

Strategic Plans

for

Mining Engineering

and

Nuclear Engineering

at UMR

Present to Fall Semester 2010

Executive Summary

The Departments of Mining Engineering and Nuclear Engineering were merged into an administrative department on July 1, 2004. In agreeing to important principles of operation, the faculty of each former department sought to establish the new department such that the joint faculty will strongly and fairly support the individual programs, nurture common programmatic and research areas, and respect the differences between the disciplines.

Over the past two years, trust among the faculty was built, mutual respect was manifested, and tremendous growth was achieved in both disciplines' programs. Significantly, no operational conflicts were realized, while the two programs largely developed based on individual efforts, but also sought the common areas upon which future collaborative efforts could evolve. The state of the union is excellent in all aspects.

The Accreditation Board for Engineering and Technology (ABET), through its Engineering Accreditation Commission, accredited the Mining Engineering and the Nuclear Engineering bachelor of science programs individually. ABET seeks from each accredited program the following discipline-specific items:

- A mission statement,
- Educational objectives, and
- Outcomes for graduates.

ABET evaluates the effectiveness of a program and its faculty in seeking continuous improvement of its curriculum through systematic assessment of achievement of educational objectives and assessment of program outcomes. Relating to the ABET-accredited separate curricula, there are no mining engineering courses taken by undergraduate nuclear engineering students, and vice versa. The mission, educational objectives, and outcomes sought for graduates are discipline-specific as well. Thus it also makes sense to pursue program-based strategic initiatives. Congruently, each discipline has formulated a vision and set of values that relate to unique missions. Therefore, two separate strategic plans are presented in the following pages.

In the future, there will likely be graduate-level courses that may be taken by mining engineering students and nuclear engineering students. Accordingly, mention of these plans is contained in each of the two strategic plans.

Total projected student enrollment numbers for the department are given in Table 1. Undergraduate student enrollment is estimated to grow by 28.3% from 265 in FS06 to 340 in FS10, and this mirrors the strong growth realized by the two programs over the past three years. Graduate student enrollment is estimated to grow by 90% from 50 in FS06 to 95 in FS10, which will assist UMR in achieving its significant projected growth in graduate student enrollment. The distance education enrollment is projected to grow

by 52% from 25 in FS06 to 38 in FS10, which supports the UMR initiative of significantly increasing its distance education enrollment. Overall the departmental enrollment is projected to grow by 38% from 315 in FS06 to 435 in FS10. The projected growth is realistic based on current and estimated demands for mining engineers and nuclear engineers in the United States over next five to ten years, particularly as ‘baby boomers’ retire and the industries grow.

Table 1 Projected Student Enrollment Through FS10

Enrollment Classification	FS06	FS07	FS08	FS09	FS10
Freshmen	80	88	95	100	100
Upper Class Majors	185	205	220	230	240
Total Undergraduate	265	293	315	330	340
Master of Science	6	10	13	17	22
Doctor of Philosophy	19	22	26	29	35
Online Master of Engineering	25	28	32	35	38
Total Graduate	50	60	71	81	95
Total All Students**	315	353	386	411	435

Table 2 gives the number of faculty necessary to keep student major to faculty ratios at a level for effective teaching and advising, which is considered 20 to 1. The faculty projections also include considerations for new collaborative research efforts among mining and nuclear engineering faculty members and new program streams.

Table 2 Projected Faculty Growth

Status	# of Students	# of Faculty	New Faculty	Student/Faculty Ratio	UMR Comparison
Current	279	11		25.4:1	>> UMR Ratio
F06	315	13 (+2)	2	24.2:1	>> UMR Ratio
F07	353	15 (+2)	2	23.5:1	>> UMR Ratio
F08	386	16 (+1)	1	24.1:1	>> UMR Ratio
F09	411	18 (+2)	2	22.8:1	>> UMR Ratio
F10	435	20 (+2)	2	21.8:1	>> UMR Ratio

Finally, the strategic initiatives of both programs are similar and strongly linked with the UMR strategic initiatives. The Department has tremendous growth opportunities because of the current and projected supply-demand situation for its graduates, and the energy thrust in the United States will undoubtedly embrace both the coal and nuclear options.

