Proposal for a Joint Degree:

Master of Business Administration and Master of Science in Mechanical Engineering

Institution Submitting Proposal:	The University of Utah
College, School of Division affected:	The David Eccles School of Business The College of Engineering
Department(s) or Areas(s) affected:	The David Eccles School of Business and the Department of Mechanical Engineering in the College of Engineering
Change Description:	Proposal of a joint degree Master of Business Administration (MBA) and a Master of Science (M.S.) in Mechanical Engineering
Proposed Beginning Date:	Fall Semester 2009

Institutional Signatures

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Jack Brittain, Dean, David Eccles School of Business

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Richard Brown, Dean, College of Engineering

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Kent Udell, Chair, Mechanical Engineering Department

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David Chapman, Dean, Graduate School

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David Pershing, Senior Vice President, Chief Academic Officer

_____,
Michael Young, President

_____,
Date

SECTION I: The Request

The University of Utah's College of Engineering, the Mechanical Engineering Department and the David Eccles School of Business request permission to establish a joint degree program that enables students to pursue a Master of Business Administration (MBA) degree and a Master of Science (MS) in Mechanical Engineering degree simultaneously. If approved, the joint degree program would be available beginning Fall Semester 2009.

This is not a request to establish a new degree program. Rather, the intent is to take advantage of complementary elements of the two programs. The MBA/MS in Mechanical Engineering is based on the assumption that because there is intellectual benefit from studying engineering and business administration in a coordinated program, a student enrolled in the joint degree program would be able to earn both degrees in less time and with a lower overall credit requirement than were that student enrolled in each program separately. Specifically, students would take 21 credit hours in the College of Engineering, 47 hours in the College of Business and a 6 hour capstone project course taught across the Colleges. Up to 9 credit hours of courses would appear on the program of study for both degrees and listed as "courses common to the dual degree programs". This option eliminates up to 18 credit hours that would be required for completing the two programs separately. Because of this overall reduction in credit requirements for both degrees, a student enrolled in the joint MBA/MS degree program can expect to complete the two degrees in five to six semesters of full-time study. Students taking advantage of the MBA/MS program must meet current admission standards and be accepted to both the MBA and the MS program. A student enrolled in the joint degree program must complete all MBA and all MS requirements, including the Comprehensive Final Exam and a public defense of their project paper, before either degree will be awarded. In the event a student exits the joint program or does not complete the full requirements, they will have the opportunity to apply qualified course credits toward the traditional MS in Mechanical Engineering or MBA degree(s).

The joint program is designed to be an immersion in the experience of innovation and therefore completed as a full-time program requiring simultaneous and continuous enrollment in two Colleges. One possible sequence of coursework is given in Appendix A. Upon completion of both programs, the student earns two separate degrees: an MBA degree awarded by the David Eccles School of Business and an MS degree awarded by the College of Engineering, Department Mechanical Engineering.

SECTION II: Need

The purpose of an MBA/MS is to combine students' applied interests and training in Engineering with the comprehensive business training gained through an MBA program. There are complementary intellectual and professional benefits associated with studying engineering and business administration. In simple terms, engineers are trained to create and/or improve products, processes and systems. However, the ultimate relevance/usefulness of their efforts is frequently determined not by technical peers or the laws of physics or chemistry. Instead, the impact is determined and/or measured by the business environment and the judgment of the market. To conceive of, or understand some technical improvement requires deep knowledge in the relevant technical discipline in addition to the logical/conceptual approach fundamental to the engineering mindset. In the same way, to anticipate or even influence the reaction of the market to the improvement requires an integrated understanding of multiple business disciplines in addition to

the value creation approach fundamental to the business mindset. With exposure on the graduate level to the technical and the commercial, MBA/MS graduates will be, with appropriate experience, qualified to direct or manage the transition of new products, processes and systems from the laboratory to the board room. The MBA/MS program at the University of Utah will leverage extant programs and foster the development of additional resources to specifically develop professionals skilled at effectively (1) identifying technology driven solutions, (2) evaluating those solutions as potential new products or processes, (3) facilitating the rapid instantiation, commercialization and use of the new knowledge in the most appropriate manner, and (4) using awareness of the market to direct new knowledge development.

