are similarly situated on the highest administrative plane (Figure 2).

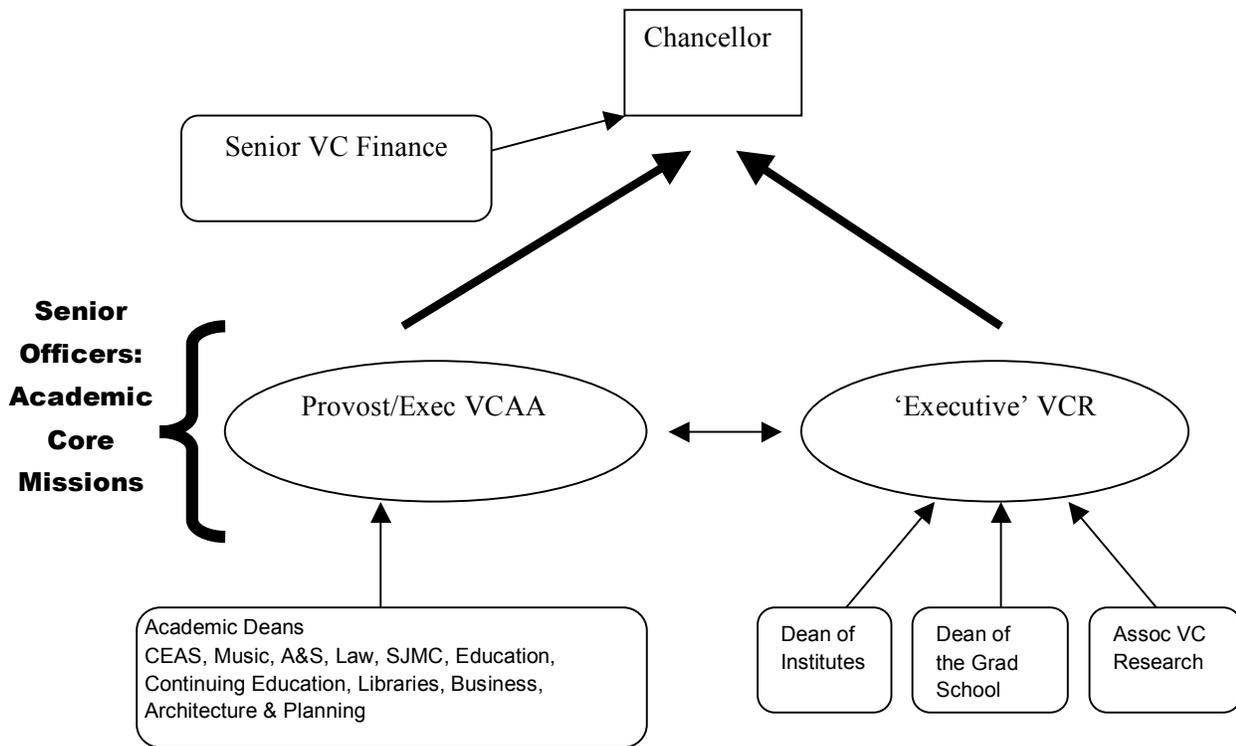


Figure 2. A proposed organization structure to emphasize the campus priorities on the core and defining academic missions.

The proposed structure clearly delineates the priority levels of the campus’s core academic missions, and those that support or derive from them. For this scheme to work

effectively, officers at the “executive” level must work closely together. Key decisions about resource allocation in support of the core academic missions must be made collaboratively. While the precise details of this new organizational scheme (e.g., the Dean reporting structure) may require further thought, it is critical that the VCR be empowered to serve the campus’s research in a meaningful way.

A New Organization for the Office of the Vice Chancellor for Research

Because the OVCR will have to manage a wide range of complex and difficult issues in support of Research, Scholarship, and Creative Work (RSCW), it will need a robust administrative structure and a substantial budget. Central to its success will be a committee of faculty members to identify opportunities and advise the VCR on how to proceed strategically; equally important will be a set of administrative units, or directorates, to shoulder the heavy and increasing burdens associated with the promotion of research and collaboration. Together these elements are the heart of CU’s transformation from a place where research occurs into a research enterprise.

I. The Vice Chancellor’s Strategic Planning Committee. A powerful strategy planning committee made up of distinguished researchers, artists, and scholars from across the disciplines on campus should be appointed to assist the VCR in identifying the domains in which investment in campus resources will lead to true excellence and avoid unintended consequences of particular proposals. It is essential that the decision-making processes of this committee be transparent. In size and status the VCR’s Strategic Planning Committee should be analogous to the Vice Chancellor’s Advisory Committee.

II. Directorate of RSCW Support. This unit will be equipped to support the *Proposal Machine* (see Appendix 1.1). It will be designed to support grant writing efforts of faculty engaged in writing complex proposals that embrace multidisciplinary approaches and span across departments. The details of the *Proposal Machine* concept are provided in the Appendix. This unit will also be responsible for coordinating requests for matching funds and other supplemental requests.

III. Directorate of RSCW Development. This unit will be responsible for developing funding relationships and coordinating the resulting agreements. It will play a major role in developing and maintaining the University’s relationship with federal, state, and local governments, non-profit organizations, foundations, industry, and philanthropic donors. This unit will also house a CU Foundation person who will be aware of faculty projects that present opportunities for donor funding.

IV. Directorate of Research Compliance. This unit will be responsible for ensuring the University is in compliance with Federal and State regulation. The compliance entities that it will administer shall include (but are not limited to) the Committees on Human Subjects Research, Conflicts of Interest, Research Misconduct, Export Controls, and Restricted, Proprietary, and Classified Research. This unit will also be responsible for a tighter coordination with other units on campus whose compliance responsibilities include, but are not confined to research activities (e.g. Radiation Safety, Institutional Biosafety, etc).

V. Directorate of RSCW Infrastructure. In a number of research universities across the country and even in our own Health Sciences Center, shared research facilities or ‘research cores’ are common. Examples of these shared facilities include high throughput genome facilities, cell

sorting, confocal and electron microscopy facilities, mass spectrometry facilities, nanotechnology facilities, x-ray crystallography and material characterization facilities, scientific computing facilities, semiconductor manufacturing facilities, and in the area of the humanities and social science key library holdings and extensive online resources. At CU-Boulder individual researchers typically create and maintain their own facilities. This is a wasteful duplication of effort. The lack of these core facilities severely restricts our ability to hire and retain top researchers and impedes CU researchers' ability to compete in a number of research areas. Top universities around the country and the world not only have these facilities, but mechanisms to maintain and staff them. Creating and maintaining adequate core facilities will be the main focus of this office. This unit will:

- Be responsible for physical facilities management, maintaining a database of all research space and core research equipment on campus and locating space for new initiatives. This database will allow the location and identification of existing and potential shared facilities as needed for research proposal, faculty recruitment and potential collaborations both within and outside of CU.
- Take the lead in organizing campus researchers in proposing needed core facilities and work to develop the appropriate mechanisms to house, staff and support the facilities. (It should be noted that there are options for federal grants to build and maintain such facilities with an option of charging researchers for their use.)
- Represent the Information Technology research support needs of the campus.

VI. Directorate of RSCW Administration. World-class research requires, and deserves, world-class administrative support. Currently, however, we lack sufficient personnel, expertise, and resources to support a growing research enterprise, while protecting the interests of the University and faculty. To meet the challenges of increasing competition, complexity, and regulations, the research administration unit will be responsible for:

- Improving the coordination of the research administration functions across campus and the system through the Offices of Contracts and Grants, Sponsored Projects Accounting, Technology Transfer, University Counsel, Risk Management, Export Control and the regulatory committees governing human research, animal care and use, bio-safety, radiation safety, and conflicts of interest.
- Enhancing training and professional opportunities for the staff members in each of these areas.
- Building and supporting the research administration capability of the campus academic and research units.
- Reducing bureaucratic duplication of effort and adding value to each part of the research administration process by developing compliant, but agile, business practices.
- Informing faculty, staff and administration regarding issues and opportunities relating to research, scholarly, and creative work.
- Increasing the quality, quantity, and availability of data for decision-making.
- Developing effective and efficient means for sharing funding information with the faculty.
- Developing strategies and procedures for supporting large multi-disciplinary and international projects.

VII. Directorate of RSCW Communication. A world-class research enterprise requires sophisticated communication machinery to coordinate the internal and external participants and to communicate our work to the rest of the world. This unit will be responsible for:

- Increasing cohesion, inspiration, collaboration, and, thus, research excellence within the University and among the departments, centers, institutes, and our existing partners such as the federal labs in the area.
- Informing the world about our research excellence in the language and medium that can best reach our audiences and constituencies, including our academic peers (influencing peer rankings, reputation, and recruitment of graduate students and faculty), government officials at the state, national, and perhaps international level (enhancing funding and promoting favorable legislation), potential business and industry partners (creating partnerships and recruitment), potential international partners, colleagues, and students (creating a true global crossroads and promoting the recruitment of talented students and colleagues), potential donors (expanding the institution's funding base), and the general public (building our public reputation, and promoting recruitment, good will, popular political support and the public good).
- Implementing a full-spectrum communications strategy that would utilize a broad range of communications media, including the Internet (CU-Boulder's and the rest of the World Wide Web), print publications (from brochures, pamphlets, and booklets created in-house and within CU to coverage in newspapers, magazines, newsletters, and other people's publications), multimedia (video, CD-ROM, DVD, web-based, etc.), word-of-mouth (giving our own faculty and staff the tools, guidance, and encouragement), and relationship management with all the interested parties and publishers in the lines of communication. Increase research excellence at CU through active and passive recruitment and facilitation of collaboration and funding.

