CM Strategic Plan Report - May 02

### Table 2.4. Goal 1: Enhance the Quality of WPI's Academic Programs

<table>
<thead>
<tr>
<th>Outcome Objectives</th>
<th>Performance Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Fully develop the WPI Plan for all students around an &quot;honors college&quot; metaphor at all levels.</td>
<td>Faculty size; number National Merit Scholars; ranking of undergraduate program; impact of first year; curriculum improvements; graduation rate; practice graduate program statistics; IQP quality; learning outcomes; number large (&gt;35) classes.</td>
<td>Provost's Office; Admissions Office; Faculty Governance.</td>
</tr>
<tr>
<td>1.2 Develop aligned incentives for faculty and staff to promote action plans.</td>
<td>Faculty diversity; faculty and staff salaries compared to benchmarks; employee satisfaction; effectiveness of reward system.</td>
<td>Provost; Director of Human Resources; Assistant VP Student Affairs; Multicultural Awareness Staff Member; Faculty Governance.</td>
</tr>
<tr>
<td>1.3 Provide increasing opportunities for student involvement in research.</td>
<td>Number students in summer research; impact of graduate fellowships.</td>
<td>Associate Provost.</td>
</tr>
<tr>
<td>1.4 Maintain contemporary teaching laboratories.</td>
<td>Adequacy of funding for equipment and instrumentation maintenance and renewal; average age statistics.</td>
<td>Property Administrator; Provost's Office; Dean, Division of Continuing Studies.</td>
</tr>
</tbody>
</table>

**Objective 1.1**  
Fully develop the WPI Plan for all students around an "honors college" metaphor at all levels.

**Performance:**  
- **Faculty size:** One new line was added two years ago, and a Chaired position is likely to be filled this year, in addition to replacing a retired faculty member last year. However, we lost
one faculty member this year, so that the net increase will be only one, with 11 total faculty.

Aspirations
The faculty size is still small, and our faculty are stretched. Long-term goal is to reach the average faculty size (14.91) of Chem. Eng. departments ranked by NRC in 2nd quarter.

• **First year:** We have added a new first-year course this year to introduce CM majors and others interested to chemical engineering. A CM faculty member is also an insight advisor. The AIChE chapter is becoming more active to provide a greater sense of community.

Aspirations
It is hoped that this course would positively influence our image on campus and, hence, enrollment and introduce those interested to the discipline early on.

• **Curriculum improvements:** The major improvement in the UG program has been the introduction of the spiral curriculum at the sophomore level following a careful study for which 3 CM faculty received the Corcoran award. New recent courses at the UG and graduate levels to maintain contemporary curriculum include: CM 321X Introduction to Biochemical Engineering; CM 580 Transformation and Transport in Environment; CM 580 Fuel Cell Technology. Experiments have been added in some UG courses. The format of the PhD Qualifying Exam has been improved.

Aspirations
More experiments need to be added in some UG courses. Our discipline seems to be at cross-roads, with job opportunities shrinking in traditional areas and growing in others. What impact this has on curriculum needs to be carefully evaluated and implemented.

• **IQP quality:** A number of CM faculty are involved as director or advisor at off-campus project centers including at Venice, London, Washington, and Hong Kong.

Aspirations
CM faculty need to be more involved with on-campus IQPs. We would also like to develop a plan for working on humanitarian projects in less developed countries.

- **Learning outcomes:** By virtue of ABET 2000, a program has been designed and implemented to evaluate student accomplishments vis-à-vis our stated program outcomes.

**Aspirations**
A plan needs to be developed for outcomes assessment to be done on a continuing basis.

**Objective 1.2**  
**Develop aligned incentives for faculty and staff to promote action plans.**

**Performance:**

- **Faculty diversity:** For a short while, 3 out of the 10 faculty were women. With the departure of one female faculty, we are left with only 2.

**Aspirations**
The issue of diversity in faculty hiring continues to be important.

- **Faculty and staff salaries:** Significant raises in the past few years have made the CM faculty salaries more competitive, but they are still short of those at peer institutions. We have been able to offer competitive salary and start-up packages to new faculty and have successfully hired 2 outstanding young faculty, one of whom received the NSF CAREER award. An exceptional Chaired professor (NAE member) is currently being recruited. However, staff salaries are unattractive, and have caused us great difficulty in filling those positions.

