

New Mexico State University

PROPOSAL FOR A GRADUATE MASTER OF ENGINEERING DEGREE
TO BE OFFERED BY DEPARTMENTS OF THE COLLEGE OF
ENGINEERING (Proposed Implementation Date: Fall 2016)

Submitted by the College of Engineering

August 2016

Prepared by:

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BACKGROUND INFORMATION AND SUMMARY

The creation of a Master of Engineering (M.Eng.) degree is proposed for the purpose of developing a parallel degree path to the Master of Science which accommodates the career goals of working professionals in a variety of engineering and technical occupations. Such degrees have an advanced professional and managerial preparation focus rather than the traditional research focus of the Master of Science programs. As a result, we propose this degree as a means of recognizing the unique orientation of such professional practice students. Research-oriented students may continue to seek the Master of Science. Students whose career goals are professional practice will seek the M.Eng. degree. We believe this degree will especially be useful to those who are working throughout New Mexico. Through the various distance education technologies available to faculty, we will be able to offer this coursework-only degree across the state and potentially worldwide. Thus, practicing engineers and technical professionals will be able to earn a high-quality master's degree that we currently offer regardless of geographic location. Engineering is a continually evolving discipline. Thus, we anticipate that many non-traditional students will seek to earn this degree as a result of their need for continuing professional education. We also emphasize that we will be positioned to serve many NMSU Engineering alumni whose career path takes them away from the Las Cruces area.

This proposal defines the structure of the M.Eng degree and the various degree areas. It is based on the existing programs offered under the Master of Science as non-thesis degrees. We expect to begin offering this degree to those admitted for Fall 2016 and beyond. Departments may phase in the degree thereafter.

Additional rationale for creation of this degree is provided by the profession. A market for graduate education is created through advances in the profession. For some time, there have been discussions regarding the need for professional engineers to seek advanced education. The National Society of Professional Engineers recommends 30 credits past the bachelor's degree requirement for professional license registration. Thus, students who graduate with bachelor's degrees in engineering and have earned Engineer-In-Training status will need to complete this requirement. This recommendation (originally proposed by the American Society of Civil Engineers) of the master's degree or 30 graduate credits will most likely be the minimum education requirement for the professional license. Thus, we position the College of Engineering

to address this need and provide students with advanced education without the need to leave their employment or relocate.

The existing resources, faculty and collaborative relationships offer a strong foundation for the creation of a M.Eng. program across the College of Engineering. The study conducted by Education Advisory Board provides extensive rationale for this program. It is included in appendix 4 to this proposal. This proposal does not request new resources for creation of this degree. It does, however, present an alternative additional funding model that leads to marketing and acquiring additional students. This funding model will be used to manage the additional teaching and administrative loads created by offering additional sections. Approval of the degree *Master of Engineering* is requested to support the academic growth needs of the College of Engineering to meet the needs of the market. Approval of the budget strategy discussed in this proposal will result in growth opportunities for NMSU as we serve the needs of engineers and technical professionals.

A.PURPOSE OF THE PROGRAM

1. Primary purposes

The primary objectives in establishing the M.Eng. are the following:

- To meet the needs of employers in New Mexico by providing advanced training for engineering professionals and technical managers in the areas offered by the College of Engineering.
- To train students for careers in engineering practice.
- To meet the needs of the profession--The National Society of Professional Engineers recommends 30 credits past the bachelor's degree requirement for professional license registration—again an argument for easily-available advanced education. This recommendation is supported by the American Society of Civil Engineers (ASCE) as the master's degree or 30 graduate credits will most likely be the minimum education representing the "Body of Knowledge" in the requirement for the professional licensure in engineering in 2025. A "Body of Knowledge" is defined by ASCE as having a broad knowledge base and combination of skills to practice successfully as a professional engineer. This knowledge and these skills may be found in the publication Civil Engineering Body of Knowledge for the 21st Century, Second Edition.
- create a degree that may be offered through distance learning technologies thus serving working professionals who need access while continuing their careers.
- To promote interdisciplinary collaboration among faculty from different departments.

2. Consistency with Role and Scope of NMSU

The development of the Master of Engineering degree is consistent with the land grant role and mission of New Mexico State University. As a Hispanic-serving and Research-Extensive university, NMSU serves “the educational needs of New Mexico’s diverse population through comprehensive programs of education, research, extension education and public service.”

The program will contribute to the Mission of the College of Engineering by creating a mechanism for access for working professionals throughout the state. Through developing the professional practice orientation of the degree, we enable those who are not seeking a research career to earn a master’s degree that recognizes the more common circumstances of working as an engineer and manager.

3. Institutional Priority of the Proposed Program

The College of Engineering supports the land-grant mission of NMSU through its focus on teaching, research and service in various areas of engineering. The Master of Engineering program will create professional development opportunities for New Mexicans who work in the various fields that will be addressed through development of this program. We consider expansion of our graduate offerings to new audiences to be a priority and a relevant component of NMSU’s strategic plan Vision 2020 in Goals 1 (Academics) and 4 (Economic Development).

4. Curriculum for the Proposed Program

We plan to label the *coursework only* degrees as the Master of Engineering. The typical curriculum will consist of 30 credits in which a concentration in a department is taken for a total of 15-18 credits and 12-15 credits are taken from electives as determined by department faculty. For example, an M.Eng. with a major in Industrial Engineering might be:

In Department:

Electives:

IE	522	Queuing Systems	EE	461	Systems Engineering
IE	533	Linear Programming	MGT	503	Organizational Behavior
IE	534	Nonlinear Programming	MGT	591	Entrepreneurship

IE	535	Discrete Optimization	EE	460	Satellite Systems
IE	563	Topics in Engin. Admin	BCIS	502	Business Information Systems

B. JUSTIFICATION FOR THE PROGRAM

1. Need

This proposal addresses a split of our existing Master of Science programs into a Master of Engineering professional degree and a research-oriented (with thesis) Master of Science degree. Through creating the Master of Engineering degree, we position the College of Engineering to become a regional provider of our high-quality graduate education to working professionals who have need of advanced education while needing to maintain their current employment. Such students have limited interest in research-oriented careers but can benefit from advanced education. Thus, we believe we will better accommodate their education needs while maintaining appropriate research experiences for on-campus Master of Science thesis students. An existing example of this is the Industrial Engineering program which graduates 40-45 MS students a year. Almost all are non-thesis students. Each department in the College will be able to address the creation of an independent Master of Engineering program to meet the unique needs of their constituents and stakeholders. Departments such as Engineering Technology and Surveying Engineering or the Department of Physics's Engineering Physics option may pursue approval of new graduate options through NMSU's normal approval process as the degree title will exist.

Student Interest

Student interest in distance-based offerings is significant. Experience with the Industrial Engineering graduate program indicates that students will market the program for us. Attached is a report of potential market demand that was performed by Education Advisory Board.

2. Duplication

A program of this type exists at a number of universities around the USA. No university in the region offers such a program. We note that existing courses will be reformatted for distance delivery at the start of the program used to award this new degree.

C. CLIENTELE AND PROJECTED ENROLLMENT

1. Clientele

a) We anticipate interest in our M.Eng. program from:

-undergraduates seeking advanced education leading toward professional practice and eventual professional engineering licensure.

-regional working professionals who seek to update their skills or obtain additional knowledge .

b) Admission qualifications

-Students will be admitted based on policies as currently exist in the various departments. Typical admissions qualifications are a Bachelor's level degree in the engineering field or closely related field. Applicants will select the M. Eng. or M.S. degree option based on their interests at the time of application and will be evaluated for admissions under the same requirements. Departments will establish appropriate standards and guidance regarding degree program selection and opportunities to switch from one degree to the other.

c) Equitable (ethnic) representation – consistent with state goals; assure access and success of underrepresented.

NMSU, designated as a Hispanic-serving institution, is favorably noted for its inclusion and commitment to the Hispanic population that makes up a dominant percentage of the state's population. The university is highly ranked by professional engineering Hispanic entities such as the Society of Hispanic Professional Engineers. We will rely on this reputation as represented in pertinent recruitment venues to assure access to Hispanic and all other minorities.

2. Projected Enrollment and Student Credit Hours Generated

At the start of this program Industrial Engineering and Electrical and Computer Engineering will offer the M. Eng. to current and future students immediately. These

two departments have existing distance programs. The other departments in the College of Engineering will develop implementation strategies and phase their programs in over the next several years.

An alternative model has been developed that assumes an amount of funding will be provided to increase the marketability of this program. This model is presented below and shows that additional enrollment over the existing master's level enrollment of the college can be achieved through offering more distance sections, better instructional design and a more aggressive marketing effort.

The current typical enrollment of MS students in the College of Engineering is about 300 students. A projected enrollment increase illustration for the first five years of the program is indicated in the chart below:

Enrollment Year	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
Total Increased Head Count	25	30	30	35	40	45
Number of Student Hours Generated	300	360	360	420	480	540

D. INSTITUTIONAL READINESS

1. Teaching faculty

Our proposal draws on the existing graduate faculty of the College of Engineering. Additional adjunct or tenure-track faculty will be required in each concentration once the enrollment for that major exceeds approximately 25 additional students.