The Significance of Institutes for Research Excellence

It is sometimes remarked that the University of Colorado has achieved a level of research and scholarly excellence that far exceeds what would be predicted based on its financial resources. A major reason for this discrepancy is the emergence, over 50 years ago, of the Institute model for advancing, organizing and implementing interdisciplinary research. This model has been remarkably successful. Interdisciplinary research institutes, in cooperation with cognate departments have produced major scientific advances and enabled the University to compete successfully for major external resources and the research talent necessary to advance the goals of the Boulder campus. The world-class research institutes that have emerged address many of the truly major issues and problems that confront the world in the following areas:

- Understanding the earth and the forces that control its climate.
- Developing and managing the earth's energy resources.
- Understanding our atmosphere.
- Understanding outer space.
- Understanding solar energy and its impact on the planet.
- Understanding the atomic and molecular underpinnings of our physical and biological world.
- Understanding human behavior and its social and political dimensions.
- Understanding the human brain and mind.

Research Institutes also make extensive and vital contributions to the CU's educational mission at both graduate and undergraduate levels. The Flagship 2030 Strategic Plan emphasizes the need to provide hands-on experiential educational opportunities for undergraduates. Our Research Institutes provide many opportunities for students to have such experiences; they not only offer training but in some cases paying jobs to undergraduates who will benefit through subsequent employment in the field.

Without question our Institutes play a critical role in the University's research mission and contribute significantly to CU-Boulder's national and international reputation as a world class university. Moreover, the research activities of our Institutes account for about 50% of our sponsored research. Our Institutes employ more than 900 researchers and supporting staff, and collectively the Institutes represent a very significant employer in Boulder County, making both a major contribution to the research mission and reputation of the University and a significant economic impact on Boulder County and the state.

The implication of this discussion should be clear. Any serious plan for fostering research and scholarly excellence on this campus should do everything possible to strengthen our research institutes. This includes making research faculty lines available and removing barriers to faculty members' ability to act in an entrepreneurial way.

On the Relationship Between the Vice Chancellor for Research (VCR) and the Institutes

The first institutes were founded a half-century ago. INSTAAR (created in 1951 from the Mountain Research Station), IBS (1957), JILA (1962), and LASP (1965) were all created when there was no multi-campus University system, and began as adjuncts to academic departments. Created by the authority of the President and the Board of Regents, the institutes were assigned administratively to the Dean of the Graduate School, who reported directly to the President. With the creation of the University system and the appointment of Chancellors for each campus, the Institute directors remained under the supervision of the Dean of the Graduate School on the Boulder campus, who eventually acquired the additional administrative designation of Vice Chancellor for Research. As the number of institutes has multiplied, several real and/or perceived problems have arisen as a result of this reporting structure. First, a central mission of the Office of the Vice Chancellor for Research (OVCR) is to promote research, scholarship, and creative work across all schools, colleges, and constituencies on the Boulder campus. The VCR/DGS is also the functional Dean of the Institutes and the principal advocate for the Institutes in dealings with the Provost. The dual role of the VCR/DGS as the principal advocate for the Institutes and for campus-wide research activities and initiatives raises the question of how potential conflicts between the needs of the Institutes and other campus units should be resolved. Moreover research, scholarship, and creative works will be singularly important in defining CU-Boulder's status at the regional, national, and international levels. As we look towards 2030, we believe that in order for CU to become a leader among research universities, the VCR will have to assume an increasingly prominent leadership role in order to intensify the focus of the OVCR on the campus wide research enterprise. This will require that the VCR relinquish the roles as Dean of the Graduate School and the functional Dean of the Institutes to subordinate officers who can concentrate exclusively on carrying out their duties.

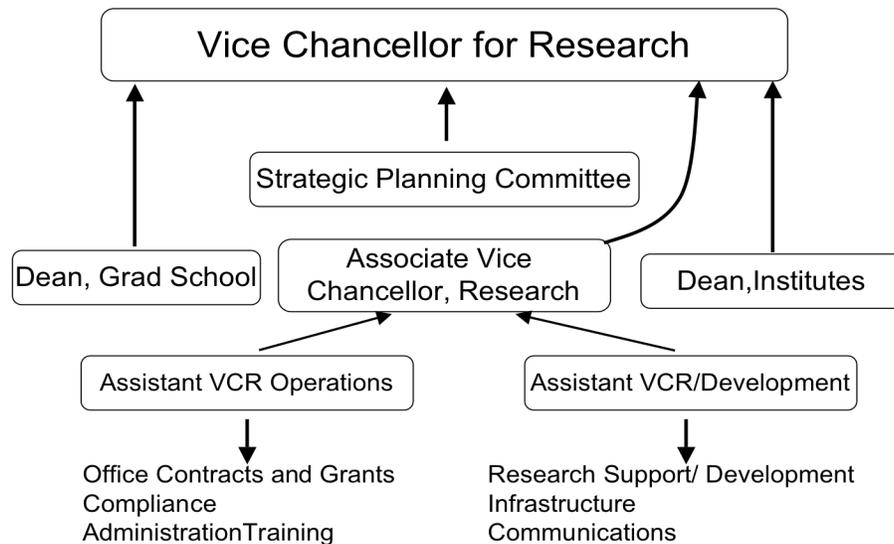
We recommend that the direct link between the VCR and the Institutes (and Graduate School) should be severed. However, we also believe that the wide interests and needs of the Institutes are still best represented through the OVCR. To meet the needs of the Institutes we recommend the creation of a *Dean of Institutes*.¹ This Dean would function as administrative overseer of, and advocate for the Institutes, and also would be responsible for sanctioning all interdisciplinary Centers on campus. This Dean would report directly to the Vice Chancellor for Research and would also be a member of the Council of Deans.

On the Relationship between the Vice Chancellor for Research (VCR) and the Dean of the Graduate School

We believe our new vision of the role of the VCR is incompatible with the duties of the Dean of Graduate School. Accordingly we recommend that there be a Dean of the Graduate School who reports to the VCR.

Organization of the Office of the VCR

We have described the functions/operations that must be carried out by the OVCR. The diagram below illustrates how we think this office should be organized.



Reorganization alone will not be sufficient to create a supportive research infrastructure on our campus. A significant and sustained investment in providing adequate staffing for each of the support units will be required to minimize the administrative burdens and impediments to research excellence that currently plague our faculty.

Transformation: An ongoing *process* (not an endpoint)

It should be emphasized that the proposed organizational changes should not be viewed as endpoints in the cultural transformation toward a more comprehensive and effective research enterprise. *Rather, these changes should be regarded as the beginning of a process that will foster the cultural transformation.* The process must be sustained and dynamic in order to allow for a research enterprise that can support existing research activities as well as respond to new opportunities and challenges in a flexible and timely fashion. A primary objective of the process is to transform a largely reactive research support culture to one that is proactive in nature.

New Resources: Money and Time

To be successful the OVCR will need significant new resources. The continuing funds and commitments for Fiscal Year 2009 are shown in detail in the following table.

	CONTINUING FUNDS	FY09 COMMITMENTS	CARRYOVER (DEFICIT)
Personnel			
Dean Grad School (DGS)/OVCR	\$1,348,201	\$1,243,282	
Committed Faculty/ OE Payroll	\$357,627	\$510,959	
Office of Research Integrity (ORI)	\$309,121	\$521,435	
Office of Contracts and Grants (OCG)	\$1,191,578	\$1,268,595	
Graduate Teacher Program (GTP)	\$160,196	\$174,979	
TOTAL PERSONNEL	\$3,366,723	\$3,719,250	(\$352,527)
Operating Expenses			
DGS/OVCR	\$172,357	\$218,551	
Research Commitment	\$261,911	\$615,754	
Matching funds	\$1,013,684	\$2,325,020	(\$1,311,336)
CRCW	\$429,852	\$429,852	
Seed Grant Programs	\$1,000,000	\$1,013,111	
Energy Initiative Program	\$0	\$549,623	
ORI	\$6,356	\$211,549	
OCG	\$112,822	\$89,521	
Graduate Teacher Program	\$62,962	\$167,167	
Grad Student Fellowships	\$2,738,176	\$2,912,271	
Graduate Student Support	\$693,512	\$1,255,120	
TOTAL OPERATING EXPENSES	\$6,491,632	\$9,787,539	(\$3,295,907)
TOTAL VCR/GRAD SCHOOL	\$9,858,355	\$13,506,789	(\$3,648,434)
<i>APPROXIMATE OVCR BUDGET</i>	<i>\$5,799,049</i>	<i>\$8,624,267</i>	<i>(\$2,825,219)</i>

Several elements of this table bear comment. First, the continuing budget for personnel in the Graduate School (GS) and the OVCR is approximately \$3.4 million per year; this figure includes the OCG, the Office of Research Integrity (ORI), the OVCR/GS, and the Graduate Teacher Program (GTP). Personnel costs for FY09 will be approximately \$3.7 million, meaning that about \$350,000 must be covered by temporary funds. The operations budgets for these offices have been trimmed extremely close to the bone. Matching funds and “hard” research commitments are similarly modest within the continuing budget, accounting for less than \$1.4 million annually. Seed grant funding (through the Innovative Seed Grant Program and the Council on Research and Creative Work) is only slightly larger, at just over \$1.4 million annually in continuing funds, while graduate student funding as a whole (including fellowships, TA matching funds, and support for the Graduate Teacher program) has a continuing budget that comes in under \$3.5 million per year. Collectively, these personnel and operational costs account for \$9.9 million in continuing funds, while budgetary commitments for Fiscal 2009 amount to just over \$13.5 million. The shortfall of \$3.6 million (the largest single component of which is a commitment to provide an additional \$1.3 million in matching funds) can only be made up from temporary funds carried forward. This is not a sustainable situation, and it puts us very much at a disadvantage with respect to our competitors and peers.

Faculty members who engage in sponsored research know only too well how the continual increase in research compliance and administrative regulations can impede their ability to compete for external research sponsorship. The volume and complexity of sponsored research contracting is increasing at a dramatic rate, and will only continue to do so as the diversity of our research sponsors increases. Our ability to respond quickly and effectively to complex research funding opportunities is impaired by a persistent lack of investment in the types of grant and contracting resources (grant and contracting personnel, electronic research administration tools and support personnel, and so on), that are required to be successful in the 21st century grants and contracting environment. In addition, many faculty are reluctant to take on the tasks of writing ‘big science’ proposals because the administrative support available for the preparation of large and complex grant applications is generally lacking (exceptions do exist in one or two of the larger research institutes where they have been able to invest in this type of support on their own). As several task force members have pointed out, shortcomings in staff support of complex sponsored research activities have repeatedly caused CU to “leave money on the table” that would have otherwise been accessible.

