



College of Sciences and Technology  
Office of the Dean

Bellingham, Washington 98225

## **COLLEGE OF SCIENCES AND TECHNOLOGY ENVIRONMENTAL SCAN, 2009-2011 Strengths, Challenges, Opportunities and Threats**

The College of Sciences and Technology (CST) periodically reviews operations and practices as part of an effort to maintain an ongoing sense of its strengths, challenges, opportunities and threats (SCOT analyses). The current SCOT analysis is an update of that done in spring 2009 as part of the 2009-2011 biennium budget reduction exercise. Previously, CST had conducted an analysis as part of our college planning exercise that produced a CST strategic plan in November, 2007.

The *mission* and strategic plan of CST recognize the central role the college plays in the delivery of Western's liberal arts core, the challenges faced in delivering science, mathematics and technology education appropriate to our state's and nation's rapidly changing needs, and its central role in bringing science, mathematics and technology expertise to the general community.

*College Mission. The mission of the College of Sciences and Technology is to provide the highest quality education in science, mathematics and technology; to participate in the discovery, communication and application of knowledge; to integrate teaching, scholarly activity and service; and to maintain a diverse college community.*

### **STRENGTHS**

The strength and reputation of the College of Sciences and Technology programs is the result of a college-wide commitment to excellence in all areas of endeavor, an exceptionally strong cadre of tenured, tenure-track and non-tenure track faculty, staff and students, and a progressive and innovative curriculum. Several clearly identifiable strengths are:

#### **Faculty, Staff, and Students**

- *Faculty excellence in classroom and research instruction.* Demonstrated by the high frequency of teaching and research awards won by our faculty and the success of our students upon graduation.
- *Quality of faculty scholarship.* Many faculty publish their research in the top journals in their field. Faculty are highly effective in obtaining external funding; the CST level of active grants in

2008 exceeded \$20M.

- *Professional and classified staff contributions.* Experienced, highly qualified staff provide high levels of professional support for college and departmental activities.
- *Student scholarship excellence.* Shown by the large number of awards won and scholarship projects presented at regional and national conference and professional meeting venues, as well as student co-authored publications.
- *Achievement in post-graduate studies.* Graduates are accepted at a high rate and excel in subsequent graduate and professional school studies.
- *Employer satisfaction with graduates.* Surveys of alums and employers of CST graduates show students are well-prepared in current and timely areas.

## Curriculum

- *Interdisciplinary studies.* CST has instituted innovative programs in geophysics, materials science (AMSEC) and neurosciences (BRAIN) that involve interdisciplinary work among CST departments and between CST and CHSS.
- *Undergraduate scholarship.* All departments emphasize and support independent undergraduate scholarship.
- *Emphasis on hands-on learning.* CST curriculum stresses active learning in laboratory, field, and project based settings. These are the best platforms for introducing and reinforcing critical analysis and quantitative reasoning.
- *Instrumentation instruction.* In lab courses and in research experiences students learn how to operate state-of-the-art instrumentation.
- *Sustainable and green practices.* Green laboratory and manufacturing practices already in place in selected departments; sustainability a future theme.
- *Science and mathematics model education programs.* Instruction is research based and involves essentials of both disciplinary and pedagogical training. The science education program is a national leader in engaging CST faculty in full partnership with WCE to produce the next generation of effective science teachers.
- *Emphasis on “frontier” fields.* Attention paid to new and emerging areas not now represented at WWU, e.g., biomathematics, engineering geology.
- *Commitment to staying up-to-date.* Students provided experience with state-of-the-art instruments and exposure to current topics in course work.
- *Commitment to effective GUR courses.* Unwavering commitment to importance of laboratory science and quality courses in the general education program.
- *Accredited and certified programs.* Where available, professional association external accreditation or certification is attained by CST departments.

## Departmental/College Structure

- *Strategic planning.* Principles of *engaged excellence* strongly supported throughout the College.
- *Collegial departments and supportive administration.* Within departments and among departments at the college level, there exists an exceptional level of good-will and willingness to cooperate in addressing challenges.
- *Staff integration in CST programs.* Expert staff are fully integrated into activities of the departments

and college, providing quality support of technical and administrative functions.

- *Integrated and interdependent curriculum.* Most CST majors take a minimum of nine required courses from other CST departments outside their home department. Additionally, CST has several interdisciplinary programs which span multiple departments. The structure of the College effectively supports broad interdisciplinary programs.

## **Graduate Programs**

- *Role in curriculum.* Graduate teaching assistants play an essential role in laboratory instruction and in high enrollment introductory courses.
- *Support for faculty scholarship.* Strong programs provide vital support of faculty scholarship, an important component in faculty recruitment and retention. Many research active faculty depend upon graduate students for research productivity.
- *Mentorship and research opportunities for undergraduates.* Graduate students guide undergraduate research projects and act as peer mentors for undergraduates in lab settings.
- *Employment prospects.* Graduates are in high demand by area companies and institutions, in some areas to a degree greater than we can supply.