Currently, there is one joint MBA/MS Engineering program in the Intermountain West. The University of Arizona offers an MBA jointly with MS degrees in Electrical and Computer Engineering, Aerospace and Mechanical, Systems and Industrial Administration and Computer Science. Comparable programs at University of Texas, University of Illinois and University of Arizona are described in Appendix B to demonstrate that the proposed program is generally similar to other programs in terms of hours and the distribution of those hours across colleges. Note that only the University of Arizona program is targeted at the development stage of the innovation timeline.

Letters of support in Appendix C

University resources -

The University of Utah is well, if not uniquely, endowed with programs/resources required to establish an MBA/MS program of national or international repute. First, the University has well regarded, research oriented Colleges of Engineering and of Business. The colleges are led by Deans who value a joint program as a facilitator of economic growth in Utah. Dean Brittain serves the University as Vice President of Technology Venture Development (Tech Venture). Tech Ventures' purpose is to turn good ideas developed at the University of Utah, a Tier 1 research university, into good business. In the most recent year, TCO helped found twenty-three new companies based on research from the University, second only to MIT in new company formation.

The University also has extensive relations with the Utah Science Technology and Research (USTAR) economic development initiative – a $180M investment by the Utah Legislature to bolster the state's research strengths and significantly increase technology commercialization. In the last academic year, eight MBA students, primarily with engineering/technical backgrounds, had internships in USTAR and worked on projects ranging from carbon sequestration to the new nanotechnology center.

Additional opportunities for development of a notable joint degree program exist in the Pierre Lassonde Entrepreneur Center. The Center hosts two student run business plan competitions, Opportunity Quest and the nationally recognized Utah Entrepreneurship Challenge. Business plan competitions specifically address the boardroom and market dimensions of new knowledge. Closer to the laboratory, the Pierre and Claudette McKay Lassonde New Venture Development Center "assists researchers with breakthrough technologies and determines the commercialization potential of those ideas while providing students a unique educational experience in new business development". Each year the Center works with the Technology Commercialization Office (TCO)

to evaluate more than 50 top technologies from the University of Utah. Of these technologies, 8-10 close to commercialization are chosen for a year long due diligence conducted by teams of business and engineering students. Over 50% of the 21 students selected to participate in this program this year are graduate business students.

Newly founded, the James LeVoy Sorensen Center for Discovery and Innovation Studies conducts research on the earliest stages of the innovation lifecycle. The Center now hosts the Product and Service Innovation Winter Conference. In this its sixth year, the conference will draw approximately 40 internationally prominent researchers who submit research for review and collegial feedback. The Center also sponsors Tech Titans, a statewide student competition of early stage ideas and designs that draws on professional through the Wasatch Front for judging and mentoring. Last year, Tech Titians drew 107 entries from 166 students and involved 23 judges.

The Technology Venture Development program includes an educational outreach component that currently involves over 800 students per year. In addition to various competitions and structured programs offered by the Pierre Lassonde Entrepreneur Center and James LeVoy Sorenson Center for Discovery and Innovation Studies, Tech Ventures provides nearly two dozen internships focused on commercialization that range from the Intellectual Property Clinic in the law school to positions working directly with PhD qualified licensing managers.

David Eccles School of Business resources –

The David Eccles School of Business is a recognized leader in the areas of innovation and entrepreneurship business education. As noted, the school has well established relationships with other centers of innovation and commercialization on campus. Faculty conducting research in innovation, commercialization or entrepreneurship specifically include Abbie Griffin (Presidential Professor), Bill Schultz, Ming Piao, Weiyu Tsai, Glen Schmidt, Lyda Bigelow, and Bill Moore. In addition, the school has recently had searches for an Entrepreneurship Professor and the Sorensen Chair in Innovation. More generally, the opportunity for inter-college dialogue is facilitated by business faculty with engineering backgrounds including Abbie Griffith (BS Chemical, Purdue), Gerardo Okhuysen, Don Wardell (BS and MS Metallurgy, the University of Utah), Mike Lemmon (BS and MS Electrical, the University of Utah), Karl Lins (BS Petroleum, Texas A&M), Glen Schmidt (MS Engineering, Kansas State), Jeff Stratman (BS Mechanical and Aerospace, Princeton), Mike Cooper (BS Industrial and Systems Engineering, Georgia Tech), Michael Halling (MS and PhD Computer Science), Paul Hu (BS Chemical), Olivia Sheng (MS and PhD, Computer and Information Systems, Rochester) Sriram Thirumalai (BS Metallurgy, IIT Madras).