The key concern is how to resolve the issues that represent barriers to research excellence. *From the outset, it should be stated that our committee recommends an ongoing study of this very complex issue.* That said, our initial estimates are that, *at a minimum*, the continuing budget resource investment in basic research support should be tripled over a 5 year period (from the current level of \$10 million in stable continuing funds to \$30 million annually). This estimate is based, in part, on the observation that compared to our AAU Research I peers and sister regional universities, our current investment in research administration is pitifully small. The facts that the Office of the Vice President for Research at Colorado State University has an annual budget in excess of \$30,000,000 (a sum that does *not* include Graduate School activities), and that the funding basis of this commitment is guaranteed by a formula based on a proportion of the funds earned annually by indirect cost recovery, should chasten us – and remind us of the degree to which our current funding model in research support relies on unsustainable practices. In addition, the campus must come to grips with critical infrastructural shortcomings (e.g., in campus IT infrastructure and support, facilities, maintenance, etc.) that

will require attention if CU is to be in a position to assert itself as a world leader in innovation and discovery. The required investments will be substantial, but the costs of not doing so will be even greater. It must be recognized that while tripling the OVCR's budget is significant, the target sum, *five years hence*, will equal only the amount expended by CSU today; and that in the context of a one-billion dollar annual campus budget (\$280,000,000 of which derives from sponsored research awards) the share of the budget committed to promoting and sustaining research will increase from roughly 1% to about 3% of the campus's annual expenditures.

The impact of tripling the campus's research support budget will be substantial. The investment will help remove the regulatory and day-to-day clerical burdens from the shoulder of faculty and allow them to focus their considerable talents on the core missions of the University. This will be accomplished in part by properly staffing the OCG and ORI so that they can be more proactive and responsive to an increasingly complex and burdensome regulatory environment. This investment will also allow for a modest expansion of existing programs that serve to "seed" and stimulate the research and scholarly activities of our faculty (e.g. through seed grant programs, expanded sponsored research cost-sharing capability, and faculty fellowships – a critical form of support for faculty in the arts and humanities).

The campus has already articulated the priority of increasing the size of our faculty by up to 300 over the next 10 to 20 years. This growth represents an exciting and significant investment in our most valuable research, creative, and scholarly resource. From a budgetary perspective, our committee strongly believes that the Chancellor and the Executive VCs will have to exercise considerable care to insure that the growth in faculty numbers is coordinated with growth in the appropriate facilities, support staff, and administrative resources. The cost of this coordinated growth will be very substantial. We recommend that there be a senior standing committee that can provide an ongoing and transparent assessment of these costs, to insure that faculty growth does not outpace our ability to provide the necessary resources and support for professional success.

Sources of Funding

A New Funding Model. Since research, scholarly activity, and creative works are defining characteristics of CU-Boulder, some stable percentage of the total campus budget should be allocated to support the faculty through the research enterprise. This money must flow directly to the OVCR.

Capital Campaign. In order to increase flexible funding, the creation of an Endowment for Research Excellence should be featured in the new Capital campaign. The goal would be to provide the OVCR with several million dollars a year for strategic investment.

Distributing Resources: Issues for the Strategic Planning Committee

The most fundamental problem will be how to distribute limited resources in a manner that has the maximum impact on Research and Scholarly excellence. As noted, we believe that decisions about the selective distribution of resources should fall on the Strategic Planning Committee (VCSPC) that will advise the Vice Chancellor for Research. Below we describe some of the likely issues and needs that this committee will face.

Research Space. There is no doubt that a tremendous constraint on the research and scholarship on the Boulder campus is physical space. The needs here are huge. They range from the need for dedicated laboratory space to a need for office space to house the researchers, scholars and support staff. The SPC together with other administrators needs to develop a coherent and transparent plan for space development, including the proposed expansion to the East Campus.

Faculty Allocation. In any plan to build excellence, faculty lines will be the most valuable currency. The VCSPC will need to formulate a transparent policy to specify how this will be done.

Faculty Retention. The hiring of new faculty is expensive and represents a major long-term investment. In order to realize a return on this investment, renewed efforts should be focused the development of strategies to retain our most productive young faculty.

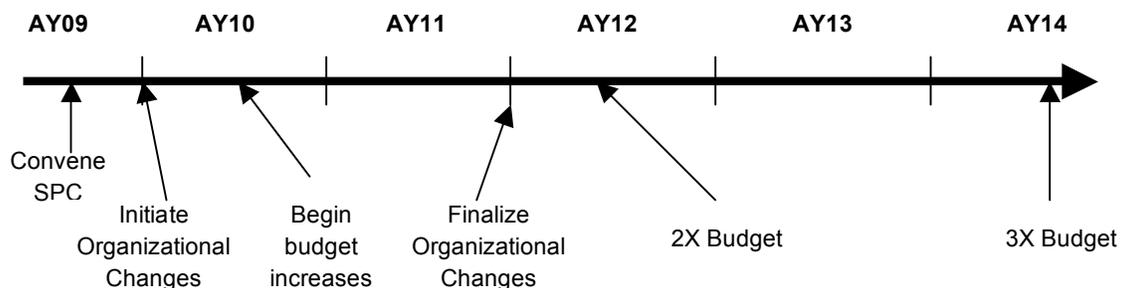
Graduate Student Support. Everyone agrees that our ability to support graduate students lags behind our peers. We must increase our ability to compete for the best students by offering competitive, multi-year fellowship support; this in turn will require very substantial investments above our current minimal levels.

Support for the Arts, Humanities, and Social Sciences. Faculty in the Arts, Humanities, and Social Sciences bring excellence to the campus that cannot be adequately measured in monetary terms, and which can offer rewards in national and international reputation vastly disproportionate to the actual dollars invested. It is vital to develop strategies that recognize this difference and create accurately targeted investments to promote and sustain the highest levels of artistic endeavor as well as research and scholarship in the humanities and social sciences.

Tradeoffs between bridging support for existing laboratories versus startup for new faculty. The University invests large amounts of startup funds for new faculty but has no mechanism to bridge established investigators who are currently suffering through the renewal process and risk losing key personnel. A new model for allocating funds that recognizes and provides mechanisms for dealing with the problem needs to be considered.

Achieving Our Goals

Achieving our goals and recommendations will happen most efficiently under the supervision of a VCR supported by a robust Strategic Planning Committee. It must be stressed that administrative structural reorganization without a commensurate investment of resources would be pointless, and perhaps disastrous. The subcommittee believes that a concrete resource investment schedule must be established prior to any administrative reorganization, and suggests the following timeline for implementation.



APPENDIX 1.1
RESEARCH SUPPORT: THE “PROPOSAL MACHINE”

RESEARCH SUPPORT: THE “PROPOSAL MACHINE”

The Proposal Machine is an administrative mechanism to assist UCB investigators in the preparation and delivery of major proposals for research funding requiring the involvement of multiple investigators and multiple partners. Priority will be given to proposals in the strategic areas identified by the Vice Chancellor for Research’s Strategic Planning Committee.

The Proposal Machine will be managed by the Office of the Vice Chancellor for Research. Its mission is to enhance the quantity and quality of large proposals (valued at \$5,000,000 or more) and will be submitted to both public and private Sponsors. The Proposal Machine will assume responsibility for overall proposal planning and development, thus allowing the Principal Investigators to focus on research design and technical writing.

Typically, the Proposal Machine will provide the following services:

- Provide and/or identify experts to analyze the Request for Proposal/Program Guidelines, political environment, and potential financial risks.
- Coordinate the proposal development team, e.g. prepare and monitor the proposal development timeline; schedule and staff meetings; provide liaison with internal and external partners -- especially subcontractors.
- Identify and/or hire disciplinary and technical consultants.
- Assemble, maintain, and format background information, e.g. University and unit profiles, past performance histories, bio-sketches, descriptions of research facilities and resources.
- Coordinate the budget and budget justification.
- Assist in the preparation of the written documents, e.g. editorial support, graphic enhancements; technical review coordination.
- Package and submit the proposal.

Preliminary Implementation Plan

1. There are five key components:

- a. Strategic Planning Committee;
- b. Principal and Co-Investigators;
- c. the Proposal Machine team;
- d. technical support (internal);
- e. domain support (external).

2. The Strategic Planning Committee will be charged with identifying target areas for support and a tentative schedule.

3. Key investigators need to be identified before opportunities arise. They should have input into the strategic planning and be responsible for preparation of anticipatory white papers that reflect the strategic plans.

4. The Proposal Machine team will be organized along the following lines:

- Coordinator: The Coordinator needs to be both a “player” and detail person. The “player” should be comfortable working with the Offices of State and Federal Relations, Technology Transfer, Risk Management as well as the Strategic Planning Committee, prospective Sponsors, external partners, etc. This person will need to understand enough

about science and technology to visualize the “big picture”, gain the confidence of the faculty, and motivate them to commit and participate. The “detail person” should be able to review and analyze the RFP, interpret agency expectations, and structure the relationship with partners and subcontractors. In addition, this will be someone who can prepare a proposal development plan and schedule, assemble and coordinate an internal/external team, and provide constant follow up.

- Proposal Analysts (2): These positions will combine the expertise of OCG’s experienced Proposal Analysts with an understanding of contracting and subcontracting. They will be able to understand and articulate the requirements of complicated proposal guidelines, prepare comprehensive and detailed budgets, and structure subcontract relationships.
- Data Specialist: this position will assemble, enter, and manage the resources files (e.g. PI vitae, current and pending funding lists, boiler plate descriptions of University resources), prepare basic data reports, process proposals, manage the office, etc.
- Graduate and undergraduate student support.
- Occasional Technical Support (internal): The Proposal Machine will combine a permanent staff with an extensive virtual office of expertise inside and outside the University and include OCG, SPA, Tech Transfer, Risk Management, University Counsel, etc.
- Occasional Domain Experts (external): Disciplinary consultants may be hired for specific proposals or on retainer to assist with planning and reviewing the proposal; editing the proposal; and putting the proposal into the context of the sponsor’s goals and objectives.