**Aspirations**
Hopefully, progress will continue to be made on faculty salaries, and staff salaries will also be accorded serious attention.

- **Employee satisfaction:** The morale among faculty, graduate assistants, and staff is believed to be generally very good.

**Aspirations**
This requires continuous vigilance and effort to maintain a
positive work environment.

- **Effectiveness of reward system**: The merit evaluation and reward system currently in place is believed to be effective. The faculty merit evaluation is conducted against specific performance metrics in teaching, scholarship, and service.

**Aspirations**
It is extremely important to improve merit raises for staff.

**Objective 1.3** *Provide increasing opportunities for student involvement in research.*

**Performance:**
- **UGs in summer research**: There are very few UG students involved in summer research, although the new UG Summer fellowships program helps. We applied for NSF-REU funding but were unsuccessful.

**Aspirations**
We should begin to get UGs involved in labs starting at the sophomore level, and not wait until their MQP in senior year. A combined BS/MS program should be promoted. Should reapply for REU program.

- **Graduate fellowships**: We have made an effort more recently to utilize the graduate fellowship (Institute, Goddard, GM) opportunities available in recruiting students with good results. We have also solicited two fellowships (Dr, Yoo fellowships) for 3 years from an alumnus ($90 K total). We campaigned for and are grateful for tuition support now offered by WPI to PhD students on fully-funded grants.

**Aspirations**
The fellowship stipends are not competitive and should be raised. This year all fellowship awardees declined our offer. The procedure of asking the students to apply for fellowships is also unnecessary. They should be considered automatically.

**Objective 1.4** *Maintain contemporary teaching laboratories.*

**Performance:**
- **Equipment and instrumentation renewal**: Our UO Lab, although with much equipment that is aging, is well-maintained, thanks to an excellent lab manager. The Provost
has provided adequate capital funding for this as well. Safety issues (hoods, neutralization system) in it have been addressed. The UG computers were upgraded last year, with department funds, however.

**Aspirations**
This needs constant vigilance. We would also like to develop new Process Control Lab experiments.

### Table 2-5. Goal 2: Further WPI's Position as a National University

<table>
<thead>
<tr>
<th>Outcome Objectives</th>
<th>Performance Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Improve the quality and diversity of the student body.</td>
<td>Admissions parameters; undergraduate geographic composition; distribution of majors; number applications from independent high schools; percentage minorities and women; percentage of students receiving financial aid.</td>
<td>Admissions Office; Director, Financial Aid; Assistant VP Student Affairs.</td>
</tr>
<tr>
<td>2.2 Support the faculty's efforts in research and scholarship.</td>
<td>Impact of thrust areas on faculty and graduate student recruiting; annual research expenditures; number proposals and awards; number publications; faculty and graduate student support levels; AACSB accreditation status; average course load for faculty; minimum and mean GRE scores; annual number Ph.D. graduates; number full time graduate students; annual research expenditures per faculty member; amount of Indirect Costs recovered.</td>
<td>Associate Provost; Thrust Area Directors; Academic Department Heads; Director, Plant Services.</td>
</tr>
<tr>
<td>2.3 Develop creative partnerships with industry, organizations, and other universities.</td>
<td>Number of partnerships; value added; statistics associated with Silicon Valley center and other new ventures.</td>
<td>Provost Office; Dean, Division of Continuing Studies; VP University Relations.</td>
</tr>
<tr>
<td>2.4 Continue to develop a</td>
<td>Student participation in humanities and</td>
<td>Provost's Office;</td>
</tr>
</tbody>
</table>
### Objective 2.1

**Performance:**

- **UG students**: The quality and diversity (% women) of our UGs is good, but the enrollment has declined by 50% following national trends plus local increased competition from CS, BME, and BB. In an effort to reverse this, we have greatly improved our Open House presentation, and have introduced a freshman course on Introduction to Chemical Engineering.

**Aspirations**

Our discipline suffers from a lack of attractive, high-tech, image of a profession that addresses crucial societal issues, e.g., pollution reduction, renewable energy, and biotechnology. Further, it is perceived by students to be a hard major with unreasonable work expectations. Retention at the sophomore level is also a serious issue that needs to be addressed immediately.

- **Graduate students**: At the graduate level, we have been more successful in improving the quality, diversity, and size of student body. The size is approaching about 30 full-time
students, 2/3rds of whom are PhD. We have been able to accomplish this by developing direct linkages to selected international schools.