Strategic Plan for Mining Engineering at UMR

Present to Fall Semester 2010

Introduction

The “Mining Industry of the Future” will grow in complexity in several dimensions, and it will be characterized by difficult challenges, whose solutions will require highly qualified graduates and advanced research initiatives. The expanding markets in Asia, Africa and South America have extended the growing demand for highly qualified graduates, and this demand will continue. Mining companies of the future will put resources in select universities with strong Mining Engineering Programs for their annual graduate requirements. UMR must therefore position itself at the frontier of Mining Engineering education and research to attract investments into its scholarly activities. *The “State of Excellence” that should guide a collective effort, in a strategic plan, must therefore focus on excellence in undergraduate and graduate education and research, availability of resources and facilities, and strong networks of alumni and partners.*

The Mining Engineering Strategic Plan complements the UMR Strategic Plan. This strategic plan is forward-looking and ambitious through FS10. The plan comprises 5 Strategic Initiatives, 20 Objectives and 50 Actions, with a vision for attaining global leadership in Mining Engineering education and research. Enrollment goals show considerable reach, anticipating about 40% increase in undergraduate and 70% increase in graduate enrollments, and 50% increase in overall enrollment by FS10. The strategic plan reflects considerable reach, and aspires for program pre-eminence in the U.S. and the global community among Mining Engineering degree programs.

Mission

The Mining Engineering Programs at UMR will continue to provide superb education and training to undergraduate and graduate students in mining engineering for the mining and construction industries of Missouri, U.S. and those global mining companies with strategic interests in the U.S. To this end, UMR will maintain outstanding faculty, experimental mine facilities, intensive explosive engineering programs, waterjet research facilities, program emphases (explosives, health and safety, coal, sustainable development environment, and quarrying), teaching laboratories, strong industry and alumni networks, and a very supportive administration. The programs will provide students with total quality education and research capabilities. From its humble beginnings in 1870, UMR has continued its tradition of excellence in educating Mining Engineers, who make a difference in industry and society, with scientific, technological and practical knowledge, leadership skills and professional ethics.

Vision

UMR will be recognized as a global leader in Mining Engineering research and education.

Core Values

The drive towards this global leadership will be achieved through a seven-component set of fundamental core values that form the basis of UMR’s tradition of excellence in Mining Engineering education and research. While adopting UMR values that embrace excellence, entrepreneurial spirit, respect, integrity, recognition and collaboration, these program-specific core values include:

***Excellence:** The efforts of faculty and staff and the network of established alumni, industry and related organizations create an environment that promotes excellence in teaching and research.*

Hands-on Experience: Through its experimental mining facilities, summer employment, cooperative education and field trips, mining engineering students at UMR receive hands-on experience, which is vital to the practice of the mining engineering profession.

Depth and Quality: UMR prides itself with depth and quality in its Mining Engineering education, a testimony borne by the performance and leadership of its alumni and the mining industry.

Hard Work: One of the defining attributes of UMR students in Mining Engineering is hard work. This attribute is attained in the classroom, on the field and in various intercollegiate competitions, where our students continue to distinguish themselves as champions.

Leadership: Leadership is ingrained in the students throughout their education at UMR. Mining Engineering students are given opportunities to lead various societies, such as, SME, NSSGA, WIM, and ISEE and competitions like the mine design, mucking and mine rescue competitions.

Unique Education: The availability of the experimental mine, intensive explosive engineering programs, the rock mechanics and explosive research facility, industrial training opportunities, attendance of conferences, and a supportive environment provides an excellent opportunity for students to obtain a unique education in Mining Engineering at UMR.

Outreach: Through its Development Board of industry executives, strong networks of alumni, research and professional societies, UMR Mining Engineering reaches out to global frontiers.

Strategic Initiatives

In the pursuit of excellence and global leadership in Mining Engineering education and research, the following strategic initiatives will provide impetus as guiding principles, as coupled with UMR strategic initiatives.

- 1. Maintaining UMR at the frontiers of Mining Engineering Education and Research:** The faculty and staff and the network of partners and alumni will pursue initiatives that will maintain and strengthen UMR's Mining Engineering as a top program of choice in US and the world.
- 2. Expanding the Depth and Quality of the Undergraduate and Graduate Experience at UMR:** UMR will provide well-diversified Mining Engineering programs for industry needs. Mining Engineering students will be exposed to research to produce both engineers with knowledge of the future and graduate students motivated to create that future. Currency shall be maintained in technology and its application in the core curricula.
- 3. Maintaining Quality and Broadening the Research Enterprise in Mining Engineering at UMR:** The mining faculty will continue to develop a strong group with individual distinction. The research activities in the Rock Mechanics and Explosive Research Center (RMERC) will be expanded and a new research center established to drive research in all other areas. The mining faculty will play a leading role in the emerging energy research at UMR, as well as work towards the establishment of a well-funded UMR – NSF – Industry Research Consortium.
- 4. Creating the Resources and Facilities for Expanding Research and Education in Mining Engineering:** As the mining program grows, additional faculty will be added to ensure efficiency and excellence. The Faculty will work towards establishing additional endowed chair/industry professorships with industry assistance, as well as an endowed fund for supporting teaching, research, administrative and student activities.
- 5. Maintaining and Enhancing our National and Global Alliances and Partnerships:** UMR will develop a well-diversified online Master of Engineering program in Mining Engineering. UMR will grow stronger networks of its Mining Engineering alumni and partners in Asia (China), Africa (Botswana and Ghana), Australia and South America (Brazil and Peru).