5. The Implementation Plan:

- Develop the function and structure of the Proposal Machine
- Assemble a start up team
- Begin to assemble resource files
- Hire new personnel
- Appoint the Strategic Planning Committee
- Develop a strategic plan
- Identify and recruit PI’s to develop “white papers”
- Identify/assemble domain experts
- Identify/commit technical support

The Proposal Machine is intended to be a resource for campus leadership and our Principal Investigators. It will depend upon their guidance and leadership to submit the most sophisticated and competitive proposals possible. As always, final decisions about the nature and the content of proposals will those of the Principal Investigator and his or her research team.

APPENDIX 2

REPORT OF THE SUBCOMMITTEE ON THE COLORADO RESEARCH DIAMOND

Subcommittee members: Cora Randall (Chair), Faye Kleeman, Russell Moore, Bryan Taylor,
Alexey Wolfson

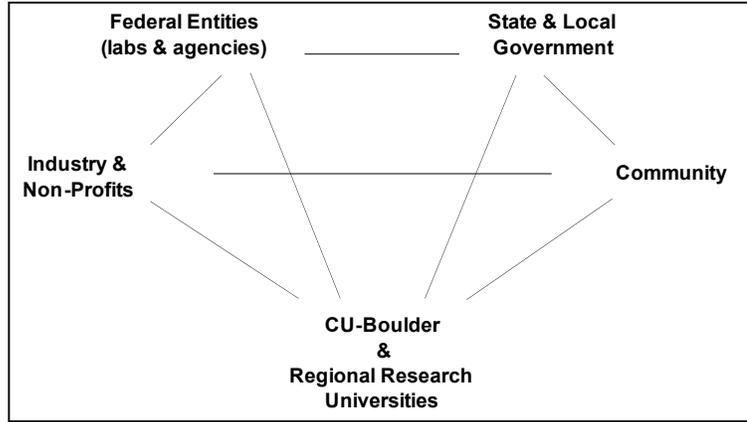
11 August 2008

RESEARCH DIAMOND SUBCOMMITTEE REPORT

Introduction

Our vision for achieving research excellence includes a fundamental change in the University culture from one of an ivory tower to one of an integrated, collaborative research enterprise. One aspect of this change is the Colorado Research Diamond (CRD).

The CRD is a “collaborative enterprise among regional universities, businesses, non-profit organizations, government, and federal laboratories” (Flagship Initiative #4) that will be initiated in order to “advance the University’s research mission as well as the state’s economic future”. It will “engage leaders of business and industry, government and federal laboratories in entrepreneurial collaborations in the development and transfer of technologies, patents, and intellectual properties to real-world applications.” It will “serve as a magnet to attract the brightest graduate students from Colorado, the nation, and around the world” (Flagship 2030 Strategic Plan).



As one critical vertex of the diamond, CU-Boulder will be a regional center of intellectual leadership and technological innovation. It will reach outward to promote growth in the surrounding region. It will be a neutral site – a “safe zone” – where industry, national laboratories, non-profit organizations, government & community groups and academia can feel secure to meet, exchange ideas, innovate, and create. In this process, CU-Boulder will model new approaches to conceptualizing and developing technology that encompass its social, political, and economic dimensions. Interactions between the arts and humanities, social sciences, and natural sciences and engineering will flourish as the underpinnings of the CRD in a world that is becoming far more inter- and multi-disciplinary.

CU-Boulder is already involved in activities that will become part of the CRD, such as the CU Energy Initiative (<http://ei.colorado.edu/>), the Colorado Nanotechnology Alliance (<http://www.coloradonanotechnology.org/home/>); CO-LABS, Inc.; the Colorado Initiative in Molecular Biotechnology (CIMB, <http://cimb.colorado.edu/>); and the Boulder Solar Alliance (<http://www.hao.ucar.edu/bsa/>). In the arts, CU-Boulder is already the home of two professional arts organizations, the Takacs Quartet and the Colorado Shakespeare Festival. Despite a weak state arts commission, the National Endowment for the Arts survey “Artists in the Workforce: 1990-2005” found that Colorado ranked fifth in terms of the number of total artists per 10,000 people. Boulder-Longmont ranked No. 6 in terms of percentage of artists in the workforce, and Fort Collins-Loveland as No. 9 in the top 10 metropolitan areas for fine artists, art directors and animators, based on the proportion of these artists in the labor force. While some collaborations have occurred between CU-Boulder and the artists and art organizations of Colorado (e.g., the 2007 world premiere of *Mall*Mart, the Musical* by the CU Department of Theatre & Dance and

Denver's Curious Theatre Company), the CRD would be an effective catalyst to foster more collaborations.

Such activities will be expanded and used as a springboard for a much more ambitious and farther reaching CRD. In order to realize the CRD vision, fundamental changes in the CU-Boulder operating philosophy and administrative infrastructure need to occur; this will require substantial commitment of financial resources. This investment will have enormous payback in the years to come, however, as the CRD enables us to build a mountain of development and economic growth in the "Flat World" conceptualized by Thomas Friedman.

Recommendations

Following are the recommendations for making the CRD concept a reality.

1-3 years

CU-Boulder should establish a nimble, flexible, and adaptable operating philosophy for becoming a regionally collaborative research enterprise in a practical world. We emphasize "regionally collaborative" as fundamental to the CRD concept. Many of the short-term recommendations below are specifically directed at establishing this new operating philosophy.

CU-Boulder should appoint the Vice Chancellor for Research to direct the CRD activities. The VCR responsibilities for the CRD will include: (1) designing and maintaining the CRD administrative and operational infrastructure; (2) assimilating research, scholarship, and creative work (RSCW) endeavors that cross all university programs, centers, departments, institutes, and colleges; (3) developing and facilitating collaborative research and entrepreneurial relationships between CU and regional research institutions such as Colorado State University, School of Mines, and the CU-Denver Health Sciences Center; (4) building partnerships with regional businesses and industry; (5) coordinating and advancing RSCW programs that involve CU in cooperation with federal labs, regional and state government, and the local community; (6) ensuring that the CU Regents are connected to the CRD via appropriate communication and advocacy.

The OVCR should be given a substantial, independent source of funding commensurate with the responsibilities outlined above and the recommendations made below, as well as all of the non-CRD responsibilities. This includes resources to establish the CRD infrastructure necessary to form and maintain permanent, proactive bridges between the University, other research centers, regional businesses, industries, non-profit organizations, and government. To achieve this, the OVCR should be elevated to the Senior Vice Chancellor level, reporting directly to the Chancellor.

The above recommendations, which deal directly with the CU-Boulder administrative structure, will require substantial resources in order to meet the unique challenges that will be posed by the CRD. We place them in the 1-3 year category because they must be initiated now; we expect many of the challenges to be met, however, on a longer term. Even something as superficially simple as increasing internal collaborations requires a shift in the basic culture of the University; incentives must be given to encourage inter- and multi-disciplinary work and cross-unit interaction. With increasing business partnerships will come a shift toward more research contracts, and the added complexities, such as nondisclosure clauses, that these entail. Intellectual Property (IP) rights must be negotiated. The Offices of Technology Transfer and

Contracts and Grants are expected to grow – and thus require more funding – in accordance with the CRD innovations. More institutional support will be needed to guide researchers in writing grant proposals. We must find a way to ease the burden of excessive regulations and compliance constraints. These are just a few examples. The main point is that building the CRD infrastructure will require serious financial investments on the part of CU-Boulder, with the expectation that in the long term, these investments will be paid back through the economic and intellectual growth the CRD will generate.

CU-Boulder should establish the policies and procedures necessary for CU and regional research universities to become service providers for the CRD. Businesses, industry, non-profit organizations, government and community groups often have needs for identifying and addressing issues that are of mutual interest and concern to CU-Boulder. They have needs for training and research that University personnel have the expertise and equipment to provide. Any such regional needs are currently met, however, in an ad hoc manner. This recommendation thus entails the establishment of formal avenues through which university personnel can learn of regional needs and regional entities can request help, and the definition of procedures/policies for university compensation. See, for one proposed model, Appendix 2.1: “The Multifunctional Service Center.”

CU-Boulder should develop metrics for success for the CRD. CRD progress must be monitored periodically to ensure that activities are on the right track, or to divert them if necessary. The metrics should be flexible enough to adapt to changing circumstances (e.g., new businesses; different economic clusters), but specific enough to apply to resource allocation decisions.

CU- Boulder should delineate the roles of soft-money researchers in the CRD and should support them accordingly. Soft money researchers bring in substantial external resources to campus, funding the salaries of over 1100 employees and numerous students on campus as well as such items as computers, laboratory instruments, clean rooms, satellite instruments, rockets, spacecraft, and even CU buildings. Of all research expenditures in Fiscal Year 2006-2007, 26% was attributed to 217 PhD-level soft money researchers in the research professor or research associate (RA) career paths at CU-Boulder. On a per-person basis, this is comparable to the 51% spent by 453 tenured and tenure track faculty members. In some units the majority of the research funding comes from soft-money researchers; for example, last year soft money RAs at the Laboratory for Atmospheric and Space Physics brought in more than \$30.6 million, or 77% of the total research revenue at LASP, making it the highest-funded unit on campus. These resources are vital for the success of the CRD – indeed for the success of CU as a research enterprise. Yet soft money researchers have little or no job security and relatively low salaries compared to industry, and hence little incentive to remain at CU in the long term. To retain these researchers it is imperative that CU provide incentives for the research they do, and remove barriers to their progress. Examples include providing start-up funds for new researchers, seed funds for innovative proposals, and access to funded fellowship opportunities. Soft money researchers should thus be invited to play the same roles as tenured or tenure-track faculty at all levels of the CRD’s operations and administration. All CU-sponsored grant opportunities should be offered to soft-money researchers as well as tenured and tenure-track faculty. The restriction on soft money salaries that currently limits their growth to a rate comparable to that of tenured and tenure-track faculty should be removed. This restriction was initially intended to promote equity, but because of the lack of job security this is an extremely inequitable policy.