2. Sufficient library and other academic supports

The Library underwent a thorough review of materials as part of the ABET accreditation in 2012 and deemed the collection adequate to support teaching and research at that time. As no new courses are anticipated with the new M. Eng. Program, existing resources are sufficient. While many of the M. Eng. Program students will be distance students, the library already makes provisions for this population. However, the Library is concerned that if any further reductions in serials subscriptions become necessary, their ability to provide support to all engineering students will be compromised. Please see Appendix 5.

3. Physical facilities adequate for the first 5 years

No physical facilities will be added as the classes already are offered.

4. Equipment and technological resources

Equipment and classrooms are available for the start of the program.

5. Other operating resources (such as clerical support) adequate to initiate the program

Clerical support will be required to serve our on-line M.Eng students. Costs will be assumed by the College of Engineering until program revenue is sufficient.

E. PROJECTED COSTS OF THE PROGRAM

1. New Costs for Program Start-Up

The next page displays a time-phased start up model for full implementation of our program. We can start the program without funding but full implementation will require additional funds to support faculty preparation time, graduate assistant support, additional course offerings, marketing and administration.

Budget Justification:

This program is proposed to earn a revenue split of 75% of tuition to support the program and 25% to NMSU administration. In doing so, we plan to support some of the

administrative costs through existing college budgets until such time as program revenue grows to support those activities.

The Quality Matters protocol will be applied to all courses taught through this program for which a revenue split is sought.

1. Program Director: Responsible for all management, coordination and marketing of distance and part-time efforts for the college. Costs borne by College until program meets revenue support goal.
2. Admin support: Hire a .50 FTE Administrative Assistant (plus fringe benefits) to assist in program delivery, administration, applications, and outreach. Grow to full-time (1.0). Costs borne by College until program meets revenue support goal.
3. Instructional designers: Start with one instructional designer to assist faculty in designing courses for distance delivery. Housed in Engineering, instructional designers will coordinate activities with Online Course Improvement Program personnel to insure courses meet best practices such as "Quality Matters." Fringe included in fringe total row. Costs borne by College until program meets revenue support goal.
4. Graduate Assistants: Assist program faculty with grading as appropriate under NMSU policies and administration. Start at 4.0 .5 FTE (20 hours per week) and grow. Estimate \$10K/semester plus fringe benefits.
5. Faculty: Budget for adjunct and supplemental or summer compensation. Fringe (.17) included in fringe total row.
6. Fringe Benefits: as stated by line totaled across the column in #6. Fringe benefits were calculated based on established fringe rates of .35 for full-time personnel, .202 for summer and adjunct hires and .08 for graduate assistants.

Master of Engineering: Revenue versus Planned Expenses

First, estimate gross revenue per class:

Students	Per Credit	Course Del Fee	Per 3-credits	Per Class Revenue	75%		25% CDF	Add a fee (100% to CoE) of \$ per credit	
					College	Admin		0.75	0.25
1	\$ 227.10	\$ 35.00	\$ 786.30	\$ 786.30	\$ 510.98	\$ 275.33	\$ 46.50	\$ 510.98	\$ 275.33
10	\$ 227.10	\$ 35.00	\$ 786.30	\$ 7,863.00	\$ 5,109.75	\$ 2,753.25	\$ 465.00	\$ 5,109.75	\$ 2,753.25
20	\$ 227.10	\$ 35.00	\$ 908.70	\$ 18,174.00	\$ 10,219.50	\$ 5,506.50	\$ 930.00	\$ 10,219.50	\$ 5,506.50
30	\$ 227.10	\$ 35.00	\$ 908.70	\$ 27,261.00	\$ 15,329.25	\$ 8,259.75	\$ 1,395.00	\$ 15,329.25	\$ 8,259.75
40	\$ 227.10	\$ 35.00	\$ 908.70	\$ 36,348.00	\$ 20,439.00	\$ 11,013.00	\$ 1,860.00	\$ 20,439.00	\$ 11,013.00
50	\$ 227.10	\$ 35.00	\$ 908.70	\$ 45,435.00	\$ 25,548.75	\$ 13,766.25	\$ 2,325.00	\$ 25,548.75	\$ 13,766.25

Five Year Budget: Master of Engineering Rollout

	2015-6	2016-7	2017-8	2018-9	2019-20	2020-21
1. Program Director	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
2. Admin Support	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
3. Instructional design	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
4. Graduate Assistant	\$ 80,000.00	\$ 80,000.00	\$ 80,000.00	\$ 90,000.00	\$ 90,000.00	\$ 100,000.00
5. Faculty	\$ 60,000.00	\$ 90,000.00	\$ 120,000.00	\$ 120,000.00	\$ 150,000.00	\$ 150,000.00
6. Fringe Benefits Cost	\$ 12,760.00	\$ 18,820.00	\$ 24,880.00	\$ 24,960.00	\$ 31,020.00	\$ 31,100.00
Total	\$ 152,760.00	\$ 188,820.00	\$ 224,880.00	\$ 234,960.00	\$ 271,020.00	\$ 281,100.00

Assume all administrative and design costs are covered by existing Distance education budget; compensate with any overage. Assume **Quality Matters** training costs are assumed by college and departments.

Graduate assistants at \$ 10K per semester per 20 hour (.5FTE)
Assume approximately 50% of sections are taught in-load without adding grad assistants.
Uses 35% for 1-3, 0.8% for 4 and 20.2% for 5

Budget Justification is included in Master of Engineering Proposal Edit 7, revised October 2015.

	12	18	24	24	30	30
Number of Sections	12	18	24	24	30	30
Assume average size of a section =	20	20	20	20	20	20
CoE Revenue	\$ 133,794.00	\$ 200,691.00	\$ 267,588.00	\$ 267,588.00	\$ 334,485.00	\$ 334,485.00
CoE Expenses	\$ 152,760.00	\$ 188,820.00	\$ 224,880.00	\$ 234,960.00	\$ 271,020.00	\$ 281,100.00
Net Revenue	\$ (18,966.00)	\$ 11,871.00	\$ 42,708.00	\$ 32,628.00	\$ 63,465.00	\$ 53,385.00

Any positive balance is used to support budget items supported by College.

F. QUALITY OF THE PROGRAM

1. Graduate Program Plan

Admissions policies will be consistent with existing departmental admissions policies in that students must be qualified to take graduate-level engineering courses. We anticipate that admissions will be less restrictive as students will be evaluated without evaluating research potential and fit.

Students will be admitted on a rolling basis to start Fall, Spring or Summer.

Outcomes Assessment

This program will comply with the principles of academic quality delineated as part of the NMHED's regulation on instructional funding. The program will evaluate student performance, advise students regarding curricular matters, and monitor student's progress to foster their success in achieving degree requirements and program outcomes. The faculty will ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The program will provide both technical content and breadth in engineering management and systems engineering. If this proposal is approved, the department will assure that the faculty will be of sufficient number and will have the competencies to cover all of the curricular areas of the program. Sufficient faculty are currently available to accommodate adequate levels of student-faculty interaction, student advising and counseling, faculty participation in university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students. The program faculty will have appropriate qualifications and are typically full-time faculty who are members of the NMSU Graduate Faculty. As always, they will have sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program. The overall competence of the faculty may be judged by such factors as education through the doctorate, diversity of backgrounds, engineering experience, teaching effectiveness and experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as Professional Engineers and/or Professional Land Surveyors. Computing and information infrastructures will be in place to support distance delivery. Institutional support, financial resources, and constructive leadership will assure the quality and continuity of the program. Resources will be sufficient to attract, retain, and provide for the continued professional development of a well-qualified faculty. Resources will be sufficient to acquire, maintain, and operate equipment appropriate for the program. In addition,

support personnel and institutional services will be adequate to meet program needs. Metrics to assure this quality include placement into faculty positions and placement into leadership positions within the private and public sectors.

Program Administration

Administration of the Master of Engineering program will be through the individual departments of the College of Engineering under the supervision of the Associate Dean for Academics. The department will be responsible for implementing and administering the program based on the standards set forth above. In addition to advising, counseling, assessment, curriculum development and quality, and equipment procurement, the department will be responsible for all informational and advertisement documents.

2. Course Requirements

The entering student will be admitted by one of the departments of the College of Engineering. The student will be advised by regular graduate faculty and select from well-developed, existing curricula.

Courses from department of choice	15-21 credits
Electives as acceptable by program	12-15 credits
Total	30-33 credits

3. Advising

A graduate faculty member adviser will be assigned to each entering student. Policies as currently employed by the individual departments will apply on advising. Again, we anticipate most students will select the Master of Engineering option. Each department will set its graduate program criteria for students entering the MS or M. Eng program and any criteria regarding a choice to switch degree options.

4. Existing Courses at NMSU to satisfy coursework for the M. Eng.:

The Graduate Catalog currently lists the existing courses toward each of the Master of Science degree that can be taken toward the Master of Engineering. We anticipate that any new courses developed will apply toward either degree. In the appendix, the current offerings are listed for reference.