Strategic Initiative 1: Maintaining UMR at the frontiers of Mining Engineering Education and Research

The mining faculty and staff and the network of partners and alumni will pursue initiatives that will maintain and strengthen UMR’s Mining Engineering as a top program of choice in US and the world.

Objective 1.1: *Maintain and strengthen UMR’s Mining Engineering as a top program of choice in the US.*

(UMR Strategic Initiatives 1: Balancing the Academic Portfolio)

(UMR Strategic Initiative 2: Aggressively Increasing Enrollment)

- Action 1.1a: Continue to prepare students to meet challenges in industry and academia.
- Action 1.1b: Continue to meet ABET accreditation requirements.
- Action 1.1c: Encourage students to participate in conferences, workshops, and intercollegiate competitions.
- Action 1.1d: Ensure periodic curricula updates with industry input.
- Action 1.1e: Hire additional GAs to assist in undergraduate teaching.
- Action 1.1f: Increase enrollment in the undergraduate program by about 40% and graduate program by 70%.

Table 1 Projected Student Enrollment Through FS10

Enrollment Classification	Mar 06	FS06	FS07	FS08	FS09	FS10
Freshmen	33	35	38	40	40	40
Upper Class Majors	75	85	95	100	105	110
Total Undergraduate	108	120	133	140	145	150
Master of Science	1	2	2	3	5	7
Doctor of Philosophy	13	13	15	18	20	25
Online Master of Engineering	24	25	28	32	35	38
Total Graduate	38	40	45	53	60	70
Total All Students**	146	160	178	193	205	220

Objective 1.2: *Provide well-diversified mining engineering programs for industry.*

(UMR Strategic Initiative 1: Balancing the Academic Portfolio)

- Action 1.2a: Develop emphases in computer-aided mine planning, ore reserve estimation and mineral/coal processing.
- Action 1.2b: Expand the undergraduate program to include advanced streams.

Table 2 Normal and Advanced Streams in the Undergraduate Program

Streams	Description	Duration (Yrs)	Cum GPA
Normal	B.S. in Mining Engineering (+ Emphasis)	4.0	
Advanced Professional	B.S./M.E. in Mining Engineering	5.0	≥ 2.75
Advanced Research	B.S./M.S. in Mining Engineering	5.5	≥ 3.00
Advanced Managerial	B.S./M.B.A. in Mining Engineering	5.0	≥ 2.75

Objective 1.3: *Introduce the M.S. in Explosive Engineering by FS07.*

(UMR Strategic Initiative 1: Balancing the Academic Portfolio)

- Action 1.3a: Add additional faculty to the Explosive Engineering Program.
- Action 1.3b: Add one GA to assist the teaching requirements of the Explosive Engineering courses.

Objective 1.4: *Expand the Online M.E in Mining Engineering Program.*
(UMR Strategic Initiative 1: Balancing the Academic Portfolio)

- Action 1.4a: Attain 50% expansion in the online ME Program by FS10 (see Table 1).
- Action 1.4b: Market the online ME Program aggressively to industry through brochures and adverts in professional magazines.

Strategic Initiative 2: Expanding the Depth and Quality of the Undergraduate and Graduate Experience at UMR.

UMR will provide well-diversified mining engineering programs for industry needs. Undergraduate and graduate students will be exposed to research to produce both engineers with knowledge of the future and graduate students motivated to create that future. Currency shall be maintained in technology and application in the core curricula.

Objective 2.1: *Maintain currency in technology and application in the core curricula.*
(UMR Strategic Initiative 1: Balancing the Academic Portfolio)

- Action 2.1a Continue to introduce fundamental concepts and applications of relevant technologies into the curricula.
- Action 2.1b: Continue to interact with and invite guest lecturers from industry to make presentations on current operations.
- Action 2.1c: Continue to send students to relevant mining conferences and mine equipment and technology expositions.
- Action 2.1d: Continue to encourage undergraduate students to work in industry in the summer terms.

Objective 2.2: *Expand existing and establish new research and teaching laboratories.*
(UMR Strategic Initiative 1: Balancing the Academic Portfolio)
(UMR Strategic Initiative 3: Expanding Research Performance and Reputation)

- Action 2.2a: Expand and maintain mine ventilation, rock testing and mine design teaching laboratories.
- Action 2.2b: Establish new teaching and research laboratories in surface and underground mining methods and equipment, and mineral/coal process engineering.

