

CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

This chapter describes the *Mission* and the *Program Educational Objectives* of the *Engineering Physics (EP) Program*, the process for evaluating their relationship to constituency and/or program needs, and their connection to the *Institutional Mission* and the *Institutional Goals*.

The current *Program Educational Objectives* for EP were formulated in 2012, just prior to the previous ABET site visit. They were compiled with the help of the *Engineering Physics External Advisory Board* (EPEAB, described in more detail in *Part E* of this section), considering the input from administrators, faculty and staff of the *Departments of Physics, Mechanical & Aerospace Engineering, the Electrical & Computer Engineering, Chemical & Materials Engineering, the Colleges of Arts & Sciences and Engineering, and the University*.

A. Mission Statement

Provide the institutional mission statement.

The mission statement of *New Mexico State University (NMSU)* is as follows:

New Mexico State University is the state's land-grant university, serving the educational needs of New Mexico's diverse population through comprehensive programs of education, research, extension education, and public service.

The mission statement of NMSU's *College of Engineering* is as follows:

The College of Engineering will uphold the land grant mission of NMSU through nationally recognized programs in education, research, and professional & public service.

The mission statement of NMSU's *Engineering Physics Program* is as follows:

The mission of Engineering Physics at New Mexico State University is to offer an accredited degree that combines high-quality engineering and physics programs to best prepare our graduating students for careers in state-of-the-art industry or to move on to advanced study in engineering or physics.

B. Program Educational Objectives

List the program educational objectives and state where these can be found by the general public.

The *Department of Physics* at NMSU currently offers three undergraduate degrees, i.e. *Bachelor of Science in Physics (BS-Physics)*, *Bachelor of Arts in Physics (BA-Physics)* and *Bachelor of Science in Engineering Physics (BS-EP)* and two graduate degrees, i.e. *Master of Science (MS)* and *Doctoral Degree (PhD) in Physics*. In this *Self-Study Report* only the *Program Educational Objectives* of BS-EP are evaluated, although there is often considerable overlap with the educational objectives/goals of the other degrees offered.

The current *Program Educational Objectives* of the *EP Program* are listed in Table 2.1. They are formulated such that they best address the needs of our constituencies and to best achieve the goals

stated in the various mission statements above. The *Educational Objectives* are formulated such that they capture the spirit of ABET's *Guidelines for Educational Objectives*.

Table 2.1. *Program Educational Objectives of the Engineering Physics Program at NMSU.*

<p style="text-align: center;">EP Educational Objective 1: Competitiveness. Graduates are competitive in internationally-recognized academic, government and industrial environments.</p> <p style="text-align: center;">EP Educational Objective 2: Adaptability. Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes.</p> <p style="text-align: center;">EP Educational Objective 3: Teamwork and Leadership. Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.</p>

Our *Program Educational Objectives* are widely advertised and publicly available through departmental advertising/recruitment brochures, fliers & hand-outs, program weblinks, official documents & reports (such as this *Self-Study Report*). They also posted in various places throughout the department.

C. Consistency of the *Program Educational Objectives* with the Mission of the Institution

Describe how the program educational objectives are consistent with the mission of the institution.

NMSU's strategic planning activities originate at the highest level of the university in the President's office. As a minority-serving land-grant institution, NMSU has established that its main overall mission is serving the people of *New Mexico* through education and research with special emphasis on preserving the state's multi-cultural heritage, protecting its environment, and fostering economic development in the State of New Mexico and the interdependent world. NMSU's primary mission is to provide quality education to a student body of various ages, interests, and cultural backgrounds. The university seeks to educate each student not only in how to earn a living but also in how to live a meaningful life. Representatives of academic departments, colleges, support units and administrative units are involved in the development and assessment of a single strategic plan for the university and many related plans for the supporting units. An important task of strategic planning is to determine, advance, disseminate and refine the educational objectives of a program. These *Educational Objectives* must be consistent with the overall strategic mission of the University as well as those defined by the *New Mexico Commission of Higher Education* (NMCHE) and the *North Central Association* (NCA). Over the past few years, NMSU has formulated and adopted an *Academic Strategic Plan*, called the *Vision 2020 Strategic Plan*, with goals that are listed in Table 2.2.

Each of NMSU's colleges, departments, academic programs and supporting units are required to produce their own individual strategic plans that should support the overarching strategic goals of the university. In this section, we hope to establish that the *Program Educational Objectives* of the *EP Program* are consistent with and supportive of the institutional goals of NMSU.