Appendices

- Appendix 1 Graduate Catalog
- Appendix 2 Letters of Support
- Appendix 3 Market Demand for Online Professional Master's Degrees in Engineering
- Appendix 4 Library

Appendix 1 Graduate Catalog

The NMSU Graduate Catalog section “College of Engineering” is incorporated by reference. <http://nmsu.smartcatalogiq.com/en/2015-2016/Graduate-Catalog/College-of-Engineering>

Appendix 2 Letters of Support

Letters of support from the various departments are included within this section.

September 9, 2015

Dr. Edward Pines
Department of Industrial Engineering
Box 30001/MSC 4230
New Mexico State University
Las Cruces, New Mexico 88003

Dear Dr. Pines,

On behalf of the New Mexico State University Chemical & Materials Engineering Department, I am writing to express support for your proposal to create a *Master of Engineering* degree. This proposed degree will enable the Chemical & Materials Engineering program to reach a wider audience of professionals by providing a practice-oriented graduate program.

The Chemical & Materials Engineering faculty believe that the availability of such a degree will benefit our students in their professional development as well as provide new opportunities for practicing engineers. Alumni of the department have explicitly requested such a program, currently are finding such opportunities elsewhere.

The Chemical & Materials Engineering Department offered CHME 102 in an online format during the summer 2015 and anticipates increasing the frequency of such offerings upon completion of the Jett Hall renovation.

This proposed program will permit the Chemical & Materials Engineering Department at NMSU to provide continuing education opportunities to alumni and practicing engineers located beyond the bounds of the NMSU campus, thus permitting the department to increase the number of engineers trained in the program without a significant increase in resources.

Sincerely,



David A. Rockstraw, Ph. D., P. E.
Robert Davis Distinguished Professor
NMSU Distinguished Achievement Professor
and Academic Department Head
Department of Chemical & Materials Engineering
New Mexico State University
Box 30001 MSC 3805
South Horseshoe Oval, JH 259
Las Cruces, New Mexico 88003



College of Engineering

(3035 Espina St.)
Department of Civil Engineering
MSC 3CE
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
575-646-3801, fax: 575-646-6049
cagesun.nmsu.edu

September 25, 2015

Dr. Edward Pines
New Mexico State University
Department of Industrial Engineering
Box 30001 / MSC 4230
Las Cruces, NM 88003

Dear Dr. Pines:

I write on behalf of the Department of Civil Engineering to support your proposal to establish a Master of Engineering degree. Such a degree will enable us to serve a diverse group of professionals by providing a practice-oriented graduate curriculum. I believe that this degree could benefit our students in their professional development and provide new opportunities for practicing engineers.

Sincerely,

A handwritten signature in black ink, appearing to read "D. Jáuregui", with a long horizontal flourish extending to the right.

David V. Jáuregui, PhD, PE
Foreman Professor and Head
NMSU Department of Civil Engineering



College of Engineering

Klipsch School of Electrical and Computer Engineering
MSC 3-0
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
575-646-3115, fax: 575-646-1435

September 27, 2015

Dear Dr. Pines:

On behalf of the Klipsch School of Electrical and Computer Engineering I write to express our support for your proposal to create a Master of Engineering degree. Such a degree will enable us to serve a wide audience of professionals by providing a practice-oriented graduate program. We believe that having such a degree available will benefit our students in their professional development as well as provide new opportunities for practicing engineers.

Our department has offered distance education/online classes to support the MSEE degree since 1996. Many of these classes will also support the ME degree. We believe the practice oriented ME degree will be well subscribed by engineering professionals employed in the Electrical and Computer Engineering industries as well as certain full-time, on campus students.

We believe that this opportunity will further contribute to the success of the Klipsch School of Electrical and Computer Engineering as we offer an opportunity to develop new knowledge and skills to practicing engineers.

Sincerely,

A handwritten signature in blue ink that reads 'S. Ranade'.

Satish J. Ranade

Department Head



New Mexico State University
Dept. of Engineering Technology and Survey Engineering
PO Box 30001, MSC 3566
Las Cruces, NM 88003-8001

Wednesday, October 21, 2015

To: Dr. Edward Pines

On behalf of the Department of Engineering Technology and Surveying Engineering, I write to express our support for your proposal to create a Master of Engineering degree. Such a degree will enable us to serve a wider audience of students and professionals by providing a graduate level engineering program which will enhance their skill sets and employment opportunities. We anticipate that our department could begin offering online graduate level coursework to support this degree in 2016.

We believe that this opportunity will further contribute to the success of the Department of Engineering Technology and Surveying Engineering, the College of Engineering, New Mexico State University, and the constituencies that we serve.

Sincerely

Professor Thomas Jenkins, Department Head
Engineering Technology and Surveying Engineering




Thomas W. Jenkins

THOMAS W. JENKINS

tjenkins@nmsu.edu
575-646-2236



College of Engineering
Department of Industrial Engineering
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New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
575-646-4923, fax: 575-646-2976
ie.nmsu.edu

Date: September 18, 2015
To: File
From: Edward Pines, Department Head 
Subject: Master of Engineering Program

This memo documents this continued support of the department faculty for the Master of Engineering program.



College of Engineering

Department of Mechanical and Aerospace Engineering
MSC 3450
New Mexico State University
P.O. Box 30001
Las Cruces, NM 88003-8001
575-646-1945, fax: 575-646-6111

December 16, 2013

Dr. Edward Pines
Department of Industrial Engineering
Box 30001/MSC 4230
New Mexico State University
Las Cruces, NM 88003

Dear Dr. Pines:

On behalf of Mechanical and Aerospace Engineering, I write to express our support for your proposal to create a Master of Engineering degree. Such a degree will enable us to serve a wide audience of professionals by providing a practice-oriented graduate program. We believe that having such a degree available will benefit our students in their professional development as well as provide new opportunities for practicing engineers.

We anticipate that our department would begin offering online classes to support this degree in the Fall 2014 Semester, although we are offering two engineering math courses asynchronously this coming spring. Additional offerings will depend on sufficient resources, including the availability of distance education facilities.

We believe that this opportunity will further contribute to the success of Mechanical and Aerospace Engineering as we offer an opportunity to develop new knowledge and skills to practicing engineers.

Sincerely,

A handwritten signature in cursive script that reads 'Ian H. Leslie'.

Ian H Leslie, Department Head

Appendix 3 Market Demand for Online Professional Master's Degrees in Engineering



Market Demand for Online Professional Master's Degrees in Engineering



Kanyin Ojo

Research Associate

Allison Thomas

Senior Research Manager

LEGAL CAVEAT

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1) Executive Overview

Key Observations

Offer a range of specializations in top areas of employer interest, such as civil and mechanical engineering, to satisfy industry demand. In addition to a standard professional master's degree in engineering, institutions offer a range of specializations in response to industry demand for graduates with niche industry knowledge. Top specialization areas at profiled programs include computer science, mechanical engineering, civil engineering, and aerospace engineering.

Incorporate business curricula to prepare graduates for industry employment. In addition to engineering skills, employers demand business competencies such as business environment skills, project management and process skills, and business intelligence skills. One institution offers a range of interdisciplinary business and engineering degree programs, such as combined degree programs and business specializations, to ensure graduates meet industry standards.

Initiate partnerships with regional technology, construction, energy, and engineering corporations to recruit prospective students to engineering master's programs. Institutions note that local corporations with interest in graduates of professional master's engineering programs approach them to serve as education providers for their employees. These employers often provide funding or reimburse tuition for employees enrolled in these programs.

Fully online professional master's programs in engineering enjoy higher enrollments than hybrid programs. Over 90 percent of students enrolled in professional master's programs at contact institutions retain employment positions while enrolled in the program. Fully online programs offer students flexibility to complete the program in accordance with their work and family schedules. Most students enroll in programs part-time and complete them in an average of three to five years.

2) Attributes of Peer and Competitor Programs

Curricular Elements

Offer Specialization to Prepare Students for Practice in Niche Industry Fields

In addition to a standard Professional Master's Degree in Engineering, institutions also offer specialization options that allow students to enroll in courses specific to their academic and professional needs. Civil engineering, computer science, mechanical engineering, and aerospace engineering prove popular among students.