Objective 2.3: *Expose students to research to produce both engineers with knowledge of the future and graduate students motivated to create that future.*
(UMR Strategic Initiative 3: Expanding Research Performance and Reputation)

- Action 2.3a: Encourage undergraduate students to participate in the UMR OURE Program.
- Action 2.3b: Continue to create opportunities for undergraduate and graduate students to work on relevant research problems within mining research facilities.
- Action 2.3c: Create opportunities for students to participate in industrial research projects.

Strategic Initiative 3: Maintaining Quality and Broadening the Research Enterprise in Mining Engineering at UMR.

The mining faculty will continue to build a strong group with individual distinction. The research activities in RMERC will be expanded and a new research center established to drive research in all other areas. The Mining Engineering faculty will play a leading role in the emerging energy research at UMR. The faculty will work towards establishing a well-funded UMR – NSF – Industry Research Consortium.

- Objective 3.1:** *Continue to build on a strong group with individual distinction.*
UMR Strategic Initiative 3: Expanding Research Performance and Reputation)
- Action 3.1a: Grow and expand individual research endeavors – graduate students, research funding, publications, and conferences.
- Objective 3.2:** *Grow and expand the RMERC research activities.*
UMR Strategic Initiative 3: Expanding Research Performance and Reputation)
- Action 3.2a: Expand research and teaching faculty with expertise in the areas under RMERC.
- Objective 3.3:** *Establish a new research center to drive research in all other areas.*
UMR Strategic Initiative 3: Expanding Research Performance and Reputation)
- Action 3.3a: Explore relevant ideas on the formation of this center.
- Action 3.3b: Establish collaborative research opportunities among the faculty whose research areas fall under this domain. These areas include: (i) mine risks and safety engineering; (ii) mine design and production systems; (iii) machinery health and longevity; (iv) excavation science and engineering; (v) mine reclamation and environment; (vi) sustainable mining; (vii) mineral/coal processing; (viii) underground mining methods; (ix) surface mining methods; (x) bulk materials handling; (xi) mining systems engineering and system optimization.
- Action 3.3c: Examine relevant areas for potential funding opportunities.
- Objective 3.4:** *Position Mining Engineering to play a leading role in the emerging energy research at UMR.*
UMR Strategic Initiative 3: Expanding Research Performance and Reputation)
- Action 3.4a: Participate in the ongoing UMR energy research deliberations.
- Action 3.4b: Identify research areas within the group that are relevant to the energy research at UMR (e.g. oil sands and oil shale extraction, coal mining and recovery, energy conversion and utilization).
- Objective 3.5:** *Work toward establishing a well-funded UMR–NSF–Industry Research Consortium.*
UMR Strategic Initiative 3: Expanding Research Performance and Reputation)
- Action 3.5a: Develop a brochure of research areas, achievements and potential benefits and distribute to industry.
- Action 3.5b: Organize a research seminar to sell the idea to industry.
- Action 3.5c: Identify NSF programs for industrial matching opportunities.
- Objective 3.6:** *Strengthen Mining-Nuclear Engineering research collaborations.*
UMR Strategic Initiative 1: Balancing the Academic Portfolio)

Action 3.6a: Expand existing collaborations between Mining and Nuclear Engineering in radioactive waste cleaning and storage, forensic tools for tagging explosives and blast-resistant barricades for nuclear power plants.

Action 3.6b: Develop new synergies in alternate energy research, environmental risks mitigation of nuclear wastes.

Strategic Initiative 4: Creating the Resources and Facilities for Expanding Research and Education in Mining Engineering.

As the mining program grows, additional faculty will be added to ensure efficiency and excellence. Additional endowed chair/industry professorships will be established with Industry assistance. An endowed fund will also be established to support teaching and research, as well as administrative and student activities.

Objective 4.1: *Attain additional faculty to match the projected growth effectively.*
UMR Strategic Initiative 1: Balancing the Academic Portfolio
UMR Strategic Initiative 3: Expanding Research Performance and Reputation

Action 4.1a: Match the UMR standard ratio of 15 students per faculty

Table 3 Projected Faculty Growth

Status	# of Students	# of Faculty	New Faculty	Student/Faculty Ratio	UMR Comparison
Current	146	7		20.86:1	>> UMR Ratio
F06	160	8 (+1)	1	20.00:1	>> UMR Ratio
F07	178	9 (+1)	1	19.78:1	>> UMR Ratio
F08	193	9 (+0)	0	21.44:1	>> UMR Ratio
F09	205	10 (+1)	1	20.50:1	>> UMR Ratio
F10	220	11 (+1)	1	20.00:1	>> UMR Ratio

Action 4.2a: Additional faculty will be required in the following priority areas of relevance to undergraduate and graduate education and research. These areas include: (i) explosives engineering; (ii) computer-aided mine design and ore reserve estimation; (iii) coal/mineral process engineering; and (iv) mechanical excavation and intelligent extraction.