## **Facilities and Equipment**

- *Physical Plant.* With the exception of the geology department and AMSEC, CST units are in modern, safe spaces.
- *Equipment.* Although some needs exist, the general level of basic equipment is good. Many departments house key state-of-the-art instrumentation to support research and teaching for both undergraduate and graduate programs.

## **Commitment to Community and Region**

- *College and department outreach.* Lectures, seminars and workshops on current and timely subjects delivered to community audiences at off-campus venues.
- *Support of local enterprises.* Faculty, staff and students bring expertise to area and regional organizations, e.g., Technology Development Center (TDC), an initiative to bring Western faculty and students into relationships with area technical innovators in support of community economic development.
- *College Leadership Board.* Involves alums and supporters of CST and its departments from the northwest area and nationally.
- *Leadership in science and mathematics education.* Programs within CST, in collaboration with Woodring, are leaders in STEM education in the State.
- *Outreach to local schools.* Faculty and students are engaged in mentoring, science fairs and other activities in area schools. Student clubs are active in the community and in area schools.

## **CHALLENGES**

The College faces challenges; while some are rooted in departmental and campus culture, many are due to limited resources. Areas where challenges exist are:

## **Faculty Recruitment, Retention and Development**

- *Salaries.* To compete with the best comprehensive universities, faculty salaries must be at competitive levels. Present faculty salaries are below average for peer-institutions.
- *Startup packages.* New faculty in experimental science and technology require support for specialized equipment, software, computers, and general supplies and materials. These startup packages must be competitive for recruitment of the best faculty and for the success of their research programs.
- *Spousal accommodation.* To make competitive hires, especially to achieve CST diversity goals, effective mechanisms are needed for spousal accommodation
- *Time commitments.* Faculty who are awarded nationally-competitive external grants, such as from the National Science Foundation (NSF) or the National Institutes of Health (NIH), have grant related responsibilities in addition to their normal load of teaching and service. Freeing blocks of time to enable research can conflict with class scheduling needs and service commitments.

## **Staff Recruitment, Retention and Development**

- *Salaries.* When competing for staff on a national level, salaries are comparatively low to other comprehensive universities.
- *Professional development.* To retain quality professional and classified staff, effective and sustainable mechanisms for additional training and advancement need to be put in place.

## **Student Support**

- *Undergraduate support.* Higher levels of student scholarship and internship support are needed to help attract students into the STEM fields.
- *Graduate stipends.* Stipends are lower than those of our competition, making it difficult to keep graduate programs strong and to attract the highest-quality graduate assistants.
- *Support for professional development.* Increased funding is needed to support more students' attendance at professional meetings.

## **Laboratory Space**

- *Enrollment limitations.* If enrollments are to be increased in our laboratory science departments, additional space for laboratory courses and research activity will be needed. Problems exist in several departments, especially biology and chemistry.
- *AMSEC centralization.* To optimize efficiency of the college interdisciplinary materials program, especially with respect to instrument use, it is necessary to consolidate the now disparately located units into one central area.
- *Upgrading Physical Plant.* Need to upgrade some of the classroom and laboratory spaces in geology and engineering technology.

## **Faculty, Staff, and Student Diversity**

- *Support for minority students.* Given the changing demographics of the incoming student population, and if we are to attract underrepresented groups into all STEM areas, more scholarships, research stipends and mentoring are needed.
- *Coordination of programs with community colleges.* Routes should be explored that would allow students to move more easily from community colleges to Western programs.
- *Recruiting under-represented groups.* In addition to scholarship support, CST must develop diversity-focused programs within area schools and community colleges.

## **Curriculum Adequacy**

- *Upper division and graduate courses.* High student enrollments in several departments currently result in their being able to provide only minimal offerings in upper division and graduate course areas and insufficient research and capstone course opportunities.
- *Increased depth in sub-disciplines.* Additional faculty are needed in selected areas to provide desired area coverage and to fully develop opportunities for faculty interaction.
- *Library support.* Ongoing erosion of library budgets results in some areas of study, especially emerging and interdisciplinary areas, being dangerously uncovered.
- *Small-course, student-centered approaches.* Owing to vacant faculty positions, and faced with position cuts, it will be hard to maintain Western's reputation for excellence in teaching.
- *Equipment/instrumentation.* To allow students to experience science and technology at the "frontiers," it is necessary to be constantly upgrading and introducing new equipment and instrumentation.
- *Less well prepared students.* There is a nationwide trend for students to be less interested in sciences and technology and to be inadequately prepared for college level coursework in these areas, requiring more remedial CST courses to be offered.