Professional Master's Degree Program Offerings at Profiled Institutions

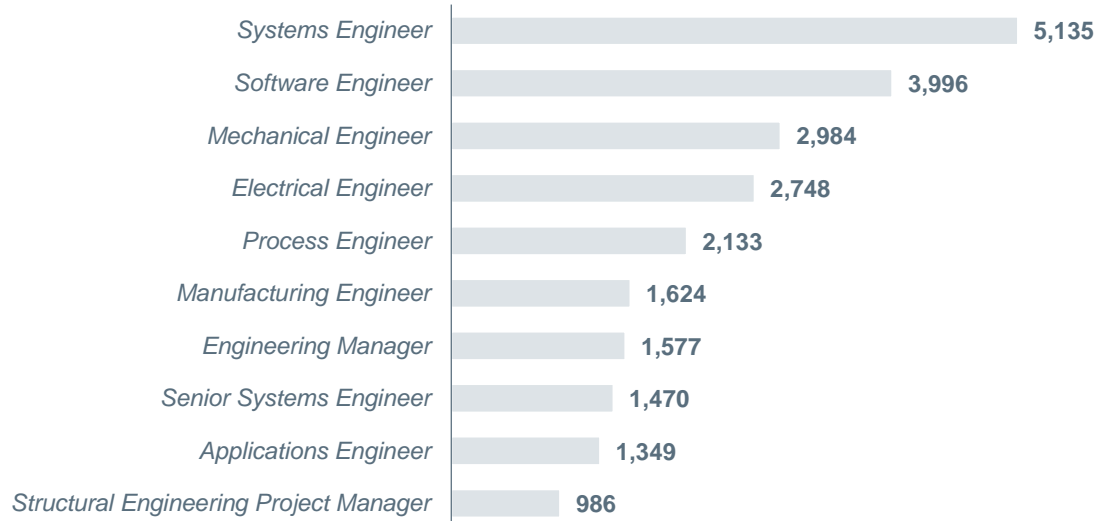
Institution	Program Offerings
North Carolina State University	<ul style="list-style-type: none"> ▪ Master of Engineering ▪ M.S. Aerospace Engineering ▪ M.S. Chemical Engineering ▪ Master of Civil Engineering ▪ M.S. Computer Networking ▪ Master of Computer Science ▪ M.S. Electrical Engineering ▪ Master of Environmental Engineering ▪ Master of Industrial Engineering ▪ Master of Integrated Manufacturing Systems Engineering ▪ Master of Materials Science and Engineering ▪ M.S. Mechanical Engineering ▪ Master of Nanoengineering ▪ Master of Nuclear Engineering
Purdue University	<ul style="list-style-type: none"> ▪ M.S. Interdisciplinary Engineering ▪ M.S. Interdisciplinary Engineering <ul style="list-style-type: none"> – Engineering Management & Leadership – Biomedical Engineering – Computation Engineering – Integrated Vehicle Systems ▪ M.S. Engineering and MBA ▪ M.S. Aeronautics and Astronautics ▪ M.S. Electrical and Computer Engineering ▪ M.S. Mechanical Engineering ▪ M.S. Industrial Engineering ▪ M.S. Computer Science
University of Alabama-Birmingham	<ul style="list-style-type: none"> ▪ Master of Engineering ▪ Master of Engineering <ul style="list-style-type: none"> – Construction Engineering Management – Advanced Safety Engineering and Management – Information Engineering and Management
University of Colorado-Boulder	<ul style="list-style-type: none"> ▪ Master of Engineering ▪ Master of Engineering <ul style="list-style-type: none"> – Aerospace Engineering Sciences – Computer Science – Electrical Engineering – Engineering Management – Telecommunications

Systems and Software Engineering Specializations Satisfy Employer Demand

Employers express the highest demand for systems engineers, software engineers, mechanical engineers, electrical engineers, and process engineers at both the national level and in the Southwest United States. The southwest region also expresses high demand for firmware engineers and network engineers. Institutions in the southwest should offer degree specializations in these technological areas to satisfy employer demand for these graduates.

Top Titles for Graduates with Professional Master's in Engineering Degrees

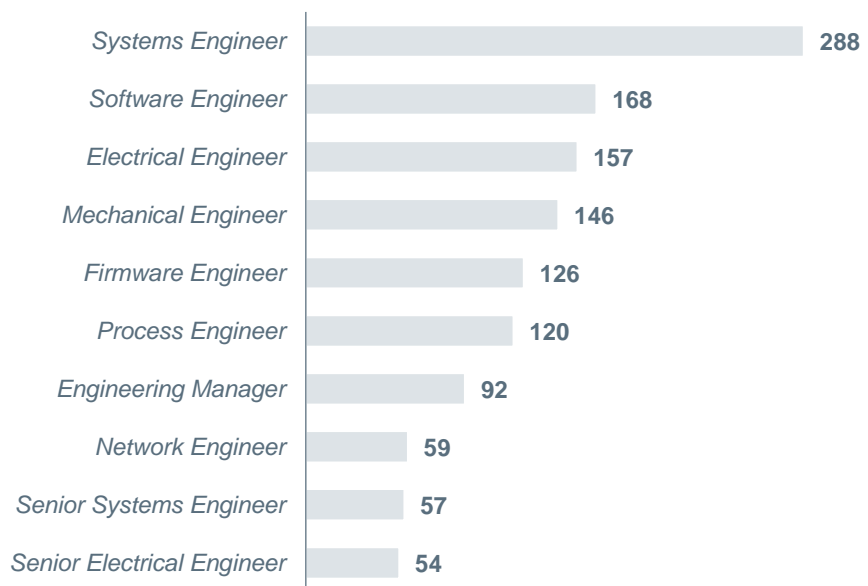
Nationally January-August 2013



n = 132,613, with 0 unspecified
Source: Burning Glass Labor/Insight™

Top Titles for Graduates with Professional Master's in Engineering Degrees

Southwest U.S. (Arizona, New Mexico, El Paso TX), January-August 2013



n = 6,640 with 0 unspecified
Source: Burning Glass Labor/Insight™

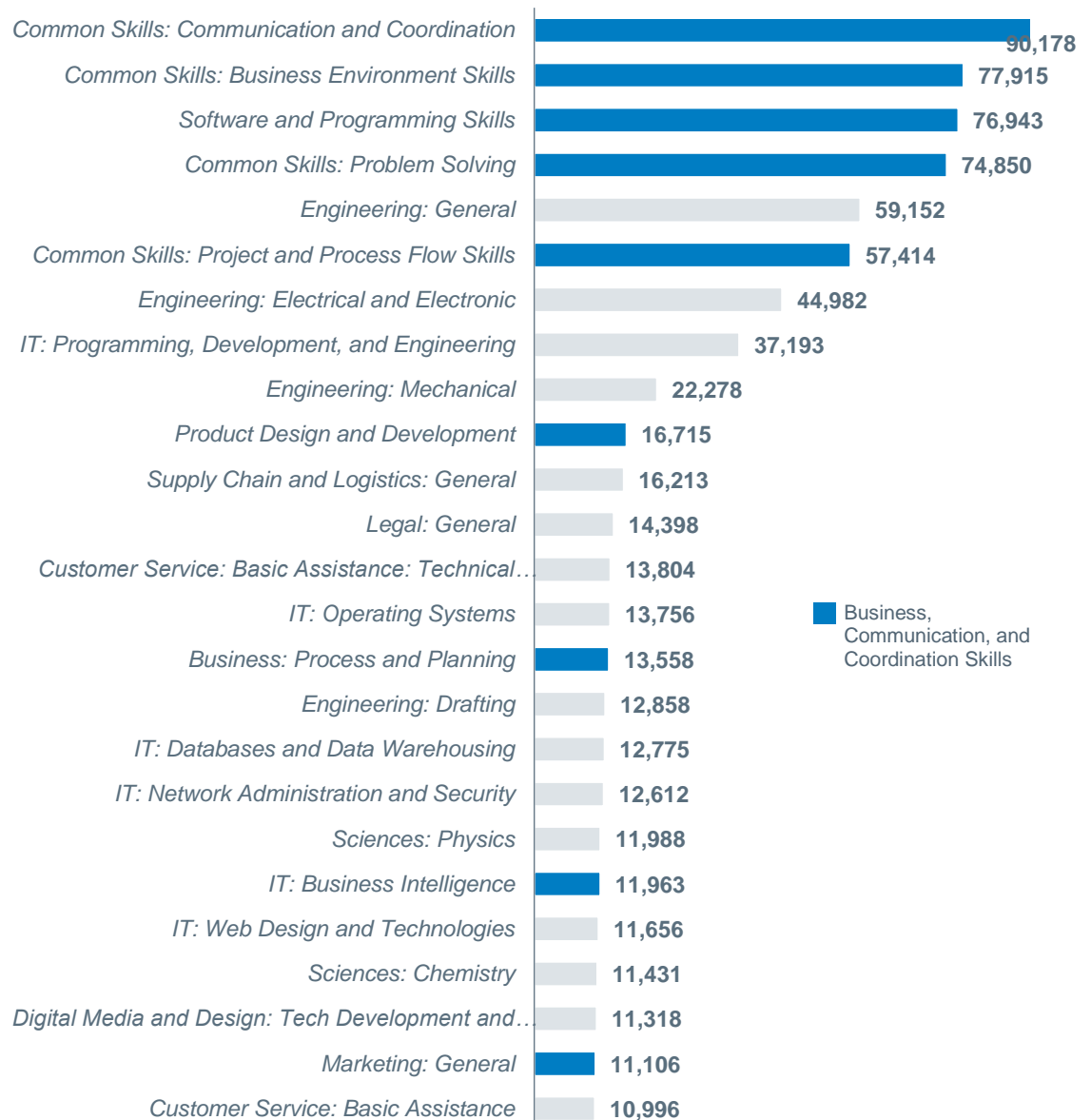
Incorporate Business and Liberal Arts Courses to Provide Graduates with Competitive Industry Advantage

Institutions establish professional master's programs to fulfill student and industry demand for the degree program. Most students possess a bachelor's degree in an engineering field and therefore already possess foundational engineering skills. In addition to more advanced engineering skills, employers interested in graduates with professional master's degrees in engineering demand communication and coordination skills, and business environment skills.