Objective 4.2: *Work towards establishing additional endowed chair/industry professorships with Industry assistance.*
UMR Strategic Initiative 3: Expanding Research Performance and Reputation
UMR Strategic Initiative 5: Pursuing External Opportunities

Action 4.2a: Discuss with industry on strategic areas of interest to industry for endowed chair/industry professorship appointments.

Action 4.2b: Assemble together materials on strategic importance of such positions, required qualifications of holders and other pertinent information for creating such positions.

Objective 4.3: *Work towards establishing an endowed fund to support teaching and research, as well as, administrative and student activities.*
UMR Strategic Initiative 3: Expanding Research Performance and Reputation
UMR Strategic Initiative 5: Pursuing External Opportunities

Action 4.3a: Follow the same procedures in Actions 4.2a and 4.2b.

Strategic Initiative 5: Maintaining and Enhancing our National and Global Alliances and Partnerships.

UMR will become a leader in the maintenance and delivery of a well-diversified online ME program in Mining Engineering. UMR will build stronger networks of UMR Mining Engineering alumni and partners in Asia (China), Africa (Botswana and Ghana), Australia and South America (Brazil and Peru). The faculty will develop a yearly research bulletin for industry and research partners.

Objective 5.1: Become a leader with a well-diversified online ME program.

UMR Strategic Initiative 1: Balancing the Academic Portfolio)

UMR Strategic Initiative 5: Pursuing External Opportunities)

Action 5.1a: Conduct a survey of industry needs in terms of courses and training and match faculty expertise to these needs.

Action 5.1b: Develop new courses based on these needs and expertise.

Action 5.1c: Market the online M.E. Program aggressively using brochures and adverts in professional and technical magazines.

Objective 5.2: Build even stronger networks of UMR Mining Engineering alumni and industry Partners.

UMR Strategic Initiative 1: Balancing the Academic Portfolio)

UMR Strategic Initiative 5: Pursuing External Opportunities)

Action 5.2a: Maintain and Expand the Mining Engineering Development Board of 18 top industry executives.

Action 5.2b: Continue to provide a supportive environment for educating mining engineering students, their summer work terms and graduate employment opportunities.

Action 5.2c: Continue to stay in touch with alumni through “Mining Engineer”, a magazine for updating alumni on faculty and student progress and activities.

Action 5.2d: Continue to interact with alumni in areas of mutual benefits.

Objective 5.3: Build even stronger networks with Asia (China), Africa (Botswana and Ghana), Australia and South America (Brazil and Peru).

UMR Strategic Initiative 5: Pursuing External Opportunities)

Action 5.3a: Continue to develop the 2 + 2 academic arrangements with the University of Botswana in Gaborone, Botswana.

Action 5.3b: Continue to develop our academic exchange relationship with Curtin University of Perth, Australia, Universidade Federal Rio Grande do Sul in Brasil, Xi’an University of Science and Technology, Xi’an, Shaanxi Province and Central South University, Changsha, Hunan Province of China.

Action 5.3c: Currently exploring collaborative research opportunities with the University of Mines and Technology (UMaT), Ghana, Universidad Catholica in Lima, Peru, China University of Mining and Technology in Jiangsu Province, China University of Mining and Technology (Beijing Graduate School) and Xiangtan University of Science and Technology of China. UMR and UMaT are currently working on an Academic Exchange Program.

Objective 5.4:

***Develop a Yearly Research News for our industry and research partners.
UMR Strategic Initiative 5: Pursuing External Opportunities)***

Action 5.4a: Faculty will report summaries of research projects undertaken with funds from the research consortium to industry partners.

Action 5.4b: Yearly research seminars will also be held to dialogue with industry partners for their inputs to the subsequent year research plans.

Strategic Plan for Nuclear Engineering at UMR

Present to Fall Semester 2010

Introduction

The Nuclear Engineering (NE) program at UMR, established in 1957, offers B.S., M.S. and Ph.D. degrees in Nuclear Engineering. The NE program at UMR, along with the Nuclear Science and Engineering Institute at UMC, is designated as one of the six regional centers for Innovations in Nuclear Infrastructure and Education by the US Department of Energy. Currently, the NE program at UMR consists of four full-time faculty members, all with Ph.D. in Nuclear Engineering and extensive academic and industrial experience. Complementing our faculty are the following facilities: A 200 KW swimming pool-type reactor, commissioned in 1963, the Computer Learning Center, the Radiation Measurements Laboratory, Two-Phase Flow and Thermal-Hydraulics Laboratory, and the Nuclear Resource Center.