The OVCR should establish mechanisms for increased collaboration between the arts, humanities, and social sciences, and the natural sciences & engineering. As noted in the introduction, one of the principles of the CRD is that we must embrace the complex opportunities for collaboration associated with science and technology. There are currently barriers in culture, incentives and physical space that discourage or prevent successful collaborations between researchers in the arts, humanities, and social sciences, and researchers in the natural sciences or engineering. Transcending these barriers will enable us to incorporate research and creative works developed in those neglected fields into the CRD, and infuse the CRD enterprise with a rich diversity of ideas, personnel, and activities. In theory, a model program is the Alliance for Technology, Learning and Society (ATLAS) institute, which focuses on information and communication technology. ATLAS is intended to be a catalyst and incubator for innovative interdisciplinary research, educational, creative, and outreach programs at CU-Boulder, but this vision has not yet been realized. For instance, due to lack of funding the ATLAS Center for the Arts, Media and Performance has not had the resources to create the incubator for CU's interdisciplinary work that it was designed to house. Instead the Black Box Theatre has become a rental house for outside groups. Competitive funds should be made available to researchers and artists with creative plans to integrate diverse fields into the CRD initiatives. Interdisciplinary training programs such as the Herbst Program of Humanities for Engineers should be implemented for students and researchers alike.

The OVCR should create a comprehensive communications plan for the CRD. To effectively create cooperation between populations of such a diverse nature and from such diverse cultures as the CRD proposes, it will be essential to create a full-spectrum communications plan that will utilize the language and mediums that can best reach our respective audiences, including researchers and artists from across disciplines to community, industry, non-profit, and government partners. We must begin a public relations effort to promote the reputation of the campus as a center for collaborative enterprises and promote how such endeavors ultimately positively impact the city, county, state, and world. To that end, we should implement a full-spectrum communications strategy that would utilize a broad range of communication media, including the web (CU-Boulder's and the rest of the World Wide Web), print publications, multimedia, word-of-mouth (giving our own faculty and staff the tools, guidance, and encouragement), and relationship management with all the interested parties and publishers in the lines of communication. The communications plan will need to encompass promotional aspects to foster new enterprises and partnerships as well as managerial aspects to ensure the lines of communication remain clear and effective throughout the research endeavors.

The CRD should utilize cyberinfrastructure to support interdisciplinary discussion and collaboration. CU should build the information infrastructure to support development of cross-disciplinary collaboratories that remotely link together scholars and artists from across disciplines and campuses with industry and community partners. This will allow scholars and artists to pursue their research and education goals regardless of physical location and the endless challenge of coordinating calendar schedules. The infrastructure will include new teleconferencing technologies, real time access to shared data, and access of remote computing power. We should develop metrics for success in virtualizing online collaborative endeavors as part of our overall assessment of our efforts. Our campus has suffered, and continues to suffer, from a lack of robust investment in research computing. Very recently, over 90 faculty members expressed a great need for the development of a high performance research computing

infrastructure on our campus. Proper investment in this area is critical if CU-Boulder scientists and scholars are to remain at the cutting edge of their disciplines.

The OVCR should be provided funds to expand the Innovative Seed Grant Program (ISGP). It is often difficult to obtain external research funding for innovative programs that have high potential payoff but also high risk. This type of research will be a cornerstone of the CRD, and must be supported financially by CU as new projects are developed. The 2008 ISGP (http://www.colorado.edu/VCRResearch/2nd_IGP.html) funded 22 programs ranging in cost from \$8,000 to \$45,000. We recommend that the budget for the ISGP be tripled in order to address innovative CRD proposals.

The OVCR and Office of Diversity, Equity and Community Engagement (ODECE) should work together to implement procedures for ensuring that the CRD collaborations both within and external to CU support an inclusive environment, encouraging diversity. A hallmark of the CRD will be innovation and creativity, which derive from the broad knowledge and experience base that comes from a diverse, collaborative community. CU-Boulder historically has not been very diverse, although the situation is improving. For example, while the majority of full-time tenured and tenure-track faculty at CU-Boulder are white, the number of tenured and tenure-track faculty of color more than doubled from 1990 when there were 71 faculty of color to 2006 when there were 162. Lack of diversity, and the perception of a lack of diversity, stifles the ingenuity and inspiration on which CRD growth will rely. With the establishment of ODECE, CU-Boulder is making strides to increase diversity on campus and nurture a more welcoming environment.

CU-Boulder should improve and expand the renewable energy and molecular biotech initiatives already started. These initiatives provide an initial foundation for the CRD. The energy initiative in particular has been highly successful at cultivating cooperative, synergistic relationships between CU-Boulder and regional businesses. As these initiatives advance, they will provide the model for development of the larger CRD. One example of how these initiatives can be altered to better fulfill the CRD vision is merging the biotech plans from CU Health Sciences and CU-Boulder into a single enterprise that can respond to regional needs and set future directions.

3-5 years

The CRD should branch out to begin initiatives in the clusters that drive the regional economy. Building on the successes of the energy and molecular biotech initiatives, CU-Boulder will be poised to begin initiatives in other economic clusters, including aerospace, geosciences, high-tech, food, sports/sporting goods, and tourism. Space science is a likely first candidate, building on the business networking of the Colorado Space Business Roundtable (CSBR, <http://coloradosbr.org/index.php>). Many academic units, institutes and centers already have collaborations with federal labs or regional groups involved in these areas. But the collaborations are randomly distributed and uncoordinated. Even on the CU-Boulder campus itself, research in similar areas (such as aerospace or the geosciences) is distributed across numerous units. The OVCR should ensure coordinated, cooperative research ventures within the CU-Boulder community, and forge links with regional universities and other facets of the CRD to start initiatives in the different economic clusters. This requires not only top-down directives, but incentives to promote grass roots communication between different units on campus and between CU-Boulder personnel and outside entities.

Real progress on the CRD will require an increase in physical space at CU-Boulder; we therefore also recommend the following.

CU-Boulder should build a CU Community Common Ground (i.e., a faculty club) to promote interdisciplinary discussion and grass roots collaboration. Today there is no common area at CU-Boulder where faculty and professional staff can meet to socialize and brainstorm ideas for future endeavors that might contribute to the CRD. The UMC is a model student center; CU-Boulder should have a parallel facility for faculty and professional staff. Success of the CRD will require interactions between personnel from different academic units, institutes, and centers, and a physical common meeting ground will be indispensable for these interactions.

CU-Boulder should, in collaboration with the city of Boulder, build a conference center. There is real need in the region for a conference and performing arts center. Convenient meeting space on campus, particularly during the academic year, is very difficult to find. Yet the needs and desires for such space are numerous, and are anticipated to escalate substantially with the growth of the CRD. Space is needed for fairs, expositions, conferences, workshops, training sessions, etc. CRD activities will bring in partners from regional businesses, federal labs, government and community groups. In our increasingly “flat” world, these groups will also include national and international partners. CU-Boulder should be both the intellectual and physical crossroads where all of these groups can join to innovate and create.

CU-Boulder should build industry incubator facilities in the research park. An industrial incubator is essential for CU-Boulder and its regional university partners to become a crystallization center for start-up industries, and to promote commercialization of Intellectual Property generated at the universities and the growth of regional high-tech companies. The incubator provides start-up companies with affordable space, office and administrative support, and business support. Availability of this support is crucial for start-ups in the most vulnerable initial period of their business development. The ultimate goal of the incubator is to create a critical mass for self-sustainable growth, with economic benefits for the region and state. See Appendix 2.2: “The Life Sciences Incubator”.

CU-Boulder should expand its current library holdings to make it the leading resource center for the region. Libraries house much of the accumulated knowledge that will inspire the economic and intellectual growth inherent in the CRD success. The CU-Boulder library is currently under-funded, with inadequate holdings and insufficient access to online journals. Further, there are barriers to regional businesses accessing library holdings, and there are even restrictions on sharing holdings between one CU campus and another. Our vision is for the CU-Boulder library to be a world-class resource for all stakeholders in the CRD. All restrictions on access by the regional community should be removed. Holdings relevant to all areas of the CRD, including all of the clusters that drive the regional economy, should be expanded to meet the needs of all facets of the diamond.

5+ years

CU-Boulder should be recognized as the national and international expert in the economic cluster areas that define the CRD. The focus areas for the CRD will be defined by areas of expertise at CU and the regional research universities and federal labs, in conjunction with the economic clusters that drive the regional economy. The 2030 goal is not, however, for CU-Boulder to simply become the regional leader in these areas, but to become known as the national and international leader in these areas.

The CRD infrastructure must prepare itself to transform the threat posed by outsourcing into an opportunity. Mirroring current trends in industry and government, the outsourcing of funded academic research labor to international regions and institutions offering lower costs has already begun. While this process offers some benefits to participants, it also threatens to steal jobs and productivity away from the CRD. It is thus imperative that the CRD put in place policies and procedures that will proactively manage the use of outsourcing in order to balance the interests of all stakeholders. Those policies should seek to develop strategic partnerships that are characterized by mutual benefit and sustainability for both the CRD and the international partner.

APPENDIX 2.1
THE MULTIFUNCTIONAL SERVICE CENTER

THE MULTIFUNCTIONAL SERVICE CENTER

Multifunctional Service Center – Industrial Incubator – Educational Center

This Appendix builds on three interrelated propositions concerning the construction of an efficient and productive interface between the University of Colorado at Boulder, the community, and its partners in the Research Diamond:

1. Most research universities provide some research functions to their community through service centers. These service centers are rarely cost effective.
2. If CU-Boulder wishes to become a crystallization center for industry (start-ups) and active commercialization of intellectual property (IP), having an industrial incubator is a must. It is difficult to run it on cost-effective basis.
3. One of the emerging trends in life science education is a hands-on approach to teaching and bringing students to the latest technologies. Most of these initiatives die because of the lack of experimental base and space to implement them.

This proposal is to create a Multifunctional Life Science Service Center which will combine all three functions and will create the economy of scale that makes its operations economically efficient. A Multifunctional Life Science Service Center will:

1. Provide services and technical support for university research.
2. Provide services to the outside research community on commercial basis.
3. Provide service base for the start-up companies in the University incubator.
4. Provide an experimental base for hands-on, advanced teaching courses (undergraduate, summer, specialized).