The industry advisory board for **Purdue University's** engineering department advised the development of interdisciplinary engineering specializations such as Engineering Management & Leadership, and a combined M.S. in Engineering and MBA program to satisfy industry demand for these skills.

Top Baseline Skills Employers Demand from Graduates with Professional Engineering Master's Degrees

Nationally January-August 2013



n = 132,613, with 0 unspecified
Source: Burning Glass Labor/Insight™

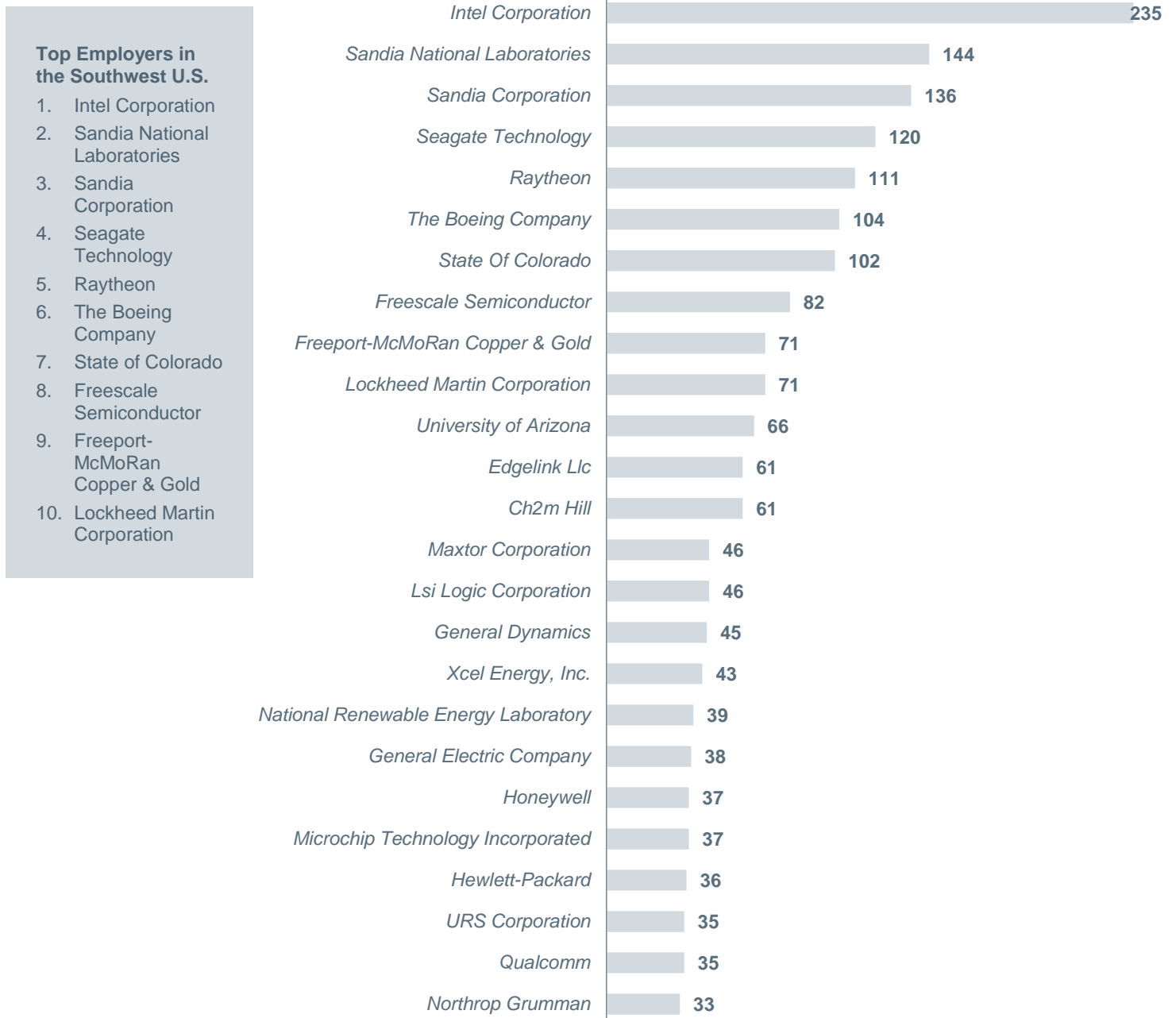
Program Marketing

Leverage Corporate Partnerships to Attract Students to Program

Contacts report that over 90 percent of students enrolled in online professional master's programs at profiled institutions are currently employed in industry. As such, many employers provide tuition or reimburse tuition for employees enrolled in online master's programs in professional engineering. **North Carolina State University** initiates partnerships with corporations to provide educational services to their employees. Institutions should market program offerings to top regional employers of graduates with master's degrees in engineering.

Top Employers of Graduates with Professional Engineering Master's Degrees

Southwest U.S. (Arizona, New Mexico, El Paso TX), January-August 2013



n = 6,640, with 0 unspecified
Source: Burning Glass Labor/Insight™



Leverage Professional Organizations and Publications for Program Recruitment and Marketing

Administrators at **North Carolina State University** advertise programmatic offerings at conferences for professional engineering organizations such as the Council for Industry and Education Collaboration (CIEC) and the American Society for Engineering Education (ASEE).

Contacts also suggest advertisement in industry-specific publications such as journals and magazines. To increase enrollment in its nuclear engineering program, administrators at **North Carolina State University** advertised program offerings in Nuclear Engineering International, a magazine for nuclear engineering professionals. Administrators witnessed an increase in applications to the program as a result.

Program Delivery



Program Length

3-5 Years

Students complete professional master's degree programs in an average of three to five years.

Provide Fully Online Instruction to Accommodate Industry Professionals

Industry professionals comprise a majority of the enrollment of professional master's degree programs in engineering. Most students have three or more years of industry experience prior to enrolling in programs. Contacts note that hybrid programs experience lower enrollments from industry professionals as industry professionals may be unable to attend programs due to work and personal conflicts. Fully online programs experience high enrollment from industry professionals as they offer increased flexibility to students. Administrators deliver instruction asynchronously via lecture capture systems and require faculty to offer online office hours to field student questions.

Most students enroll in programs on a part-time basis and complete programs in an average of three to five years. Administrators suggest that new students enroll in one course per semester. Once students learn to manage the course load, students may enroll in two courses per semester.

North Carolina State University allows students up to six years to complete the degree program but students must be concurrently enrolled every semester until graduation.