Aspirations
We plan on increasing the graduate program to 40 full-time students. We plan to develop relationships with NE schools and University of Puerto Rico (UPRM) for recruitment of more US graduate students.

Objective 2.2 Support the faculty's efforts in research and scholarship.
Performance:

- Faculty and graduate student support: As mentioned above, even with the anticipated addition of a Chair, the faculty size of 11 is too small and the faculty resources are stretched. Even though the average annual teaching load per faculty is 3, with MQP and graduate student advising and our active IGSD involvement, this is still too high. Sabbatical leaves encouraged for professional development further exacerbate this.

- The financial resources of department are inadequate to support all TAs over the summer, which is crucial to attracting good graduate students. However, we did institute a largely successful program for rotating TAships every two years to encourage external support for senior students and increase number of RAs. We need to resecure a TA line lost last year due to low UG enrollment.

- Thanks to substantial university support, many of the laboratories (GH 017, GH 018, GH023, GH 116, GH 217, GH 218, GH 222, OH 014, OH 015, and OH 017) in the department have been partially or fully renovated and the general quality of laboratory space is improved dramatically. Further, some new lab space (~1,500 sq. ft.) has been added to the department (OH014, OH015, GH217). Machine and Electronics shops have been improved, and an SEM added to department facilities.

- The RDC seed grants is a good start at the university level, but the resources provided are modest.
Aspirations

- We hope to be allowed this year to replace the faculty member who left recently, and grow by another 2 faculty over the next couple of years to reduce teaching loads further, to reduce dependence on adjuncts, and to allow sabbaticals. The recent cuts in department operating budget need to be restored for adequate faculty travel and other support. Giving from industry and alumni to department needs to be increased. Research incentive returns to productive faculty need to be increased, e.g., greater proportion of indirect costs plus department contribution to their development account. WPI needs to provide better support for protection and exploitation of faculty and student IP.

- Despite renovations and some modest growth in lab space, the space remains woefully inadequate. We long to acquire more laboratory and office space, although the best prospects so far seem to be through the Biotech Institute.

- We also need funding to maintain the SEM and XRD owned by the department.

- **Research support:** The grant proposal activity has increased considerably in recent years, as has the department funding. The average annual funding is now at around $130K/faculty.

Aspirations

The funding level needs to be further increased to be commensurate with that of schools in the NRC 2nd quarter.

- **Scholarly productivity:** The average annual productivity figures are around 3 journal publications and 5 conference presentations/faculty, and

Aspirations

This also needs to be higher to be commensurate with that of schools in the NRC 2nd quarter.

- **Graduate program:** Our program is approaching roughly 30 full-time fully supported graduate students, with roughly
2/3rds in the PhD program. The 9-5 work culture earlier prevalent among graduate students has changed, and our graduate program is on its way to becoming a strong program. CM PhDs have received the Sigma Xi award for research excellence the last two years. Last year we graduated 3 PhDs, while this year it is 4.

Aspirations
It is our objective to be a premiere program in the NE, ranked only behind MIT, and of a quality equivalent of UMASS, Amherst, and those programs in NRC 2nd quarter. Our graduate student stipends are uncompetitive and need to be raised substantially. We plan on graduating 0.4-0.5 PhDs/faculty/year, in accordance with characteristics of schools in NRC 2nd quarter, or 5 PhDs/year with current faculty size.

We would like to develop a distinctive PhD program (an IGERT proposal has been submitted) with themes adapted from the WPI UG model including co-advisors from other disciplines and industry, an industrial internship, and Advisor Apprenticeship at a WPI international project site.

Objective 2.3 Develop creative partnerships with industry, organizations, and other universities.

Performance:
- Universities: For recruitment of high quality graduate students, we have developed ties with selected students in France, Jordan, India, and China. A particularly creative partnership in its 2nd year is with ENSIC, Nancy, France, where we have signed an exchange agreement for getting 2-3 graduate students/year from ENSIC, in exchange for 2-3 MQP projects there.

Aspirations
We would like to develop a relationship similar to that with ENSIC with the University of Puerto Rico (UPRM). We also need to develop ties with selected NE schools for graduate student recruitment.

- Industry and other organizations: Our active ties with
industry are limited but growing. There currently is research funding in the department from Nuvera Fuel cells, W.L. Gore, Engelhard, Hyperion, Howmedia, UTC, and Shell. There also are a number of MQP sponsor relationships. We have started a Fuel Cell Center (FCC) and have recruited 3-4 dues paying members ($30K/y) so far. FCC is also developing ties with Mass Renewable Energy Trust (MRET), a state agency.