Life Science Service Center

Most research universities (including Colorado State University) have service centers for life sciences. The reason is that most labs require very expensive equipment to be used just several times a year. It is much more cost-effective to use the equipment collectively. This helps to increase the efficiency of start-up funds and gives people with an occasional need to perform particular work easy access to the equipment and professional help. The downside is that service centers require good competent management (technical, financial and political) to be efficient.

CU-Boulder has a patchwork of individual/common services. As good citizens, researchers with equipment usually allow others within their department to work on their equipment, but this rarely extends to other departments. As a result, solving a technical issue might require many times as much time and effort in another department.

Some limited common services are available. For example, Molecular, Cellular and Developmental Biology (MCDB) runs sequencing and gene profiling services, but they are used mainly by the department and are more expensive than commercial services. The problem is the scale of operations. The Health Sciences center is more advanced and offers more services, including to external users. They started with a genomic facility, which has had only limited success thus far.

Service centers become of greater importance when new technologies are developing. Genomics is one of such example. At the current time it is very difficult to imagine a leading research university that does not have a developed genomics program. CU-Boulder does not have such a program, despite the fact that a significant number of scientists are working on genomics problems. Having a centralized support facility will significantly increase the efficiency of their research and create new options that are simply unavailable now because none of the individual researchers can afford the required equipment and establish the processes. Without centralized support it simply means that life sciences research on campus will lag further behind.

The genomics service center is required to support a significant number of environmental studies (part of the Energy Initiative) that are exclusively based on massive genomics (metagenomics) methods, and a variety of more traditional functional research. This center should include a modern sequencing facility, gene expression facility and RNA Interference (RNAi) screening facility. RNAi is a relatively new technology that enables (among other things) identification of gene functions. Out of 22,000 human genes, only about 7,000 have assigned functions. Human functional genomics is at the forefront of life science research, and RNAi technology is key to it. A significant part of the initial funding for the genomics center may come from NIH institutional grants. Operational expenses will later be covered from service fees. CU-Boulder has a sufficient concentration of intellectual power to make a case for a genomics center.

This genomics facility may serve as a first step in creating a more comprehensive Service Center that will provide more routine services, including access to equipment, technical help, performing operations, and outsourcing advice. Many activities that are performed in the labs can be efficiently outsourced – it is a matter of knowing where – to achieve economies of scale.

Life Science Industrial Incubator (see also the Appendix 2.2)

If CU-Boulder desires to become a crystallization center for local industry (Research Diamond) and significantly increase the revenues from Technology Transfer activities, creation of an industrial incubator is a must. The major issue of start-ups is very limited funding to cover the gap between formulating the idea and obtaining Stage A investment or major government support. Providing start-ups with space, and more importantly with access to affordable services, is key to a start-up success. Creation of the Service Center is essential to running a successful Life Science Industrial Incubator. That is why creation of an incubator should proceed in parallel with a service center (simultaneously providing the service center with revenues).

The Fitzsimons Bioscience Business Incubator (FBBI) at the Bioscience Park Center (<http://www.fitzbiobusinesspartners.com/>) is a successful model on which the CRD life sciences incubator should build. The FBBI has reasonable rent rates, provide limited services and facilitate interactions between start-ups and auxiliary businesses and venture capital. There is a waiting list of start-ups wishing to get into the incubator, despite the fact that its provision of services is limited (compared to incubators in Boston or Bay area). A challenge to be met in encompassing the FBBI into the CRD is that it is governed by the Fitzsimons redevelopment authority, and is not under the charge of CU-Boulder.

Educational activities

The practical education of undergraduate students in life sciences at CU-Boulder is inadequate. Most graduates have acquired little practical experience in the lab, a hindrance to furthering their career. But practical, hands-on courses are difficult to implement in the traditional classroom setting, and require uninterrupted periods of time. The Service Center can be used for such courses – including both routine techniques (such as cloning, protein expression) to techniques exploiting the cutting-edge technologies (gene profiling, metagenomics, etc). These courses could be part of the summer session educational activities, when specialized, intensive courses can fit into student schedules.

Final comments

Creation of a Multifunctional Life Science Service Center is a big, innovative project, which carries benefits for many facets of University activity and which may attract significant outside funding. Successful, practical implementation of the concept will significantly increase the efficiency of research fund utilization, create better conditions for obtaining research funding by individual researchers, and generate revenues through services, tech transfer activities and innovations in the educational process.

APPENDIX 2.2
THE LIFE SCIENCES INCUBATOR

THE LIFE SCIENCES INCUBATOR

The idea of the Life Science Incubator is to promote commercialization of intellectual property (IP) generated in the University and the growth of regional biotech companies. It is achieved by providing start-up companies with affordable space, office and administrative support, and business support. Availability of this support is crucial for start-ups in the most vulnerable initial period of their business development. The final goal for the incubator is to become a crystallization center for biotech industry and eventually to create a critical mass for self-sustainable growth (evident benefits for state and local government).

Brick-and-mortar incubators are quite wide-spread in the country, especially in the regions with high concentration of academic and biotech institutions (e.g., the San Francisco Bay Area, San Diego, Research Park Triangle, the greater Boston area, and New Jersey). There is a strong correlation and probably a causal relationship between the availability of incubators and the prosperity of the industry (number of start-ups) in the region.

The newer concept of incubators includes providing start-ups with business “counseling”, entrepreneurial and financial support. It is usually achieved by creating a board that consists of industry experts who (usually on a volunteer basis) coach entrepreneurs on business practices and provide advice on getting capital or other funding. The same group serves as a link between entrepreneurs and venture capital. Sometimes there is a small fund associated with the incubator, providing some seed capital for equity positions in start-ups.

The one incubator in Colorado exists in Fitzsimons Research Park (<http://www.fitzscience.com/Available-Property-Incubator-Space.aspx>). It is a very basic organization providing research space and basic services (office, address, communications, etc). Even as it is, this incubator seems to be a real success. More than 100 companies passed through it in four years. Some are real success stories (Myogen, ARCA Biopharma). There is a waiting list of companies to get into the incubator, indicating an unsaturated demand. The incubator has 60000 sq ft of space with 100% occupancy. With current lease rates around \$20-22/sq ft it generates around \$1.2 million in revenue. The details of the operating costs are not available, but considering average costs of \$10/sq ft for operations (\$600,000) and a staff of 6 people (\$400,000), it should be slightly profitable or revenue neutral. It seems that the incubator has indeed attracted biotech start-ups to the area. The Fitzsimons incubator administratively is governed by the Fitzsimons redevelopment authority, representing the city of Aurora (the leading role) and the University. It was funded by a complex scheme including these and probably some private partners.

The incubator is complemented by the statewide Fitzsimons BioBusiness Partners organization (<http://www.fitzbiobusinesspartners.com/>) whose goal is to provide business support for start-ups. This has garnered significant experience in bringing together local government, university and business groups. The goal of FBB_p is to raise a pool of money to provide matching funds for local businesses, as well as establish communication between start-ups and the broader business community.

A different model for a life science incubator is realized at the University of Florida. There the incubator is run mainly by the University. Anecdotally, its creation has had a strong positive effect on the local biotech community.

The bottom line

1. An incubator is essential to promote the commercialization of developments in the University and the growth of local life science businesses.
2. Brick and mortar incubators are not sufficient. They should be complemented by a business type organization that will provide entrepreneurs with experience and facilitate access to capital.
3. Successful development requires collaboration between university and local government and should be a joint project.
4. Colorado (Denver-Boulder metro area) has unsaturated demand for incubator services. Incubators can be run in at least a revenue-neutral mode.
5. Considering these and other circumstances, creation of a life sciences business incubator in Boulder has significant chances of success.
6. The Florida model (university-led) is well-suited for Boulder if the Fitzsimons incubator can be merged into the model.
7. A Life Sciences Incubator in Boulder may help to commercialize the Energy initiative developments in life sciences

Other considerations

The success of the Energy Initiative is to a significant degree due to joining many programs into one. With Life sciences we have two competing programs – the Boulder Biotech Initiative, and the Health Science Center Bio-science initiative. They seem to be competing and even hostile to one another. Combining the two under one roof may strongly promote the case for the State, as occurred with Energy. Unlike the situation with the Energy Initiative, there are no Federal labs in Colorado, but significant biotech presence is here. Consequently, collaboration with local biotech industry should be a more important component of biotech development in Colorado.

APPENDIX 3
REPORT OF THE GLOBAL CROSSROADS SUBCOMMITTEE

Subcommittee members: Douglas C. Sicker (Chair), Bud Coleman, Robert Guralnick, Merlyn Holmes , and Russell Moore.

14 August 2008

GLOBAL CROSSROADS SUBCOMMITTEE REPORT

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Appendix 3.1: How much of a global crossroads is CU-Boulder at Present?

Preface: Why build a global crossroads at CU-Boulder?

Building a global crossroads at CU-Boulder is an essential part of furthering the University's mission and Flagship 2030 Core Initiative "Fostering Research Excellence." Our ability to internationalize will derive from our ability to achieve and maintain an absolute leadership role in research, scholarship and creative works.

In addition to the inherently enlivening and thought-provoking benefits of having a diverse and international population of students and scholars on campus, there are more pressing reasons for supporting a global Crossroads effort. A primary consideration is that the United States can no longer safely assume that it will automatically be an unequivocal leader in graduate education and research in the world, and establishing CU-Boulder as a global crossroads will help secure us prominent status among international higher education institutions. Furthermore, intellectual exchanges, interconnections, and collaborative relationships will be increasingly more important in order to marshal the intellectual and physical resources that will be required to address the major and often global issues that we will face as we move toward 2030. CU must establish an integral global crossroads in order to be an institution that plays a major role in this global community.

Current Status: How much of a global crossroads is CU-Boulder at present?