## **Program Financial Support**

- *External funding.* Many CST needs, e.g., student stipend and travel support, require increased levels of funding. Balancing the time demands of research and teaching with proposal writing is becoming increasingly difficulty. Additionally, federal, state and foundation budget problems may significantly reduce the success rate for funded grants.
- *Increased efficiency.* All areas of college activity must be examined, including instrument use, staff utilization, etc., to develop efficiencies, especially if faced with significant budget reductions.
- *High-demand enrollments.* As the economic environment improves, ways to take advantage of opportunities for State and Federal support of targeted, high-demand needs must be found.

## **OPPORTUNITIES**

Because of the rapid advances that are occurring in STEM areas and the acknowledged high demand for graduates in these areas in the State and country, there will be exciting and numerous opportunities to address. Activities for CST to pursue are:

## Curriculum Development

- *Increased interdisciplinary programs.* Given the expertise we have in several disciplines, development of interdisciplinary programs should be pursued.
- *New graduate programs.* Several CST departments stand poised to introduce professional science masters programs, an area of growing need regionally and nationally.
- *Program expansion.* For example, we can consider new offerings in general education and evolving the industrial technology program to an engineering technology program.
- *Assessment culture.* Will provide needed input to support refinement and development of timely and modern curriculum.
- *Student Recruitment.* Introductory survey courses are not the most effective means to recruit students from underrepresented groups into science, mathematics and technology. With additional resources, new and innovative introductory courses could be developed.

## Resource Development

- *Expand efforts in State high demand areas.* As State needs for science, mathematics and technology, and mathematics and science education training increases, CST will pursue opportunities at targeted and decision package funding.
- *Grow research/scholarship culture.* As faculty replacement takes place and junior faculty are hired, CST will build a culture that fully supports a reasonable level of scholarship and publication by all faculty.
- *Faculty participation in external funding.* In some CST departments, expectations will be increased for faculty to write proposals and generate external support for students.
- *Naming opportunities for CST facilities.* CST will identify various facilities within the College that could be named for contributors of significant gifts.
- *Scheduling to maximize faculty effectiveness.* To achieve maximal faculty participation in several CST departments the level of scholarship should/could be increased, through departmental guidance and time management.
- *Chair mentorship.* To facilitate highly effective leadership in chairs, a chair mentoring program should be developed.

## Community Outreach

- *Technology Development Center (TDC).* Working in concert with CBE, the Port of Bellingham, the Technology Alliance Group and other community interests, CST can develop an entity that supports innovation in this area and provides new scholarship opportunities for our students and faculty.
- *Biodiversity institute.* Given the strengths in and leadership available from our biology department, it is viable to consider a State biodiversity institute associated with Western.
- *Center in data mining and information retrieval.* Through greater involvement of the computer science department with the outside community, key areas of need can be addressed.
- *Science and mathematics education programs.* Given our current leadership position in these areas, it is possible to assume leadership to the point of establishing a STEM education institute associated with WWU.

## **Diversity Enhancement**

- *Programs with community colleges.* Through development of recruiting programs and cooperative mentoring efforts with community colleges, we can better access traditionally underserved students.
- *Student mentoring systems.* Increased involvement of CST students in a system of mentoring developed to recruit students from underrepresented groups into science, mathematics and technology, for example the Compass to Campus Program. To improve student retention upper level CST students could be recruited to mentor struggling lower level students.

## **THREATS**

The College of Sciences and Technology faces threats that are both external and internal. Currently, threats that are the result of State revenue shortfalls and the resulting reduction of funding to Western pose serious threats to our programs, in both qualitative and quantitative respects. Major areas of activity could be threatened. Details of how/where the reduction impacts could be felt are listed below.

### **Tenure Track Faculty Positions; impacts of eliminations:**

- *Time to graduation.* In departments which have increasing enrollments, the lack of new faculty will not allow increased course offerings necessary for timely graduation.
- *Student Research.* With larger class sizes and increased service responsibilities faculty will have less time to mentor undergraduate student research.
- *Access to the majors.* The ability to offer key courses to majors would be limited by a reduction in the number of faculty and would result in a reduction in the number of majors or in an increased time to graduation.
- *Departmental rejuvenation/rebuilding.* Several departments of the College will be unable to undergo substantial rejuvenation as a result of the replacement of senior by junior faculty. Furthermore, several departmental divisions, e.g., electronics engineering technology and mathematics education, are at risk if we cannot replace retiring or resigning faculty members.
- *New interdisciplinary program initiatives.* New programs such as AMSEC and BRAIN, programs that are a major part of CST future development and are still in early and formative stages of development, will be seriously slowed.