The demand for nuclear engineering graduates currently far exceeds the graduation rate of nuclear engineers nationwide. Increase in demand is due mainly to the increasing emphasis on pollution free electrical energy, and the fact that 75% of the nation's professional nuclear workforce will retire within 5 years. According to President Bush's Agenda, "Nuclear power should play an important role - perhaps an increasingly important role - in America's energy future. Even maintaining its 20 percent electrical generation share will require building more nuclear power plants as demand for electricity grows." Furthermore, it is anticipated that nuclear technology will also be used increasingly in the future for nuclear medicine, space exploration, and hydrogen production.

Fortunately, the enrollments in Nuclear Engineering both nationwide and at UMR are increasing dramatically. The Fall 2005 NE enrollment of 133 is expected to reach 215 by Fall 2010. In order to meet the needs of an increasing number of students and to enhance our national reputation, a Strategic Plan is presented that is commensurate with UMR's Strategic Plan.

Mission

The Nuclear Engineering Program has a primary mission to provide an outstanding and comprehensive undergraduate and graduate education in nuclear engineering. The program provides well-educated nuclear engineering professionals and leaders to Missouri and the nation, in the commercial nuclear industry, national laboratories, and the nation's defense and federal agencies. The objectives of the Bachelor of Science program are to provide each student with fundamental knowledge of nuclear engineering and related technologies, analytical and problem solving ability, ability for technical communications, professional ethics, leadership and interpersonal skills, capability to conduct research, and the ability to recognize the value of and pursue life-long learning. NE graduate program provides each graduate with an in-depth knowledge in a specialized area related to current or future nuclear technologies.

Nuclear Engineering is committed to a strong engineering program administered by highly motivated and active nuclear engineering faculty. The program interacts with professional societies, and the nuclear industry to promote continuing education, research opportunities, and public dissemination of information about issues and advances in the field.

Vision

UMR will be recognized as an internationally recognized leader in Nuclear Engineering research and education.

Values

Nuclear Engineering (NE) program will pursue its vision while fostering professional ethics, accountability, excellence in teaching and research, and fairness to all. NE program is committed to:

Excellence: Faculty, staff, alumni, and industry create an environment that collectively is conducive to excellence in teaching and research as measured against national standards.

Integrity: Integrity is ingrained in all aspects of NE education and research. Students are apprised of their ethical and social responsibilities through seminars and the Senior Design project.

Comprehensive Education: In addition to receiving an in-depth technical knowledge, NE students receive a broad education including reactor operator experience, challenges associated with current and next generation nuclear reactors, and the integration of social and ethical issues associated with the development of various nuclear technologies for the benefit of society.

Outreach: NE program is committed to the enhancements in female enrollments as well as the enrollment of under-represented groups. In addition, the program actively pursues the dissemination of nuclear-related knowledge to the community at large.

Collaboration: In order to bring state-of-the-art knowledge to our students, NE program collaborates with nuclear utilities and national laboratories in the areas of summer and co-op employment and joint research opportunities.

Strategic Initiatives

1. Increasing Enrollment: NE program will increase its enrollment by increasing diversity, increasing retention, providing additional scholarships and raising appeal of the nuclear engineering profession amongst high school students nationally by means of NE summer camps.

2. Maintain Quality of NE Undergraduate and Graduate Programs: The NE program at UMR is one of the top-rated programs in the nation. The quality of the program will be maintained by continually upgrading the curriculum and laboratory facilities with input from alumni and the NE Development Board.

3. Enhancing Industry, Government and National Laboratory Partnerships: NE program will create opportunities and develop resources by partnering with nuclear industry, national laboratories, U.S. Nuclear Regulatory Commission, and U.S. Department of Energy.

4. Expanding Research Performance and Reputation: NE program will expand its research activity and performance by hiring quality faculty, rewarding research productivity and focusing on interdisciplinary collaborations which will have the largest impact on our reputation.

5. Enriching the Student Experience: NE program will promote academic excellence, diversity, teamwork, and leadership skills. To this end, NE will emphasize a state-of-the-art technical knowledge, communication skills, hands-on reactor laboratory, thermal-hydraulics laboratory and reactor operations training, interaction with nuclear industry, and a student mentoring program.

Strategic Initiatives

Strategic Initiative 1: Increasing Enrollment

NE program will increase its enrollment by increasing diversity, increasing retention, providing additional scholarships and raising appeal of the nuclear engineering profession amongst high school students nationally by means of NE summer camps.