Compared to peer institutions, CU-Boulder is currently near the median in terms of the numbers of international scholars and students on campus. In a global context, the diversity of countries of origin that make up our current international student body is rather limited to the extent that most of that population derives from relatively few countries. The breadth of international representation amongst our international scholars and artists is slightly better. An examination of where the international representation is on our campus reveals that the distribution of international students and scholars across departments is decidedly skewed. Many departments have few or no international graduate students whereas others have uncommonly high numbers. Additionally, in some units that do contain a significant number of international students, the diversity of country of origin is strikingly narrow with students coming from only one or two countries. Whether or not this relatively narrow diversity of international representation should be viewed in a negative or positive light is difficult to ascertain, as the issues underlying this representation are complex. As a major research

institution that strives to maintain and improve its prominence on the international stage, a key objective is to attract the best and brightest students, scholars, and artists to CU-Boulder to exchange ideas with our faculty and students. Within various disciplines it is a stark reality that global thought leaders are not evenly distributed across all nations and this likely contributes to the skewed international representation that is seen within certain units on our campus. While increasing the international breadth of representation our campus would be enriching, we recognize that the issues surrounding our ability to do so are clearly complex.

See Appendix 3.1 for more details on this inquiry.

Principles

The overarching goal should be *engaged global citizenship*, where the University actively draws the best minds from around the globe and fosters work within its faculty and student body on problems and issues of global importance and international impact. In order to attract the best and brightest from around the world, the University must first focus on maintaining and improving excellence in research and creative work, and bolster its reputation and rankings. In tandem with working to accomplish these core goals, CU-Boulder must also find ways to take full advantage of the international experiences of the students, scholars, and artists already within departments and in the broader community as well as by encouraging and supporting work on international topics, travel, and international studies among our students and faculty. The Global Crossroads of the twenty-first century will not be limited to geographic travel but will also include substantial electronic or “virtual” communication as well. CU-Boulder will need to build and maintain both forms of “travel.”

Recommendations

1. Implement the six best practices for internationalization as identified by the American Council on Education as “Strategies of Highly Active Research Universities”:

Articulated Commitment

- Conduct formal assessment of internationalization in the last three years.
- Highlight international education in recruitment literature.
- Have procedures to enable students to study abroad without delaying graduation.

Academic Offerings

- Administer international internships for credit.
- Administer international field study for credit.

Organizational Infrastructure

- Have a campus-wide task force exclusively for international education.
- Use internal e-mail to communicate about international education.
- Use an established system to communicate about students’ study abroad experiences.

External Funding

- Actively seek funding for international education.
- Solicit private funding.
- Solicit federal funding.

Institutional Investment in Faculty

- Earmark funds for faculty to lead study abroad programs.
- Earmark funds for faculty to travel abroad for meetings or conferences.
- Earmark funds for faculty to study or conduct research abroad.

Student Programs

- Earmark funds for students to study or work abroad.
- Establish a meeting place for students to discuss international issues.

N.B.: These best practices, and the methodology used to derive them, are described in Madeleine F. Green, “Measuring Internationalization at Universities” (Washington, D.C.: American Council on Education, 2005; ACE publication number 311875); it can be consulted in electronic form at <http://www.acenet.edu/bookstore/pdf/2005FordResearch.pdf>.

2. Establish the Colorado Center for Global Studies, as proposed in the Flagship 2030 materials. This center will provide the critical infrastructure for supporting internationalization and a platform for the Office of the Vice Chancellor for Research to expand its international partnerships. As well, it will offer our students extraordinary opportunities to explore the world and interact with its leading thinkers and artists. The foundation of such a center would include a senior-level administrator and office space, along with support staff and an adequate budget.

The primary focus would be to create a locus for scholarly and creative work concerning global issues facing society at large. Strengthening and expanding our current relations and Memorandums of Understanding (MOU’s) with universities in other countries will be essential, as will establishing and managing relationships with governmental bodies such as the European Union and international businesses or other possible sources of funding and collaboration. A new program built around these endeavors would be the naming of “Colorado Fellows,” who will be selected in a competitive campus process based on their existing record and experience integrating international perspectives in their work. Other initiatives would include the creation of a CU-Boulder Fellows Abroad Program and continuing growth of the CU-Boulder Study Abroad program for students. CU should also look to expand student and faculty exchanges around the world, including the creation of an “International Summer School” program, where we would invite scholars and artists from around the world to CU-Boulder for one to two weeks of intense study and collaboration. Lastly, CU should develop an International Studies degree-granting program at the Masters and perhaps undergraduate level.

3. Increase the number of international scholars and students. To meet the current Institute of International Education’s (IIE) honor roles (and thus gain visibility as a true Global Crossroads), we should add:

- At least an additional 208 international scholars to be in the "Top 40 Leading Institutions Hosting International Scholars" and
- At least an additional 2,227 international students (graduate and undergraduate) to be in the "Top 25 Institutions Hosting International Students."

4. Create a healthy, vibrant global crossroads that will self-perpetuate by word-of-mouth and reputation, establishing our own standards for breadth, depth, and distribution of scholars and students across departments, nurturing long-term relationships with scholars from abroad, and making our international guests feel valued. It is important that we ensure the experiences of international scholars and students are good ones and that we establish more consistent means of staying connected with them for years or decades after their departure. (Many contracts between international firms and CU-Boulder come about due to alumni who have returned to their home countries.) This will not only benefit the continued growth of the global crossroads but also future research collaborations and the Colorado Research Diamond.

5. Facilitate and support faculty participation in international endeavors, particularly in those fields where internationalization has yet to become common. CU should provide incentives so that faculty get credit for and are encouraged to incorporate international issues, exchanges, and collaborations in their teaching, research, and/or creative work. International sabbaticals should be encouraged. One specific recommendation is to sponsor an international sabbatical competition similar to the Faculty Fellowship award already in place.

The University should provide necessary resources for faculty to encourage international efforts, such as offering seed grants for travel abroad and using existing mechanisms like the Travel Authorization program to provide important information about international travel stipulations, rules, guidelines, etc. These issues are multi-faceted, from import and export rules and travel issues, to mechanisms for establishing long term collaborations with partners overseas. The University should also encourage faculty to have leadership roles in international conferences and workshops and provide funding or other incentives for such endeavors.

6. Create an internationalized curriculum. In cooperation with the Vice Chancellor for Academic Affairs, internationalize our curriculum at the undergraduate and graduate levels.

7. Create residential centers for research and education abroad. Many of our peer institutions have established research and educational campuses abroad. This allows for effective exchange of faculty and students between campuses here in the U.S. and elsewhere around the world. CU should commit to establishing similar campuses in strategic locations outside of the United States.

8. Utilize cyberinfrastructure to support internationalization. CU should build the information infrastructure to support development of international collaboratories that remotely link together scholars and artists from across the globe. This will allow scholars and artists to pursue their research and education goals without regard to geographical location, as well as dramatically lowering costs and impacts associated with international endeavors. The infrastructure will include new teleconferencing technologies, real time access to shared data,

and access of remote computing power. We should develop metrics for success in virtualizing international endeavors as part of our overall assessment of our efforts.

9. Create a communications strategy to promote important concepts related to our international endeavors. We must inform the world about our research and creative work excellence and successes in international activities in the language and medium that can best reach our respective audiences. We must begin a public relations effort to promote the reputation of the campus as a center for international studies and promote how such studies ultimately positively impact the city, county and state. To that end, we should implement a full-spectrum communications strategy that would utilize a broad range of communication media, including the web (CU-Boulder's and the rest of the World Wide Web), print publications (from brochures, pamphlets, and booklets created in-house and within CU to coverage in newspapers, magazines, newsletters, and other people's publications), multimedia (video, CD-ROM, DVD, web-based, etc.), word-of-mouth (giving our own faculty and staff the tools, guidance, and encouragement), and relationship management with all the interested parties and publishers in the lines of communication. We should develop a marketing campaign to increase CU-Boulder's visibility internationally. Components could include a visual identifier, such as a globe with an enlarged Colorado across the middle and a slogan, such as "Colorado: At the center of the Global Crossroads," or something to indicate we are at the heart of the global research and education community.

10. Create clear policies and procedures regarding outsourcing. Mirroring current trends in industry and government, the outsourcing of funded academic research labor to international regions and institutions offering lower costs has already begun. We recognize the importance of continuing to create a global, intellectual commons that balances the need for outsourcing against some of the potential dangers (loss of campus identity and product, intellectual property concerns, etc.) while ensuring that we preserve our academic integrity and mission as a university. It is thus imperative that the Office of the Vice Chancellor for Research in combination with the new Colorado Center for Global Studies put in place policies and procedures that will proactively manage and flexibly adapt to the use of outsourcing in order to balance the interests of all partners and preserve our academic characteristics and quality. Those policies should seek to develop strategic partnerships that are characterized by mutual benefit and sustainability for both the University of Colorado at Boulder and our international partners.

11. Recruitment: some preliminary, non-exhaustive strategies. We should increase the international numbers where it is easiest first. One strategy is to take advantage of exchange rates and reach out to those students who can now pay for their American education, perhaps particularly Europe where they can receive fellowships for study abroad. We should also find and follow up on existing international connections and relationships, such as international MOUs, faculty and staff with personal and professional international connections, the Office of International Education, international students (encourage word of mouth recruiting), alumni with international connections and parents with international connections.

We should identify international focal points of excellence from which we can draw talent and ideas, and establish links with them. And, finally, we should put additional recruiting

efforts into countries and continents that are not well represented by carefully selecting and focusing on one or two promising institutions within each one and tending those relationships.

12. Develop evaluation methods for assessing and rewarding success. It is important to have concrete goals and measurable successes. We should track our international efforts in a centralized, comprehensive and concrete / incremental manner. Faculty Reports of Professional Activities can be used to collect data on faculty participation in international effort as a separate report section. FRPAs can also be used to reward global research efforts. Lastly, we can try to quantify what value results from international exchange.

Timelines

1-3 Years:

- Create a Global Crossroads Task Force with the charge of developing a Center for Global Studies.
- Consolidate international efforts from across the Boulder campus.
- Establish our own internal standards and goals for a healthy, vibrant global crossroads.
- Explore importance and means of integrating international studies curriculum at undergraduate level.
- Define administrative position and duties of Center for Global Studies.
- Develop and implement communications strategies.
- Create an outsourcing policy.
- Proactively recruit and provide incentives for those international students and scholars likely looking for home institutions in the United States. / Increase our numbers.
- Identify the international partners with whom we want to establish long-term relationships and begin the process.
- Identify successful residential centers for research and education abroad, and develop plans for our own.