### **Non-tenure-track Faculty Positions; impacts of reductions:**

- *Teaching power reduction.* Because research and service or not required of NTT faculty, the amount of teaching power is approximately 1.5 FTE of a TT/TN faculty position.
- *Time to graduation.* Placement of many NTT faculty is in GUR courses as well as in entry level courses required for CST majors. A reduction in any of these courses would result in a greater time to graduation campus-wide, but particularly in CST.
- *Upper level courses.* Tenured and tenure-track faculty who would otherwise be teaching upper division courses would be needed for covering introductory courses, this would significantly impact the number of majors and time to graduation. Additionally, there are several departments where the NTT faculty play essential roles in teaching particular courses and programs.

### **Graduate Program; impacts of reduction:**

- *Introductory courses.* The quality of introductory courses with laboratories will be significantly diminished if there are high enrollments with less graduate teaching assistants, as departments will first attempt to preserve the quality of curriculum in the upper level courses. The introductory labs will become less hands-on and less able to teach critical analysis and quantitative skills.
- *Faculty research.* Many CST faculty depend upon graduate students for sustaining research productivity.
- *Undergraduate research.* Many undergraduates are directly involved in research projects with graduate students.
- *Recruitment of under-represented groups.* Less opportunities for recruiting first generation college students, as near peers graduate students can act as more accessible mentors than many faculty.

### **Quality of Faculty and Department Administration; impacted by:**

- *Low faculty salaries.* If we are to compete with the best comprehensive universities, it is necessary that we not lose momentum in our efforts to bring faculty salaries of tenure track faculty and instructors to more competitive levels. Significant time and good will is lost if faculty must acquire job offers from other universities for salary increases at Western.
- *Uncompetitive faculty startup.* New faculty in all areas of experimental science and technology require support for specialized equipment, software, computers, and general supplies and materials. Our inability to fund basic and competitive startup packages will severely impact our ability to recruit new faculty into most areas of biology, chemistry, geology, engineering technology and physics.
- *Inadequate chair stipends.* If we do not find a way to better compensate chairs, we are at risk of being unable to maintain current high levels of departmental administration. Increasing stipends and decreasing teaching loads is necessary in order to recruit the best faculty to serve as chairs.
- *Faculty travel/professional development.* If our faculty are to be recognized in their fields and stay current with the development of “frontier” areas, we must provide adequate support for travel and conference participation.
- *Changing workloads.* As budgets continue to be reduced and faculty positions are either cut or left unfilled, the ability of remaining faculty to increase their scholarship activities (e.g., publications, conference attendance, and grant proposals) is diminished.

### **Quality of Professional and Technical Staff; impacted by:**

- *Low salaries.* High quality staff are essential to any well functioning department. If our goal is to compete with the best comprehensive universities nationally, it is necessary that our staff be offered competitive salaries.
- *Staff travel/professional development.* If our staff are to be current in their fields, we must provide adequate support for travel to conferences or training participation/attendance.
- *Increasing workloads.* As budgets continue to be cut, and staff workloads increase, quality and safety can be at risk.

**Professional, Administrative and Technical Staff Support Reductions; will impact:**

- *Departmental advising.* Although not a primary responsibility of administrative staff, coordination of departmental advising and much early-phase advising is done by selected, experienced staff. Loss of key staff will put more work back on faculty, further reducing their productivity in teaching and scholarship.
- *Professional development.* It is essential to have administrative and technical staff that are current in their areas and in their abilities to support current and future curricula, a situation threatened by reduced funding.
- *Maintenance of vital/expensive equipment.* Not having trained professionals to maintain and supervise use of key equipment/instrumentation could compromise student safety in laboratories and puts us at risk for great expense which cannot be accommodated by current operating budgets.

**Quality of Undergraduate and Graduate Program Scholarship; not maintained if:**

- *Graduate student stipends are low.* If we are to successfully attract graduate students to our programs, we will need to increase stipend levels to a point where they are competitive with institutions of our quality.
- *New faculty are not hired.* In order to support our desired level of undergraduate scholarship activity, sufficient numbers of tenure track-faculty are needed to accommodate increasing numbers of majors.

**Support of Infrastructure Reduced; will affect:**

- *Ability to recruit faculty.* If we cannot supply a supportive environment in which faculty will conduct their teaching and research, we cannot expect to recruit and hire competitively.
- *Acquisition of instrumentation/equipment.* To have state-of-the-art programs in laboratory, instrumentation, and computer intensive areas, we must provide support for high quality and modern facilities.
- *Reduced ability to maintain laboratory equipment.* A reduction in operating budgets for departments and the College will impact our ability to maintain and repair instrumentation in teaching and research laboratories.

**Curriculum and Program Innovation; slowed in:**

- *Interdisciplinary initiatives.* Our ability to develop interdisciplinary programs in biomathematics, engineering geology, biochemistry/cell and molecular biology, electronics ET/computer science, etc. will be seriously impacted.
- *General education offerings.* Faculty initiatives to develop new courses and incorporate modern science into courses will not be affordable.