**Aspirations**
It is hoped that research ties with industry and especially the FCC industrial membership would grow substantially. We would also like to develop ties with process control and the biotechnology industry in NE. We need to get more industrial representation on our Advisory Board.

**Objective 2.4**  
*Continue to develop a comprehensive base of programs through aligned resource allocations.*

**Performance:**
- *Review of academic programs:* While both our UG and graduate programs are of excellent quality, we need to evaluate them regularly. **Aspirations**  
  We would like to improve the external perception of our programs and continue innovativeness at both the UG and graduate levels.

- *Alumni relations:* We have a large number of successful and interested alumni, with whom we have only a limited relationship. A successful initiative was the start of the Bob Wagner fund, kicked-off at an event last Fall, attended by 130 alumni. The fund has successfully raised $250K for student development activities.

**Aspirations**
We need to engage our alumni better, including regular surveys for ABET evaluation of accomplishments of department objectives, satisfaction with their preparation, and suggestions for improvements. A newsletter for the department needs to be developed. Other ideas include pairing UGs with alumni mentors, and making alumni awards.

**Objective 2.5**  
*Expand opportunities for synchronous and asynchronous*
networked learning.

Performance: • We currently offer no courses in the evening or on the web and have no students involved in distance learning.

Aspirations
Even though the traditional chemical industry within driving distance is limited, there are opportunities for evening courses in developing industries, e.g., biotechnology and fuel cell technology, which we should exploit. We also need to explore web-based courses.

Objective 2.6 Conduct a comprehensive image-building and marketing effort.
Performance: • Although we have not engaged in a comprehensive and sustained image building and marketing effort, a number of steps have been taken to enhance reputation. These include hosting a Hospitality Suite at a professional meeting, development of a Department Colloquium Series, a highly successful P&G Symposium (which needs to be resurrected following loss of its benefactor from Advisory Board), active faculty participation in professional society meetings and chairing sessions, increasing faculty participation on journal editorial boards. An article on the department was also recently published in Chemical Engineering Education in addition to 2 page description in Peterson's Guide.

Aspirations
With the recent kick-off of a comprehensive and coordinated marketing effort at the university level, the department needs to follow suit. The activities should include substantially better web-page, graduate brochure, etc. We should develop hallway displays on faculty research activities.

Table 2.6 Goal 3: Establish WPI as a Leader in Global Technological Education

<table>
<thead>
<tr>
<th>Outcome Objectives</th>
<th>Performance Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Expand participation by students and faculty in the Global Perspective</td>
<td>Dollar value of scholarship fund; faculty involvement; number projects conducted at global sites; number faculty and students</td>
<td>VP University Relations; Provost's Office; Faculty Governance, Dean,</td>
</tr>
</tbody>
</table>
Objective 3.1  Expand participation by students and faculty in the Global Perspective Program.

Performance:  • The department faculty are substantially involved in the global program. Three different CM faculty have been involved as director or advisor at off-campus project centers including at Venice, London, Washington, and Hong Kong. In addition, MQPs have recently been advised at off-campus sites including Hong Kong, France, and NASA. Although no data have been gathered, it is believed that the proportion of CM students at off-campus sites is good.

Aspirations
Develop MQP opportunities at other international/off-campus sites.

Objective 3.2  Make the transition from multinational sites to a global system.

Performance:  • No current activity at the department level.

Aspirations
  o We would like to develop the following themes of our global technological education:
  o We seek to establish a program to accomplish humanitarian objectives in less developed countries through the application of appropriate technologies.
  o We would like to integrate the WPI global theme vertically into our graduate education as well, as proposed in our IGERT proposal to NSF, by including an Advisor Apprenticeship for doctoral students in the program at a WPI International Project Site, where the graduate student would advise IQP students under the tutelage of a resident faculty advisor.
### Table 27. Goal 4: Improve WPI’s Campus Culture and Community Presence