3-5 Years:

- Evaluate effectiveness of our efforts in creating the Center for Global Studies and adjust accordingly.
- Proactively recruit international students and scholars in line with our own internal standards for a healthy, vibrant global crossroads.
- Establish and manage the relationships with identified international focal points of excellence.
- Complete processes to develop an international studies curriculum at the graduate level.
- Complete process to integrate international studies curriculum at undergraduate level as recommended by task force.
- Establish the first residential centers for research and education abroad.

5+ Years:

- Review all plans and goals and re-adjust as needed.

Funding

We will need to consider potential funding sources for building center and infrastructure to support various programs, including federal agencies such as the NSF which has an international collaboration division. Additionally, we should explore ways in which the global crossroads concept can itself generate resources, from recruiting students from countries or institutions who can pay their tuition to identifying international sources of research funding, such as a current Middle East negotiation for a water filtration project.

APPENDIX 3.1
CURRENT STATE OF INTERNATIONALIZATION AT CU-BOULDER

HOW MUCH OF A GLOBAL CROSSROADS IS CU-BOULDER AT PRESENT?

Data. To examine the information reported below and to see additional pieces of this puzzle, see the documents gathered at <http://www.colorado.edu/VCRsearch/globalcrossroads/>.

Preliminary Analysis

- **Numbers:** The 646 international scholars (recorded as faculty, researchers, and postdoctoral fellows) and the 1,135 international students enrolled at the University of Colorado at Boulder make CU neither more nor less a "Global Crossroads" than the average American university. We may be below average for graduate students simply because our total graduate student enrollment is lower than average.
- **Breadth:** The countries of origin of our current international student body is uneven with approximately 60% coming from Asia and the next highest category (Europe) accounting for only 14%. Our international scholars have a slightly more even spread with the two largest categories being from Europe (45%) and Asia (39%), but there remains room for improvement in both.
- **Distribution:** The distribution of international students across departments is decidedly limited. The vast majority of international graduate students (324 out of 766) are in Engineering. Next are the Physical Sciences with 93 international students, and then Computer & Information Sciences and Support Services with 58 and Social Sciences with 52. International scholars are also rather unevenly distributed across departments with the most being in Engineering (188 out of 646); then Life/Biological Sciences (166), Physical Sciences (110), then dropping to the Social Sciences and History (30).
- **Depth:** While many departments have few or no international graduate students, some departments, ironically, may have too much of a good thing. They have such high proportions (upwards of 80%) of representatives from particular countries that they no longer realistically serve as a "Global Crossroads." We don't currently have the data on the percentage of international scholars within departments.
- We don't currently have the data on outward-bound scholars and students, but it is unlikely that we are above average in these regards either.

Some Possible Goals

- To meet the current Institute of International Education's (IIE) benchmarks, we would need
 - At least an additional 208 international scholars to be in the "Top 40 Leading Institutions Hosting International Scholars."
 - At least an additional 2,227 international students (graduate and undergraduate) to be in the "Top 25 Institutions Hosting International Students."¹
- Establish and aspire to our own standards for distribution of scholars and students across departments.
- Take better advantage of the international scholars, students, and staff (including our large Hispanic contingent of staff members) that we have. Find ways to make better use of their international experiences within departments, across campus, and into the larger Boulder/Denver/Colorado communities.
- Bring the best and the brightest to campus, including international scholars and students, and find ways to make better use of their international experiences.
- Encourage and support international work (in subject area scope and location) and travel for our scholars and students. Find ways to better share their international experiences at home.

¹ Both of these measures seem to be based on sheer numbers, not percentages: a strange methodology, but there you have it.

Some Preliminary Recruitment Strategies

- Increase the international numbers first where it is easiest to do so:
 - Take advantage of the fallen dollar and reach out to those students who can now pay for their American education, perhaps particularly Europe where they can receive fellowships for study abroad
 - Find and follow up on existing international connections and relationships:
 - International MOUs
 - Faculty and Staff with personal and professional international connections
 - Office of International Education
 - International students - encourage word of mouth recruiting
 - Alumni with international connections
 - Parents with international connections
 - Identify international focal points of excellence from which we can draw talent and ideas, and establish links with them.
- Put additional recruiting efforts into countries and continents that are not well represented by carefully selecting and focusing on one or two promising institutions each and tending those relationships.

APPENDIX 4
REPORT OF THE YEAR-ROUND LEARNING SUBCOMMITTEE

Subcommittee members: Darna Dufour (Chair), Fred Anderson, Valerio Ferme, Jim Goodrich.

20 July 2008

YEAR-ROUND LEARNING SUBCOMMITTEE FINAL REPORT

Introduction and subcommittee goal

The goal of this subcommittee was to evaluate how a change of the University's academic calendar to a three-semester, year-round schedule would impact research excellence

(Core Initiative 2 – Foster Research Excellence). The three-semester, year-round schedule is referred to as year-round learning (YRL), and is one of the 10 Flagship Initiatives of Flagship 2030. The rationale for this change in the academic calendar is that it would “...expand learning and research opportunities for both students and faculty – and make better use of resources, including facilities, personnel and equipment.”¹

The phrase “year-round learning” can be used in the broad sense to cover all university calendars that include some teaching during the traditional summer break. However, we assume that the YRL Flagship Initiative is to change CU-Boulder’s academic calendar to a trimester model with both faculty teaching and student enrollments spread equally over the three trimesters. Further, we assume that the change to YRL would not affect faculty teaching loads.

Major Findings

- None of CU’s peer institutions (public and private AAU Research I universities) currently have academic calendars based on YRL.
- The change to YRL would likely have a negative impact on the research of most faculty members.
- The change to YRL could benefit the research of a minority of faculty whose research requires travel abroad for a month or more during the two-semester academic year.

Basis

The above findings are based on (1) discussions within the subcommittee, with other members of the CU faculty and with faculty at other institutions; (2) current practices at AAU institutions; (3) a review of the literature on YRL models at other universities. Discussions within the subcommittee and with other faculty emphasized the following:

- Different types of calendars could accommodate YRL. For universities with an academic calendar based on semesters, summer school can be used to extend classes to year-round. Similarly for universities with academic calendars based on quarters or trimesters, the 4th quarter, and 3rd trimester can be used to.
- Providing faculty the flexibility to fulfill their teaching requirements during the summer (or 3rd trimester) would benefit some faculty such as those who do field research in places where the rainy/dry season conditions are a consideration, and those doing archival research in Europe, where many archives are closed for prolonged periods of time during the summer.
- Requiring faculty to teach during the 3rd trimester will negatively impact the research of many faculty members who rely on the traditional summer break to conduct research, write, catch-up, and plan ahead.
- Requiring faculty to teach during the 3rd trimester could hamper faculty recruitment, especially in the natural sciences. Since the main congresses and collaborative projects for scientists from different institutions take place during the Summer term, many

¹ <http://www.colorado.edu/flagship2030/downloads/flagshipsummary.pdf>

scientists would see the Summer trimester as impeding or hampering their professional research profile.

- Time is an important currency for faculty, and un-fragmented periods of time are highly valued. The traditional summer break not only provides a reprieve from teaching obligations, but also from the other obligations like advising, service and administrative responsibilities that compete for faculty time during the academic year. Change to a YRL model would provide periodic breaks from teaching, but not from other obligations.

Current practices at other AAU publics were assessed using the data posted at <http://www.colorado.edu/pba/records/flagship/index.htm> . These can be summarized as follows:

- The majority of the AAU publics have a calendar system based on semesters, a minority are on the quarter system, and one (University of Michigan) is on a trimester system.
- “Summer” enrollment in terms of the %SCH (percentage of student credit hours) is roughly similar under all calendar systems, and averages 7.1% SCH, a little higher than CU-Boulder (5.5%SCH).
- For the five AAU publics on the quarter system, the summer enrollments tended to be higher, 9.1% SCH. For Michigan, the only AAU public on trimesters, enrollment in the 3rd trimester is 6.1% SCH.
- Highest summer enrollments are at Florida (12.5%), which has a state requirement that students earn hours for graduation during at least one summer.

We surveyed the relevant literature using two search engines, Web of Science and Google. With one exception, the literature on YRL we identified was focused on K-12 education. The only document we were able to locate that addresses the impact of YRL on the research of university faculty is the 2002 publication by Baldwin and McInnis entitled “The Organization of the Academic Year.”¹ Major points regarding the impact of YRL models on research are:

- There has been little discussion, and almost no useful analysis, of the impacts of YRL on research.
- In late 1960’s and early 1970’s a number of universities in the USA experimented with, and quickly abandoned trimester YRL systems. Those universities included the University of Florida system, University of Pittsburgh and City Colleges of Chicago. The authors refer to it as the “discredited trimester system.”
- There is little current interest in the USA, Europe or Asia in YRL systems.
- Bond University in Australia had been successful in implementing a YRL system. Bond is a private, vocationally oriented university.
- Disciplinary differences in the conduct of research could be “especially problematic” in YRL systems.
- In YRL systems there would be risk of moving toward teaching only faculty.
- Summer is an important time for faculty research. Since the opportunity to pursue their own research is a major source of job satisfaction for academics, providing time for research is especially important for research-intensive universities.

¹ Posted at http://www.dest.gov.au/archive/highered/eippubs/eip02_7/eip02_7.pdf.

Subcommittee recommendations

- *Do not* implement a YRL model that will require all faculty to teach during the traditional summer break.
- *Do* provide faculty the flexibility to satisfy their teaching obligations during the traditional summer break.

Further recommendations

Although we strongly recommend against implementing a YRL model, we offer the following suggestions should the campus decide to implement such a system notwithstanding the negative effects it will potentially have on research, scholarship, and creative work at CU.

- In the next three years allow interested departments to experiment with YRL by permitting faculty to count summer courses as part of a normal teaching load.
- In year four evaluate the success of departments experimenting with YRL, and if successful encourage other departments to experiment with YRL.