3) Employer Demand

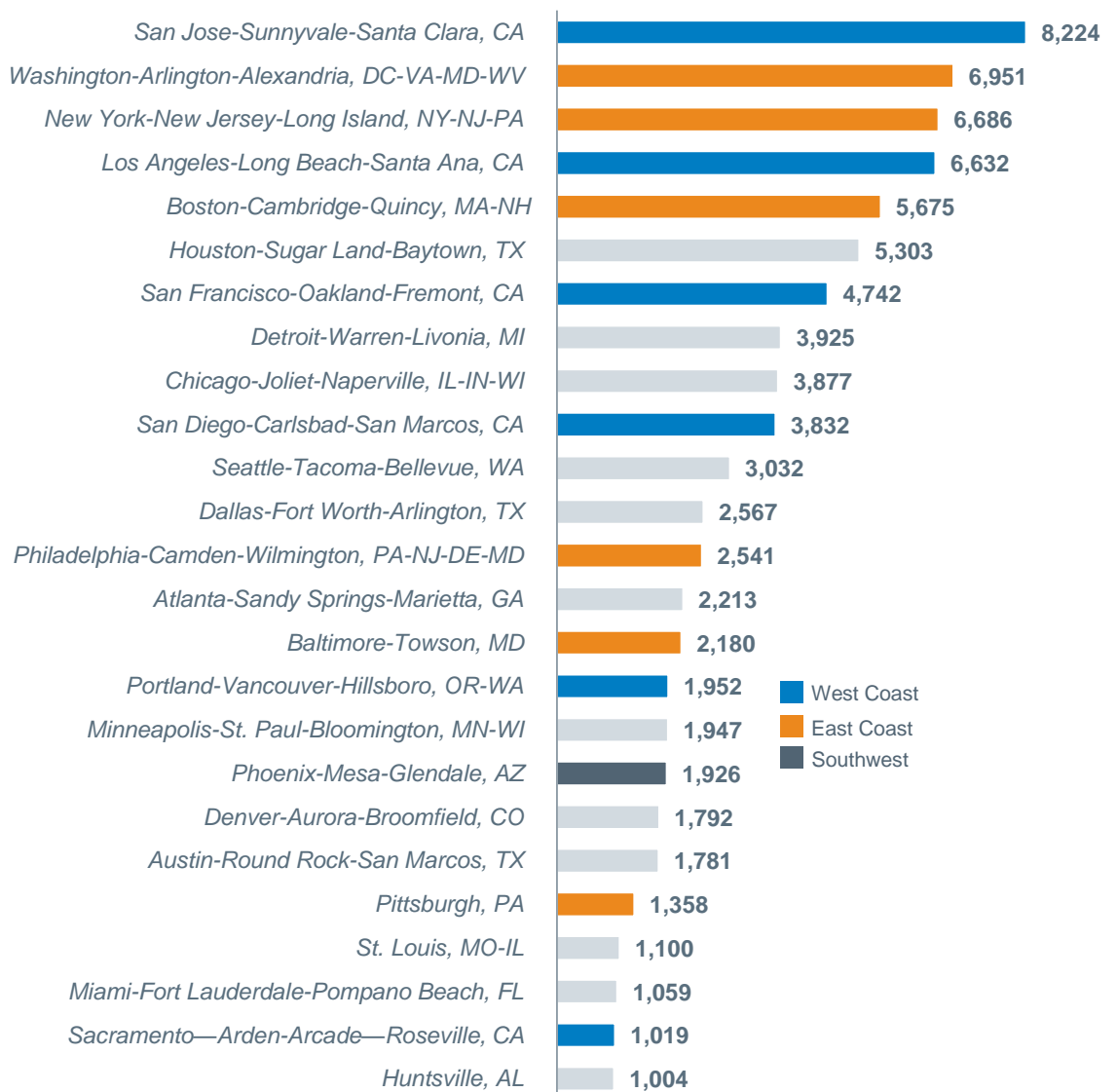
Top Locations

The East and West Coasts Express Highest Demand for Professional Master's Degree Programs

Employers located in California, and the Northeast display the greatest demand for graduates of professional engineering master's degree programs. Top metropolitan statistical areas (MSA) on the West Coast include San Jose, Los Angeles, and San Francisco. The Washington, DC MSA expresses the highest demand on the East coast, followed by the New York area.

Top Regions for Graduates with Professional Engineering Master's Degrees

Nationally, January-August 2013



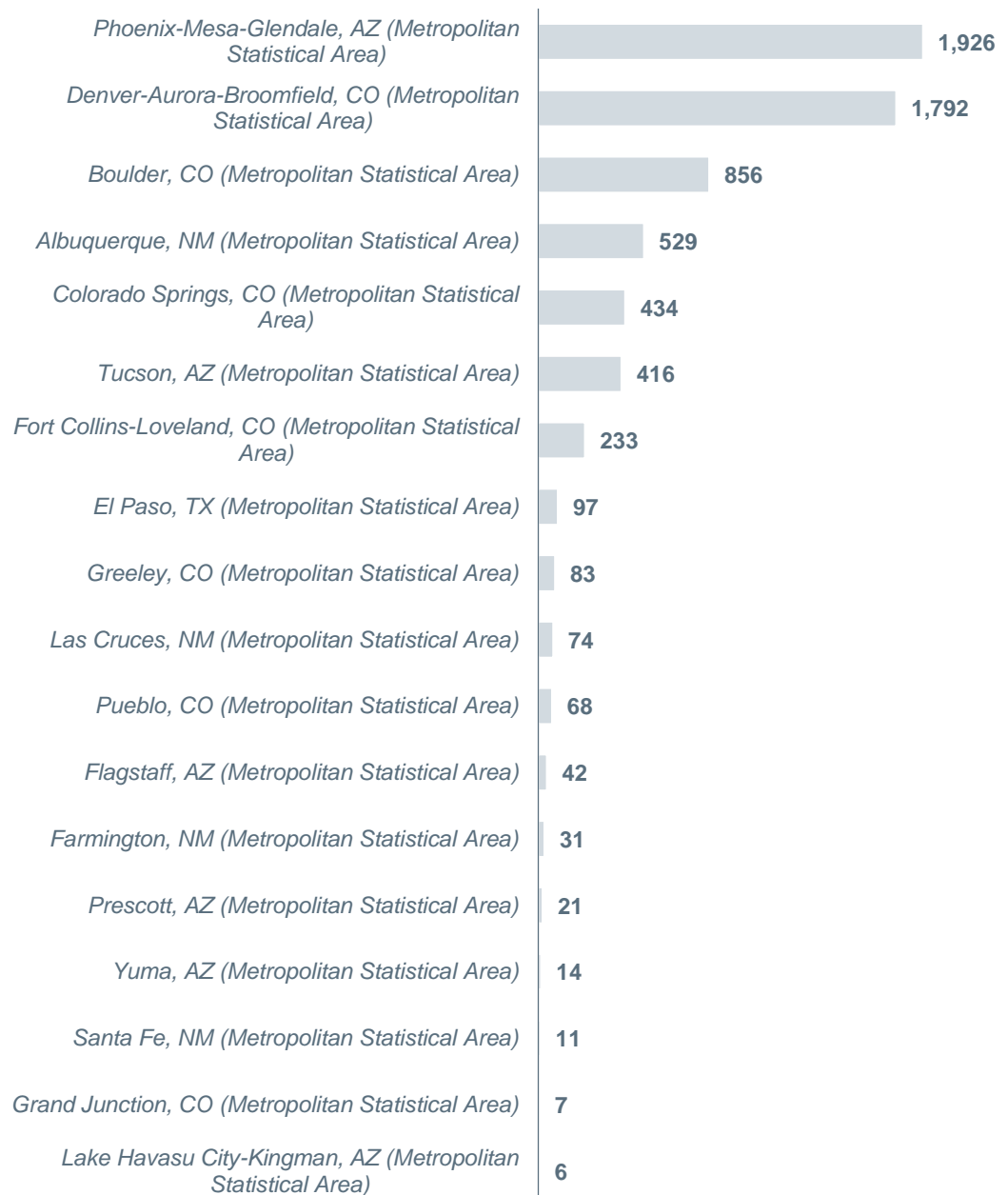
n = 132,613, with 0 unspecified
Source: Burning Glass Labor/Insight™

The Phoenix Area Boasts Highest Demand for Engineering Graduates in the Southwest

The Phoenix-Mesa-Glendale Arizona area boasts 30 percent of employer demand for graduates with professional engineering master's degrees in the Southwest United States. The Denver-Aurora-Broomfield area displays 26 percent of demand for these graduates. The top six MSAs represent 96 percent of employer demand for these degree programs. Administrators should focus on employers in these regions to identify prospective students for its programs. Outside of these top MSAs, the wide dispersion of employer demand across the Southwest reinforces the importance of fully online programming.

Top MSAs with Interest in Graduates with Professional Engineering Master's Degrees