- Objective 1.1:** Continue to increase enrollment till we reach 60 Freshmen, 130 upper class majors and 25 graduate students, as follows in the Table 1 below. (UMR Strategic Initiative 2: Aggressively Increasing Enrollment)
- Increase female undergraduates to 57 (30%)
 - Increase minority undergraduates to 19 (10%)

Table 1 Projected Student Enrollment through FS10

Enrollment Classification	FS05	FS06	FS07	FS08	FS09	FS10
Freshmen	36	45	50	55	60	60
Upper Class Majors	89	100	110	120	125	130
Total Undergraduate	125	145	160	175	185	190
Master of Science	5	4	8	10	12	15
Doctor of Philosophy	3	6	7	8	9	10
Total Graduate	8	10	15	18	21	25
Total All Students	133	155	175	193	206	215

Action 1.1 a: Recruit high caliber students for NE Summer Camp from nation’s high schools.

- Increase female students to 30% of campers.
- Increase minorities to 10% of campers.

Action 1.1 b: Recruit high-caliber African-American students from Lincoln University using funds from the current Department of Energy (DOE) grant to UMR NE program for Nuclear Engineering University Partnership.

Action 1.1 c: Recruit high-caliber African-American students from Harris-Stowe College and Normandy High Schools in St. Louis using DOE Innovations in Nuclear Infrastructure and Education (INIE) grant.

- Invite students to UMR campus for nuclear reactor tours
- Invite students to UMR campus for learning principles of radioactive decay and shielding.

Objective 1.2 **Maintain a second-to-third year retention rate of 90%.**

- Encourage and facilitate mentoring and tutoring of sophomores by upper class students.

Objective 1.3 **Conduct a reactor-based summer workshop for High School and Community College teachers (1 Continuing Education credit).**

- Reactor Operations
- Half-life experiments

Objective 1.4 **Conduct a summer workshop for High School and Community College Teachers in Radiation Measurements (1 Continuing Education credit).**

- Radio-nuclide identification
- Dose rate measurements
- Shielding of radiation.

Strategic Initiative 2: Maintain the high quality of NE Undergraduate and Graduate Programs:

The NE program at UMR is one of the top-rated programs in the nation. The quality of NE program will be maintained by continually upgrading the curriculum and laboratory facilities with input from alumni and the NE Development Board.

Objective 2.1: **Upgrading NE curriculum and courses (UMR strategic Initiative 1: Balancing the Academic Portfolio).**

- Action 2.1 a: Offer a course in radiation-based techniques for oil well logging, non-destructive testing, analysis of geological media, and environmental trace element analyses.
- Action 2.1 b: Continue to emphasize fundamental concepts and its applications in nuclear technology.
- Action 2.1 c: Modify course contents in NE curriculum using input from alumni and employers.
- Action 2.1 d: Continue to interact with industry and invite guest lecturers from industry to make presentations on current topics.
- Action 2.1 e: Continue to encourage undergraduate students to work in industry or national laboratories during the summer.

Objective 2.2 **Enhance and maintain existing research and teaching laboratories (UMR Strategic Initiative 3: Expanding Research Performance and Reputation).**

- Action 2.2 a: Maintain the teaching and research capabilities of Nuclear Reactor Laboratory.
- Action 2.2 b: Enhance and maintain the teaching and research capabilities of Two-Phase Flow and Thermal-Hydraulics Laboratory.

Action 2.2 c: Enhance and maintain the teaching and research capabilities of Radiation Measurements Laboratory.

Strategic Initiative 3. Enhancing Industry, Government and National Laboratory Partnerships: NE program will create opportunities and develop resources by partnering with nuclear industry, national laboratories, U.S. Nuclear Regulatory Commission, and U.S. Department of Energy.

Objective 3.1 Maintain existing partnership between UMR and AmerenUE. (UMR Strategic Initiative 5: Pursuing External Opportunities)

Action 3.1 a: AmerenUE provides \$60,000 per year to UMR NE to perform research on issues related Nuclear Plant Life Extension. The partnership should be maintained.

Objective 3.2 Maintain existing partnership between UMR, AmerenUE and USDOE. (UMR Strategic Initiative 5: Pursuing External Opportunities)

Action 3.2 a: AmerenUE provides \$60,000 per year to UMR NE to perform research on issues related Nuclear Plant Life Extension. USDOE matches the grant to a maximum of \$60,000 per year by a DOE/Industry Partnership grant. This partnership should be maintained.