Mechanical Engineering resources -

The Department of Mechanical Engineering has an entrepreneurial history with several success spin-off companies (such as SARCOS) and a strong design legacy. By nature, mechanical engineering products tend to be innovative machines that might easily be commercialized. The success of our undergraduate senior design sequence is built on the combination of new ideas (typically generated by faculty), adherence to proper design methodology, and the availability of product realization shop.

Most Mechanical Engineering faculty have design interest including Dan Adams (Composite Materials and Solid Mechanics), Tim Ameel (heat transfer and thermodynamics), Ebbe Bamberg

(Design and Precision Machining), Don Bloswick (Design and Ergonomics), Kuan Chen (Heat Transfer and Aeronautics), Larry DeVries (Mechanics and Materials), Bruce Gale (Bio-medical and Micro-fluidics), Ian Harvey (Nano-fabrication and Micro-mechanics), Stephen Jacobson (Design and Advanced Machines), Stephen Mascaro (Design and Robotics), Sandy Meeks (Controls and Bio-mechanics), Meredith Metzger (Fluid Mechanics and Small Aircraft Aerodynamics), Mark Minor (Robotics and Controls), Eric Pardyjak (Fluid Mechanics and Sustainable Energy), Will Provancher (Design, Robotics and Haptics), Rober Roemer (Design and Bio-engineering), and Kent Udell (Heat Transfer and Sustainable Energy).

The department of Mechanical Engineering manages the product realization shop with extensive manufacturing capabilities. These shops are adjacent to the student design studio, which was created to support the hands-on activities of undergraduate and graduate students. Further, the department participates in the maintenance of the nano-fabrication laboratory, allowing the manufacture of nano-scale prototypes by students in the joint program.

Section III: Institutional Impact

It is expected that the MBA/MS will bring in an additional 5 students in the first year, 10 students in the second year and reach a steady sustainable yearly intake of 30 students within five years. There is currently capacity in both colleges to accommodate this growth near-term. The full-time MBA program currently admits 50-60 students each Fall. There exists ample capacity to accommodate projected growth near term. It is anticipated that the MBA/MS and associated programs will also increase the quality metrics of the application pools and the admitted classes.

Graduate classes in the College of Engineering can accommodate increased marginal enrollment with little logistic accommodation. It is anticipated that students will not be directly involved in or sponsored by faculty research so the increased load on faculty will be minimal.

There will be some need for the coordination of admissions and academic advising between the two programs. The Business School Masters Programs Office (MPO) will take the lead in this coordination. The College of Engineering/Mechanical Engineering Department will inform the MPO as soon as a current or prospective student indicates intent to apply for or matriculate in the joint program. The MPO will inform the COE and Mechanical Engineering Department Director of Graduate Studies whenever a current or prospective MBA student files an application to the joint program. Students applying for acceptance into the MBA/MS program must meet the admission requirements of both the Business School and the Department of Mechanical Engineering.

The University of Utah has sufficient lab facilities to accommodate the new program and near-term growth. No additional library resources are anticipated.

Near-term we project no new tenure track faculty will be required. The departments have sufficient coverage in content[1] so that only two new courses will need to be developed. Described below, the new

[1] Business courses suitable to students in the joint program(s) include: FIN 6300 Venture Capital, FIN 6881 Managing the Venture process, MKT 6860 Marketing Research, MGT 6810 Entrepreneurship, MGT 6830 Entrepreneurial Consulting, MGT 6860 Lassonde, MGT 6910 Management of Technological Innovation, FIN 6310 Advanced Venture Capital, MGT 6710 Strategy and Technology, MGT 6820 Building the Entrepreneurial Venture, MKT 6715 Entrepreneurial Marketing, MKT 6910 Entrepreneurial Internet Marketing, and Independent Study Courses.

courses can be staffed with current faculty, or with adjuncts readily available from the University of Utah's network of researchers, innovators, and entrepreneurs.