Southwest U.S. (Arizona, New Mexico, El Paso TX), January-August 2013



n = 6,640, with 0 unspecified
Source: Burning Glass Labor/Insight™

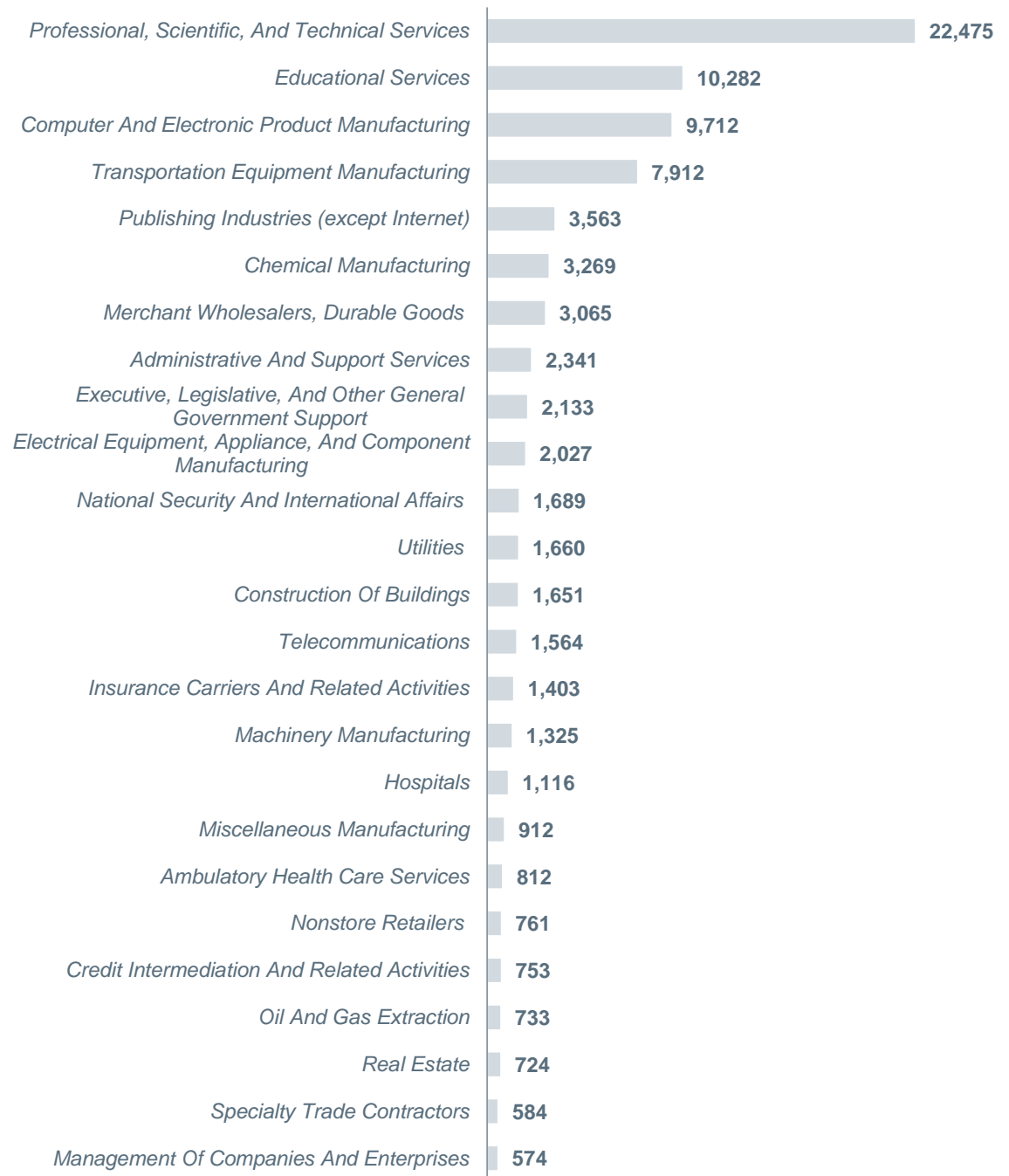
Top Employers and Industries

Target Employers in the Professional Services Industry

Employers in the professional, scientific, and technical services industry display the highest demand for graduates of professional master's degree programs in engineering. The educational services industries express the second highest demand for graduates of these degree programs. Institutions should initiate partnerships with employers in these industries to recruit students in these programs.

Top Industries for Graduates with Professional Engineering Master's Degrees

Nationally, January-August 2013



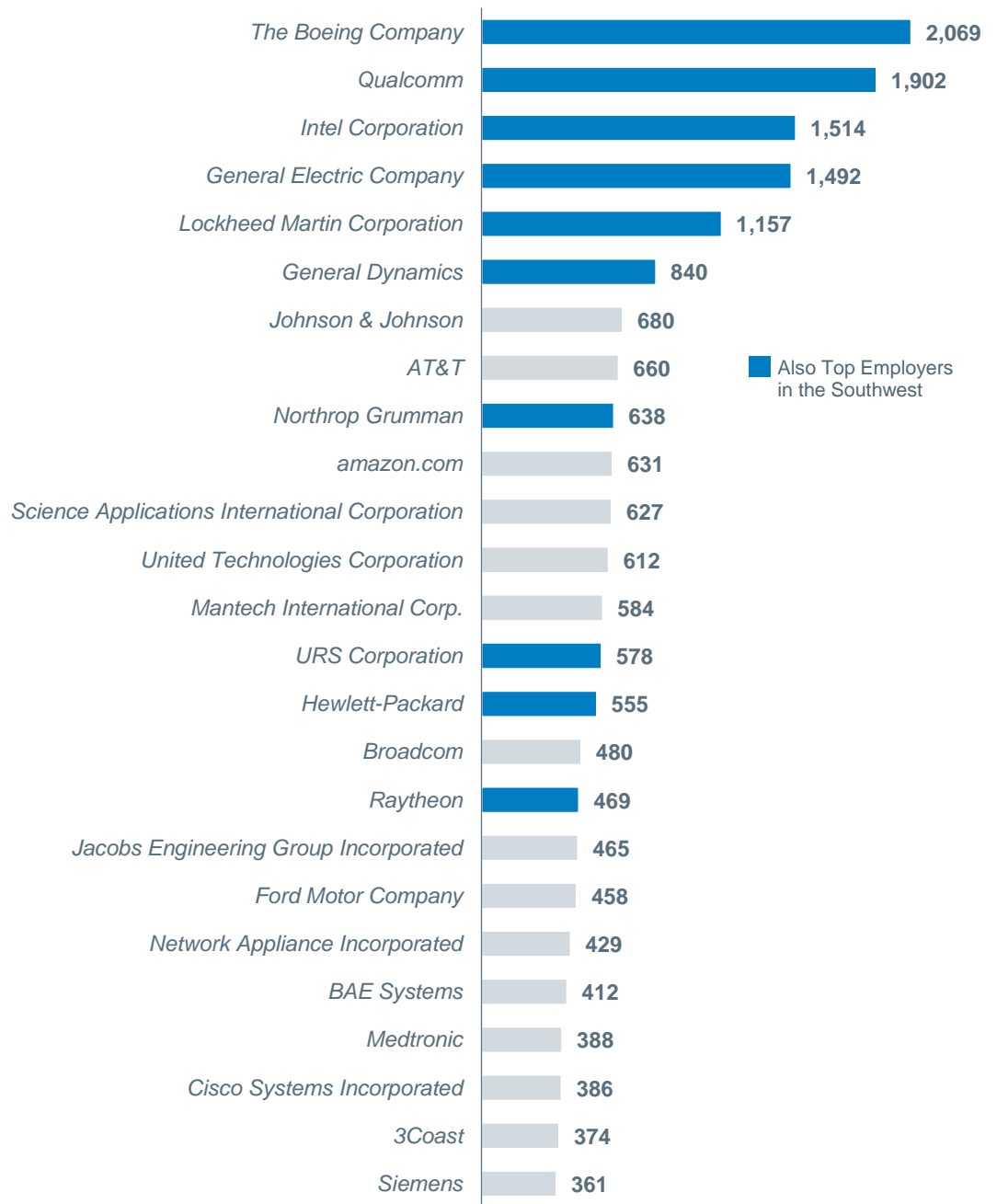
n = 132,613, with 0 unspecified
Source: Burning Glass Labor/Insight™

Multinational Corporations Express High Demand for Professional Engineering Master's Degree Graduates

Top employers with interest in graduates with professional master's degrees in engineering include The Boeing Company, Qualcomm, Intel Corporation, General Electric Company, and Lockheed Martin. Institutions should approach these corporations as their high degree of profitability may incline them to fund tertiary education for their employees.