Table 2.2. *Current Vision 2020 Goals for NMSU*

<p style="text-align: center;">Goal 1: Academics and Graduation. Provide stellar programs, instruction, and services to achieve timely graduation.</p> <p style="text-align: center;">Goal 2: Diversity and Internationalization. Provide a diverse academic environment supportive of a global society.</p> <p style="text-align: center;">Goal 3: Research and Creative Activity. Promote discovery, encourage innovation, and inspire creative activity.</p> <p style="text-align: center;">Goal 4: Economic Development and Community Engagement. Drive economic, social, educational and community development.</p> <p style="text-align: center;">Goal 5: Resource Stewardship. Optimize resources to effectively support teaching, research and service.</p>
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Our three *Program Educational Objectives* for EP are aligned with the five NMSU's *Vision 2020 Goals*, as briefly discussed below.

The *EP Objective 1: Competitiveness* is connected of the *Vision 2020 Goals 1: Academics & Graduation, 3: Research & Creative Activity* and *4: Economic Development & Community Engagement*. Our EP graduates have been proven to be competitive in the job market and are prepared to participate in research and economic endeavors.

The *EP Objective 2: Adaptability* supports the *Vision 2020 Goals 2: Diversity & Internationalization, 3: Research & Creative Activity, 4: Economic Development & Community Engagement* and *5: Resource Stewardship*. Our *EP Program* thrives to train graduates to work in multi-disciplinary and often multi-cultural teams with sometimes limited resources. Graduates learn that they must occasionally adapt, learn new skills, and acquire additional expertise to address unfamiliar challenges.

The *EP Objective 3: Teamwork & Leadership* is connected to the *Vision 2020 Goals 2: Diversity & Internationalization, 3: Research & Creative Activity* and *4: Economic Development & Community Engagement*. Almost all successful research or economic endeavors require teamwork and/or leadership skills, and such skills must extend to populations with diverse backgrounds, given the largely global economy nowadays.

D. Program Constituencies

List the program constituencies. Describe how the program educational objectives meet the needs of these constituencies.

The *Engineering Physics (EP)* degree is an engineering degree awarded through the *College of Engineering*, but it is housed in the *Department of Physics*, which belongs to the *College of Arts & Sciences*. The *College of Engineering* and the *Department of Physics* established an *Engineering Physics (EP) Program Committee* with members from the *Departments of Physics, Aerospace & Mechanical Engineering, Electrical & Computer Engineering, and Chemical & Materials Engineering*. EP students can select between four different concentrations: *Engineering Physics*

with the *Aerospace Concentration* (EP-AE), *Chemical Concentration* (EP-ChE), *Electrical Concentration* (EP-EE), or *Mechanical Concentration* (EP-ME).

The *Educational Objectives* of the *EP Program* are strongly determined by the input, needs, demands, expectations and requirements of our constituencies. Below, we tabulate our constituencies and how they contribute to the development of our *EP Program*.

EP students

Students provide feedback to the program through mandatory student evaluations of each course taken, during advising sessions with the EP advisor and Senior-Student Exit Interviews with the *Department Head*. EP students also meet with the *Engineering Physics External Advisory Board* (EPEAB) during their site visit, at which time they can formulate any concerns or suggestions related to the *EP Program* to the EPEAB, with no NMSU faculty or administrators present.

Potential Employers (Industry, Academia, Government)

This is an important constituency group, and it is strongly represented on our EPEAB; for membership, see Table 2.4. The EPEAB typically meets every other year, although more frequent annual meetings may be called, if needed. Members of the board provide important feedback to all aspects of the *EP Program*, such as required skills of graduates, educational objectives and outcomes assessment. The EPEAB evaluates the overall program, identifies its strength and weaknesses and provides a written report that includes suggestions on how to improve the program. Apart from input through the EPEAB, many of NMSU faculty and staff members have close interactions with representatives from industry and/or national laboratories, and their comments and suggestions are considered as well.

Physics Faculty and Staff

The *Department of Physics* holds annual retreats and all faculty and non-administrative support staff (instructors, lab coordinators) are required to attend. The central focus of the retreat is to discuss the progress and weaknesses of all physics programs, including needed changes in the curriculum and/or the overall program educational objectives.