Students will experience the interplay of engineering and business in early stage product/process development through a year-long, 6 credit hour (3 CH Fall, 3 CH Spring), capstone course. The course will require students, individually or in small groups, to identify and understand some "new knowledge" originating in engineering or allied disciplines as precursor to a thorough and disciplined evaluation of its economic viability as instantiated in a new product or process. This interdisciplinary course will be jointly developed and delivered by engineering and business faculty. Involvement of University centers in such a course is yet to be determined but expected to be high. A description of the capstone course is in Appendix D.

In addition to the 6 hour capstone course described above, the MBA/MS and other MBA/Masters of Engineering programs may require the development and delivery of a 3 hour Design course. The course would be open to graduate business and engineering students with appropriate technical backgrounds. A description of the Design course is in Appendix E.

Section IV: Finances:

In the short run, the departments and colleges have capacity to handle the increased enrollments. As the MBA/MS and similar programs grow in scale and scope increased administrative (recruiting, admissions, orientation, advising, career management) and teaching loads will be offset by SCHs and productivity funding. Potential involvement of Tech Ventures or other University entities, and hence their associated costs and contributions, cannot be predicted at this time, but Tech Ventures will continue to provide internships and would like to engage students from this program.

We anticipate students will primarily be returning professionals and will pay full tuition for the program, including applicable differentials and fees. The departments and Colleges will actively pursue external funding for scholarships/assistantships. Since these graduate students will not be directly engaged in the research mission any funding for scholarships or assistantships will generally at a lower level than that of students working on sponsored research.

Appendix A – Program Structure

Business	Capstone	Engineering	
1.5		0	Summer Yr 1
13		3	Fall Yr 1
10		6	Spr Yr 1
9		*3*	*Sum Yr 2*
6	*3*	*6*	*Fall Yr 2*
7.5	*3*	*3*	*Spr Yr 2*
47	6	21	

Required Courses by semester

Summer Yr 1 – Teams (1.5)
Fall Yr 1 – Financial Accounting (3), Marketing Management (3), Managerial Economics (3), Data Analysis I (1.5), Production and Operations I (1.5), Communications (1)
Spring Yr 1 – Financial Management (3), Managerial Accounting (1.5), Information Systems (1.5), Data Analysis II (1.5), Production and Operations II (1.5), Communications (1)
Summer Yr 2 – Marketing Research (3), Design (3)
Fall Yr 2 – Strategic Management (3), Managing and Leading (3), Capstone I (3)
Spring Yr 2 –Capstone II (3)

Additional details regarding MS requirements can be found on the Mechanical Engineering web site.

By taking simultaneously taking business and engineering courses, the students will be continually exposed to business and engineering faculties, research and their peers. Pedagogically, it accentuates the integration/interaction of the two areas.

Appendix B – Comparable Joint MBA/Engineering Degree Programs[2]

The MBA/Master of Manufacturing and Decision Systems Engineering – University of Texas

Students spend their first year in the Dual Degree Program taking Engineering courses. The second year is dedicated to MBA core courses and approved business electives. The final year is a combination of courses from both departments. (The MBA Program begins in the fall semester only and all students are expected to enroll in fifteen credit hours per long semester during the academic year that is devoted to business courses.)

Students must complete at least 76 credit-hours of coursework:

- 28 hours of required MBA core courses (Note: BA 380N, a required MBA core course, is also an Engineering core course)
- 18 hours of business electives
- 6 hours of MDSE core courses
- 15 hours of MDSE "Technical Option" Courses or their pre-approved substitutes
- 6 hours of MDSE electives
- 3 hours of MDSE Master's Report (MFG 398R)

MBA/Master of Mechanical Science and Engineering* – University of Illinois

(*- also programs in Civil and Environmental, Computer Science, Electrical and Computer, Industrial and Enterprise Systems and Materials Engineering)

The Illinois MBA and the Department of Mechanical Science and Engineering (MechSE) have jointly established a program leading to a MBA/MSME degree. Students must apply for admission to both the MBA program and to the Mech E department. Students must complete a total of 92 hours of graduate coursework to obtain both degrees. The requirements for the MSME degree in this joint program are a total of 32 hours of coursework, which include 8 hours of thesis coursework. To complete the MBA degree requirements, students must complete 60 hours of coursework, which includes one concentration.

Students in the joint degree program spend their first year in the MBA curriculum, paying tuition at the MBA rate. In the second year, students take courses in Mechanical Engineering and pay tuition at the MSME rate. In the final (third) year, students take courses in both business and engineering. The degrees are awarded simultaneously upon completion of all requirements in both curricula. Students pay MBA tuition for three semesters.