<table>
<thead>
<tr>
<th>Outcome Objectives</th>
<th>Performance Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Construct and renovate facilities to accommodate social and academic activities and solve the parking problem.</td>
<td>Funds available; adherence to construction timetable.</td>
<td>VP University Relations; VP Student Affairs; Assistant VP Student Affairs; VP Administration; Director, Plant Services.</td>
</tr>
<tr>
<td>4.2 Improve ethnic and gender diversity in our community.</td>
<td>Quality of life on campus; role and value of support groups.</td>
<td>VP Student Affairs; Assistant VP Student Affairs; Multicultural Awareness Staff Member.</td>
</tr>
<tr>
<td>4.3 Provide a safe environment for our community that fosters learning and development with appropriate alternatives to alcohol and drug abuse.</td>
<td>Safety statistics; number violations of alcohol and drug policies; results of CORE Alcohol and Other Drug National Survey; results from Higher Education Research Institute National Survey.</td>
<td>Director Public Safety; Campus Safety Officer; Assistant VP Student Affairs; Healthy Alternatives Office.</td>
</tr>
<tr>
<td>4.4 Expand efforts to meet the needs of adult learners.</td>
<td>Net revenue; numbers of faculty and students involved.</td>
<td>Dean, Division of Continuing Studies; Director, ADLN; Academic Department Heads.</td>
</tr>
<tr>
<td>4.5 Enhance the Career Development Center.</td>
<td>Number students and employers involved; placement rates; number of alumni participating.</td>
<td>Director, Career Development Center; VP Student Affairs; VP University Relations.</td>
</tr>
<tr>
<td>4.6 Maintain facilities and surrounding peripheral properties according to master plan.</td>
<td>Progress against maintenance plan; deferred maintenance balance; state of grounds and facilities; neighborhood</td>
<td>Director, Physical Plant.</td>
</tr>
<tr>
<td>Objective</td>
<td>Description</td>
<td>Performance</td>
</tr>
<tr>
<td>-----------</td>
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<td>-------------</td>
</tr>
<tr>
<td>4.1</td>
<td>Construct and renovate facilities to accommodate social and academic activities and solve the parking problem.</td>
<td>None.</td>
</tr>
<tr>
<td>4.2</td>
<td>Improve ethnic and gender diversity in our community.</td>
<td>None.</td>
</tr>
<tr>
<td>4.3</td>
<td>Provide a safe environment for our community that fosters learning and development with appropriate alternatives to alcohol and drug abuse.</td>
<td>None.</td>
</tr>
<tr>
<td>4.4</td>
<td>Expand efforts to meet the needs of adult learners.</td>
<td>None.</td>
</tr>
<tr>
<td>4.5</td>
<td>Enhance the Career Development Center.</td>
<td>None.</td>
</tr>
<tr>
<td>4.6</td>
<td>Maintain facilities and surrounding peripheral properties according to master plan.</td>
<td>None.</td>
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</tbody>
</table>
Objective 4.7  
**Enhance support for K-12 system and the local community.**

**Performance:** None.

<table>
<thead>
<tr>
<th>Outcome Objectives</th>
<th>Performance Measures</th>
<th>Responsible Parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Improve library resources, services, and facilities</td>
<td>Relocation of Mass Academy; library budget constraints; number projects involving digital library; off-campus usage statistics.</td>
<td>Associate Provost; Director, Gordon Library; VP University Relations; Director, Plant Services; Faculty Governance; VP Information Technology.</td>
</tr>
<tr>
<td>5.2 Establish state-of-the-art computing resources and network performance</td>
<td>Network capacity; internet usage statistics; modes of off-campus access; state of computer laboratories and central servers.</td>
<td>VP Information Technology; VP University Relations; Provost's Office.</td>
</tr>
<tr>
<td>5.3 Create and maintain sufficient electronic classrooms to support on- and off-campus programs.</td>
<td>Usage rate of IT in classes; state of electronic classrooms; notebook computer usage rates.</td>
<td>Director Plant Services; Director, Instructional Media Center; Provost's Office; Director, CEDTA.</td>
</tr>
</tbody>
</table>

The CM department has little direct role in the accomplishments of Goals 4 and 5, except indirectly through our contributions in maintaining ethnic and gender diversity in the community, fostering an atmosphere within the department that is conducive to learning and scholarship, some involvement in high schools, and maintaining good educational and research facilities within the department. These goals are very important to us.

**Objective 5.1**  
**Improve library resources, services, and facilities.**

**Performance:** None.

**Objective 5.2**  
**Establish state-of-the-art computing resources and network performance.**
Objective 5.3  Create and maintain sufficient electronic classrooms to support on- and off-campus programs.

Performance:  None.