Objective 3.3 Enhance and Maintain existing partnership between UMR and National Laboratories (Argonne, Idaho, Pacific Northwest National Laboratories). (UMR Strategic Initiative 5: Pursuing External Opportunities)

Action 3.3 a: National Laboratories have provided Graduate Research Assistantships to our graduate students in the past. This relationship should be enhanced to find new resources for supporting graduate students.

Objective 3.4 Maintain existing partnership between UMR and Lincoln University. (UMR Strategic Initiative 5: Pursuing External Opportunities)

Action 3.4 a: USDOE has provided to UMR NE \$125,000 per year to promote Minority-Majority University Partnership in Nuclear Engineering. The partnership should be maintained.

Strategic Initiative 4: Expanding Research Performance and Reputation:

NE program will expand its research activity and performance by hiring quality faculty, rewarding research productivity and focusing on interdisciplinary collaborations which will have the largest impact on our reputation.

Objective 4.1 Attain additional faculty to match the projected growth effectively. (UMR Strategic Initiative 1: Balancing Academic Portfolio) (UMR Strategic Initiative 3: Expanding Research Performance and Reputation)

Action 4.1 a: Match the UMR standard ratio of 15 students per faculty

Table 3 Projected Faculty Growth

Status	# of Students	# of Faculty	New Faculty	Student/Faculty Ratio	UMR Comparison
Current	133	4		33	>> UMR Ratio
F06	155	5 (+1)	1	31	>UMR Ratio
F07	175	6 (+1)	1	29	> UMR Ratio
F08	193	7 (+1)	1	28	> UMR Ratio
F09	206	8 (+1)	1	26	> UMR Ratio
F10	215	9 (+1)	1	24	> UMR Ratio

Additional faculty will be hired in the following priority areas of relevance to undergraduate and graduate education and research. These areas include: (i) Reactor Physics; (ii) Nuclear Fuel Cycle; (iii) Radiological Engineering; (iv) Nuclear Fusion; (v) Probabilistic Risk Assessment.

Objective 4.2: Maintain high standards in the hiring, promotion, and tenure of faculty (UMR Strategic Initiative 3: Expanding Research Performance and Reputation).

Action 4.2 a: Review tenure and promotion criteria to effectively evaluate contributions in teaching, scholarship, and service.

Objective 4.3: Perform research in areas of national need.

Action 4.3 a: Identify areas of national need and write proposals for funding by Department of Education (GAANN).

Action 4.3 b: Identify areas of interest to USDOE and write proposals for funding (NEER, NERI).

Action 4.3 c: Identify areas of interest to US Nuclear Regulatory Commission and write proposals for funding in the areas of Two-Phase Flow, Nuclear Materials.

Action 4.3 d: Identify areas of interest to Callaway Nuclear Plant and write proposals for funding in the areas of Nuclear Plant Life Extension.

Objective 4.4: Strengthen Mining-Nuclear Engineering research collaborations. (UMR Strategic Initiative 1: Balancing the Academic Portfolio)

Action 4.4 a: Expand existing collaborations between Mining and Nuclear Engineering in radioactive waste cleaning and storage, forensic tools for tagging explosives and blast-resistant barricades for nuclear power plants.

Action 4.4 b: Develop new synergies in alternate energy research, environmental risks mitigation of nuclear wastes.

Strategic Initiative 5: Enriching the Student Experience:

NE program will promote academic excellence, diversity, teamwork, and leadership skills. To this end, NE will emphasize a state-of-the-art technical knowledge, communication skills, hands-on reactor laboratory, thermal-hydraulics laboratory and reactor operations training, interaction with nuclear industry, and a student mentoring program.

Objective 5.1 Provide research experience to 75% of students

- Action 5.1 a: Increase undergraduate participation in UMR's OURE.
- Action 5.1 b: Increase student participation in authorship of technical papers at both undergraduate and graduate levels.
- Action 5.1 c: Encourage students to present their research work locally to their peers as well as at national and international conferences of American Nuclear Society (ANS).

Objective 5.2 Enrich students knowledge about current research topics

- Action 5.2 a: Encourage students to attend local as well as national professional meetings of American Nuclear Society (ANS) to enrich their technical knowledge on current and active research topics.
- Action 5.2 b: Maintain our current collaborative seminar sharing relationship using V-Brick real time net-conferencing technology. For example, seminar sharing with UMC's NE program provides additional opportunities for the students to enrich their technical knowledge on current research topics by learning from expert speakers on the UMC campus.

Objective 5.3 Provide opportunities for Peer Mentoring

- Action 5.3 a: Encourage students to hold study sessions with senior students to accelerate learning.
- Action 5.3 b: Increasing student participation as teaching assistants in Lab classes and nuclear reactor operations to enhance learning.