MBA/MS *Science and Technology - University of Arizona**

(* - includes Computer Science, Electrical and Computer Engineering, MIS, Optics, Aerospace and Mechanical Engineering, and Systems and Industrial Engineering)

[2] Materials in this Appendix taken from university/program websites.

Year 1
Traditional MBA core courses + 1 or 2 courses that leverage professional expertise and experience.
Summer
Complete an Entrepreneurial Principles and Environments Course for credit as well as work on your Master of Science Thesis or Report.
Year 2
Electives to meet graduation requirements for both colleges + optional completion of entrepreneurship certification courses/activities. Program admission to the McGuire Center for the entrepreneurship certification is automatic.

Appendix C - Letters of Support

Appendix D – Capstone Course Description

Course content and structure developed jointly by Abbie Griffin (Marketing), Glen Schmidt (Operations), Bill Schultz (Management), Bob Hitchcock (Bioengineering), Mikhail Skliar (Chemical Engineering), Kent Udell, Eberhard Bamberg, William Provancher (Mechanical Engineering)

- **6-hour Capstone Class -** Fall and Spring semesters of the second year. Students must take both semesters of the class.
  - Fall Semester Yr 2 – Between the start of school and mid-October, students individually develop initial evaluations for one specific new technology or project idea. This can either be one of the project ideas that the students were exposed to during the summer or one of their own project ideas. Students meet twice weekly. In one session each week, they meet to compare notes and obtain advice on their evaluation process and reactions to the outputs of that process from both faculty and peers. In the second session, classroom instruction will be provided on topics including IP protection, project management, valuation, internationalization, and other topics to be determined. The week before Fall Break, students distribute their project evaluations to the faculty and their student peers, and then "pitch" their projects to move forward into development for the rest of the year. Student peers rate the projects proposals and vote for their membership preferences. Over fall break, a panel of professors and industry personnel choose some number of projects to go forward based on professional and student peer evaluations. After the break, students are assigned to teams to work on those projects.
  - Second half of Fall Semester Yr 2 through Spring Semester Yr 2 – Student teams work with their technologist, industry coaches, clinicians and professors (and TCO if locally generated) to refine the underlying IP, develop proof of concept efficacy (either physically or digitally) and select a commercialization pathway. Teams must complete and present business and marketing plans consistent with commercialization pathway.
    We expect that at least some teams will participate in Tech Titans and the Utah Entrepreneurship Challenge. Additionally, teams may present their plans to the University Venture Fund, Launch Pad or TCO for possible funding.

Minimum deliverables for the final phase of the class are: functioning prototype of the innovation, digital or physical proof of the prototype's technical efficacy, an analysis of possible commercialization paths and an N month development (technical and business/marketing) plan for the innovation.

The course has been reviewed and unanimously approved by the David Eccles School of Business Masters Curriculum Committee.

Appendix E - Design Course Description

Course content and structure developed jointly by Abbie Griffin (Marketing), Glen Schmidt (Operations), Bill Schultz (Management), Bob Hitchcock (Bioengineering), Mikhail Skliar (Chemical Engineering), Kent Udell, Eberhard Bamberg, William Provancher (Mechanical Engineering)

- **Design Course** -Summer Semester Yr 2 - A 3-hour preparatory design/build course using a common mini-project objective. Teams of 3-5 students must design and build a working ***solution*** to a common assigned ***problem***. Depending upon the problem, solutions may be a product or process. Minimally, the solution will have to be physically prototyped within a prescribed time period (summer semester). Pedagogical content will include: obtaining customer understanding, design methodology (Ulrich and Eppinger), creativity, critical problem solving, systems thinking, and economic analysis (product costing). Examples of potential problem assignments include: a solar cooker for use in underdeveloped countries, water desalinization and/or purification for underdeveloped countries, and creating a ridable paper bicycle. Concurrently, students (not as teams) are exposed to locally generated new technologies in a series of seminars organized with Technology Venture Development, TCO, USTAR and university departments.[i] Although this course is mandatory for students in the dual Engineering/MBA program, Engineering or Business graduate students with the appropriate technical background could also take the course.

The course has been reviewed and unanimously approved by the David Eccles School of Business Masters Curriculum Committee.