To manage the cross-college *EP Program*, the *Department of Physics* has created an *Engineering Physics (EP) Program Committee* that includes members of the *Department of Physics* and the associated engineering departments. The *Physics Department Head* and the *Associate Dean of Engineering for Academics* are *ex-officio* members of this committee. Current membership of the *EP Program Committee* can be found in the first section of this *Self-Study Document (Background Information)*. The *EP Program Committee* oversees the program progress, makes sure that assessment procedures are followed, continuously evaluates the health of the program, and implements necessary program changes. While the *EP Program Committee* directs the *EP Program*, it relies on the involvement of other faculty members from physics and the participating engineering departments for program assessment and improvement.

Faculty of Affiliated Engineering Programs

Three engineering faculty members, one each from the *Departments of Mechanical & Aerospace Engineering*, *Chemical & Materials Engineering* and *Electrical & Computer Engineering*, serve on the *EP Program Committee*, and they participate in the committee meetings on a regular basis. The engineering committee members also serve as spokespersons for the needs and interests of the *EP Program* at their respective home departments in the *College of Engineering*.

Alumni

Since its inception, the *Department of Physics* tries to keep an updated list of its alumni, their current contact information, their current employment status and occupation. In many cases, the department has succeeded to keep close contact with past alumni and it performs occasional alumni surveys. Moreover, the EPEAB has alumni representation on the board.

Peer Institutions that offer EP or similar majors

We are in close contact with other academic institutions that also offer an *Engineering Physics Programs*, accredited by ABET. A few examples of ABET-accredited *EP Programs* are *Colorado School of Mines*, *South East Missouri State University*, *Tulane University*, *University of Oklahoma* and *University of Maine*. The *Department Head of the EP Program* from *South East Missouri State University* serves as a member on our EPEAB and he is a certified ABET evaluator; we therefore built on his experience for program progress and accreditation purposes.

Graduate Schools

Graduate schools are an important potential destination for our students. Several of our EP alumni pursue advanced graduate studies in physics or engineering following their graduation from EP. The curricula of the pre-existing physics and engineering programs are therefore tailored for the needs of students seeking graduate education. The EPEAB has current representation from academic institutions, which offers graduate programs to EP graduates.

Citizens of New Mexico

As the land-grant state university of the *State of New Mexico*, NMSU and its programs have strong commitments to citizens of the state and in the region. Many of our EP students and their parents come from *New Mexico*, and the *EP Program* is actively involved in many outreach and educational activities to the public.

Constituency needs are implemented into the *Program Educational Objectives* such that they are consistent with and supportive of the strategic mission of the university and its units. Each of the constituency groups plays an important (and often complementary) role in both the evaluation and improvement of our *EP Program*. Input from our constituencies is included in the assessment of the program and we solicit their assistance for further developing our program. Moreover, many of our constituencies serve as members of the EPEAB (see Tables 2.3 and 2.4). With their input, the *EP Program* has been designed such that students acquire strong fundamental knowledge in physics and individual engineering concentrations, adopt effective communication and problem-solving skills, develop the ability to tackle new problems, and achieve a level of preparation that allows continuation to advanced studies after graduation. Graduates of the *EP Program* should be able to apply their acquired skills to solve research and development problems of interest for industry, governmental laboratories, or academic institutions. The potential employment opportunities for EP graduates are extensive, and they include research and development, energy and utility, manufacturing, automotive, photonics, aerospace, defense and space, sensor technology, and many other fields. While the *EP Program* intends to prepare the students for a wide range of professional careers in industry and governmental laboratories, it will also prepare them for graduate studies in engineering or physics.

E. Process for Review of the Program Educational Objectives

Describe the process that periodically reviews the program educational objectives including how the program's various constituencies are involved in this process. Describe how this process is systematically utilized to ensure that the program's educational objectives remain consistent with the institutional mission, the program constituents' needs and these Criteria.

Evaluating and improving the *Program Educational Objectives* for our *EP Program* is dynamic and continuing process. If needed, adjustments and improvements to the *Educational Objectives* are initiated by the *EP Program Committee*, which suggests changes and/or modifications to the objectives, if needed. The processes and procedures for establishing, publishing and evaluating the *Program Educational Objectives* are briefly described in the sections below.

The *Engineering Physics (EP) Program Committee* is the main body in charge for the following aspects related to the *Program Educational Objectives*:

- formulate *Program Educational Objectives* and revise them, if needed;
- periodically evaluate the achievement of *Program Educational Objectives*, and make suggest changes to program delivery and/or content, if needed; and
- publish *Program Educational Objectives* and data related to their achievement.