Top Employers of Graduates with Professional Engineering Master's Degrees

Nationally, January-August 2013



n = 132,613, with 0 unspecified
Source: Burning Glass Labor/Insight™

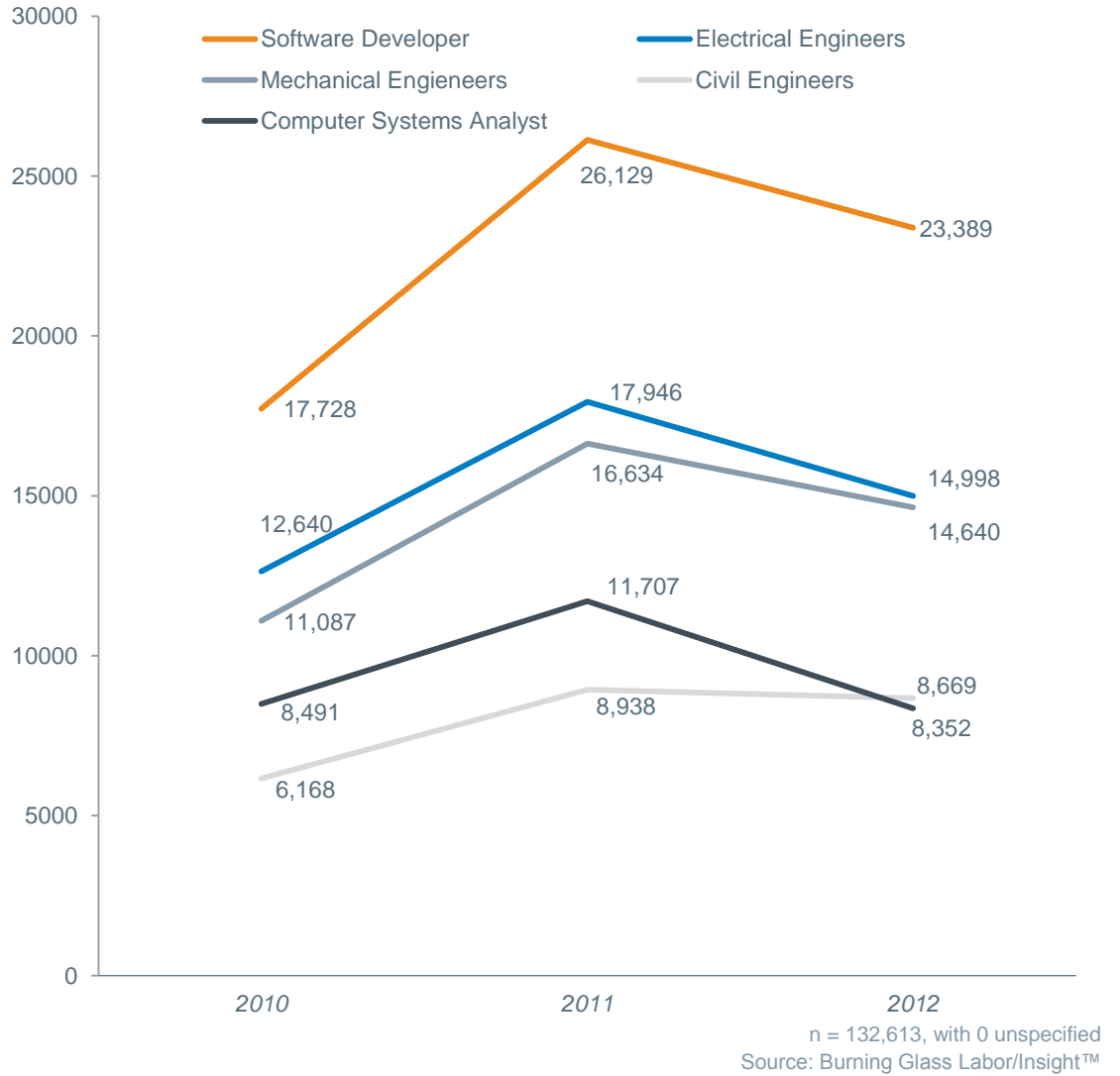
Employment Opportunities

Graduates Secure Employment in a Range of Engineering Positions

Employers nationwide seek graduates with professional master's degrees in engineering to serve as software developers, electrical engineers, mechanical engineers, civil engineers, and computer systems analysts. Although 2011-2012 indicates a slight decrease in demand, likely due to nationwide economic conditions, employer demand for these positions has enjoyed a net increase since 2010.

Employer Demand Time for Top Five Occupations for Graduates with Professional Master's Degrees in Engineering

Nationally, January-December 2010, 2011, 2012



4) Research Methodology

Project Challenge

Leadership at a member institution approached the Forum with the following questions:

- What is the demand for graduates of professional master's in engineering degree programs in the southwest United States (i.e., New Mexico, Arizona, Colorado, and West Texas)?
- What is the national demand for graduates of these degree programs?
- What occupations most commonly demand graduates of these degree programs? Who are the top employers of these graduates?
- Which engineering sub-disciplines (e.g., civil engineering, mechanical engineering) display the largest demand for graduates of these degree programs?
- What are the attributes of online professional master's in engineering degree programs?
- How do administrators align program curricula with market demand? How have program directors modified curricula to adapt to changing market needs?
- What are the professional and demographic characteristics of applicants and admitted students, with respect to age, gender, and educational attainment?
- What program strengths do marketing materials emphasize to students? Through what outlets do program directors advertise programs?
- Do programs maintain industry partnerships? How do administrators capitalize on these industry partnerships?

Project Sources

The Forum consulted the following sources for this report:

- Advisory Board's internal and online research libraries (eab.com)
- The Chronicle of Higher Education (<http://chronicle.com>)
- National Center for Education Statistics (NCES) (<http://nces.ed.gov/>)
- Contact institution Web sites

Research Parameters

The Forum interviewed directors of professional engineering master's programs at public institutions.

A Guide to Institutions Profiled in this Brief

Institution	Location	Approximate Institutional Enrollment (Undergraduate/Total)	Classification
North Carolina State University	South	10,000/28,000	Research Universities (very high research activity)
Purdue University	Midwest	25,000/34,000	Research Universities (very high research activity)

University of Alabama-Birmingham	South	41,000/32,000	Research Universities (very high research activity)
University of Colorado-Boulder	West	18,000/11,000	Research Universities (very high research activity)

Burning Glass Labor/Insight™

Burning Glass – The Education Advisory Board’s Partner for Real-Time Labor Market Data

Part of the data included in this report made possible through our partnership with Burning Glass, a Boston-based firm specializing in use of web spidering technology and Artificial Intelligence engines to mine more than 80 million online job postings for real-time employer demand data. Under the partnership, the Education Advisory Board may use certain features of Burning Glass’s proprietary tool called Labor/Insight™ to answer common member questions about employer demand for specific educational requirements, job titles, and competencies over time and by geography. A fuller description of the tool is available at <http://www.burning-glass.com/products/labor.html>.

Learn about Burning Glass and Labor/Insight™

Many Education Advisory Board member institutions subscribe to the Labor/Insight™ tool, to provide program directors and marketers desktop access to the tool’s full suite of features. Burning Glass is pleased to provide Labor/Insight™ to our members at a substantial discount. For more information about the service, please contact Kelly Bailey, Business Development Manager, kbailey@burning-glass.com or 732-800-2484.

Definition of Terms

The total number of “unspecified” job postings included in a data sample is indicated below all charts and graphs in this report. Job postings are considered “unspecified” for a skill, industry, employer, geography, certification, education requirement, or major when the job posting did not advertise for one of these particular job characteristics and therefore should be subtracted from the total number (n value) of job postings analyzed in the query. Capital cities may be overrepresented in instances where job postings do not specify a location within a state.

Networking Contacts

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Appendix 4 Library Resources

Appendix 4: NMSU Library Report -prepared for the College of Engineering, Masters of Engineering Proposal

Library Materials

The library actively manages 1,829,158 scholarly resources. Of these materials, approximately 10.8% comprise the Engineering collection; call numbers QC and T-TP and TS1-194. Engineering Librarian Paula Johnson works with the College of Engineering departmental library liaisons to obtain monographs, journals, and other non-book or media materials for ongoing collection development. The Library also maintains a selection of industry codes and technical standards. Additionally, College of Engineering students and faculty may request standards for use as needed. Such requests are generally filled within 24 hours.

The majority of the library's resources are online, accessible via the library's web page <http://lib.nmsu.edu/article.shtml>. The library provides access to general academic databases and to numerous databases geared specifically toward the research needs of Engineering students and faculty. Resources may be accessed on campus or remotely by proxy server verification of user status. Users may set up a VPN to bypass continual proxy re-verification.

Note: The NMSU Library's continuing fiscal constraints present a challenge for providing resources to support scholarly and professional work in STEM-H disciplines. Nationwide, academic research libraries are struggling to offset annual inflation costs associated with the acquisition of library research materials. NMSU Library has experienced sustained budget compression over the past decade, a trend that shows no indication of slowing down or reversing. As a result, the library is falling further and further behind in its ability to acquire research information, and is increasingly dependent upon other research libraries and content providers to meet users' needs. Every year the NMSU Library is reducing the number of resources available to support academic programs. Since 2005, the library has had extremely limited funding to establish basic, core collections for new programs that have been formally approved.

Library Services

Information Delivery Services (IDS)

Request It! includes interlibrary loan, document delivery, and related delivery and pick-up services <http://lib.nmsu.edu/depts/accserv/ids.shtml>. Students, faculty, and staff seeking access to information, whether owned by the NMSU Library or other organization, may take advantage of *Request It!* services by clicking on the link in the library's catalog, databases, or from WorldCat. In most cases, *Request It!* is available at no charge to the user. Turnaround times vary depending upon the time of the semester and the availability of the item.

Per Association of College and Research Libraries (ACRL) standards that promote equitable access and services for distance education users, the IDS staff will mail returnable materials via *Request It!* delivery services <http://lib.nmsu.edu/aboutlib/policies/policy019.shtml>. Postage-paid return mailers are provided at no charge to eligible users. Articles and other documents are delivered electronically to the user's account whenever possible.

Reference and Research Assistance

The library's Reference and Research Services department staff and faculty are familiar with the collection and resources, and are available to answer reference requests that come to the desk, by telephone, email, or via chat during operating hours. Questions requiring more in-depth work or subject knowledge are referred to the Engineering Librarian for a personal consultation.

Library Instruction

The Library's instruction staff offers general orientation sessions to provide students with an overview of available resources and the most effective ways of utilizing them. Library faculty members also offer course-specific instruction per faculty request, and special topic workshops are also given throughout the year (e.g., Finding and Accessing Technical Standards).

Course Reserves

Faculty may place physical materials on Reserve at Zuhl, with loan periods determined by the instructor. Library staff may also assist faculty who wish to create persistent links to electronic library resources in their learning management system (Canvas) course pages.

Equipment, Technology and Study Space

There are 68 computers in Zuhl, 42 in Branson, and wireless connectivity throughout both facilities. Laptops and iPads are available for loan, as well as DVD players and other peripherals. Each building offers networked printers, photocopiers, and no-cost scanning stations. Branson and Zuhl Libraries provide comfortable and productive learning spaces, offering a mix of quiet areas for individual study and group work areas that feature larger desktops, additional electrical outlets, and mobile tables, chairs and whiteboards to facilitate collaboration.

Submitted by Paula Johnson
Engineering Librarian
November 3, 2015