As mentioned above, our *Program Educational Objectives* were revised in 2012, just prior to the previous ABET accreditation cycle, and in close collaboration with the 2012 *Engineering Physics External Advisory Board (EPEAB)*. Our *Educational Objectives* are formulated such that they follow the ABET guidelines, and show consistence with the institutional goals and the needs of the program constituents, particularly potential employers and graduate schools. The EPEAB and the *EP Program Committee* discuss and review the continued adequacy of our *Program Educational Objectives* during the EPEAB site visit (see below).

The main body in charge of evaluating whether the *EP Program* is successful in achieving its *Educational Objectives* is the EPEAB, which meets every 1-2 years with the *EP Program* representatives at NMSU. The *EP Program Committee* prepares updated materials and data in support of whether the *EP Program* achieves its *Educational Objectives* to the EPEAB prior to site visit. Aside from EPEAB input, the *EP Program Committee* tries to stay in touch with the program's alumni, either through voluntary *Alumni Surveys*, connections through *LinkedIn* or similar professional networks, and/or personal contacts. We have contact information for more than 80% of our alumni, a significant fraction of whom provide information and data connected to our *Program Educational Objectives*. Those data are collected and updated (if needed) in the documents and/or spreadsheets that are kept in a *OneDrive* folder dedicated to the *EP Program*. In addition, the *Engineering Physics Program Committee* occasionally seeks informal feedback from other constituents, such as employers of our EP alumni and faculty and administrators involved in the program. Data and informal feedback pertaining to the achievement of *Program Educational Objectives* are discussed in the *EP Program Committee*, which meets regularly each semester (at least monthly, but up to weekly when, for example, changes to the program are required or an EPEAB meeting is upcoming). The *EP Program Committee* formulates recommendations for program improvement for consideration by the physics faculty, and recommendations may lead to changes or modifications in program delivery, assessment, and approaches, some of which are discussed in *Criterion 4 – Continuous Improvement*.

The *Program Educational Objectives* for the *EP Program* are posted near the main office of the *Department of Physics*, and they are prominently displayed on the homepage of program's website. Data related to its achievement of the *Program Educational Objectives* are periodically updated on the program's website (about once a year). Moreover, alumni information is often included in presentations, fliers, brochures and newsletters, prepared for recruitment and/or outreach purposes.

The EPEAB plays an instrumental role for the overall program evaluation and assessment of achieving its *Educational Objectives*. The EPEAB has four standing tasks: 1) review current policies and procedures within the program, 2) identify potential issues and areas of concern, 3) evaluate whether the program achieves its stated *Educational Objectives*, and 4) prepare a report for distribution to the *EP Program Committee* and the *Deans*. The members for the 2012, 2014 and 2016 EPEAB are listed in Table 2.3.

Table 2.3. Members of the 2012, 2014 and 2016 EPEABs.

2012 EPEAB

On-Campus Visit: January 23 & 24, 2012

Dr. Steven Castillo, Sandia National Laboratory, Albuquerque, New Mexico, **Mr. Jon Haas (Chair)**, NASA Johnson Space Center, Las Cruces, New Mexico, **Prof. Mark Holtz**, Texas Tech University, Lubbock, Texas, **Dr. Alan Lovell**, Air Force Research Laboratory, Albuquerque, New Mexico, **Prof. David Probst**, Southeast Missouri State University, Cape Girardeau, Missouri, **Dr. Mark Schraad**, Los Alamos National Laboratory; Los Alamos, New Mexico, **Dr. John Schaub (EP Alumnus)**, Valparaiso University, Indiana, **Mr. Ronald Tafoya**, Intel Corporation, Rio Rancho, New Mexico

2014 EPEAB

On-Campus Visit: April 24 & 25, 2014

Dr. Steven Castillo, Sandia National Laboratory, Albuquerque, New Mexico, **Ms. Laura Dominik**, Honeywell, Minneapolis, Minnesota, **Mr. Jon Haas (Chair)**, NASA Johnson Space Center, Las Cruces, New Mexico, **Prof. Mark Holtz**, Texas Tech University, Lubbock, Texas, **Dr. Alan Lovell**, Air Force Research Laboratory, Albuquerque, New Mexico, **Prof. David Probst**, Southeast Missouri State University, Cape Girardeau, Missouri, **Dr. Mark Schraad (Chair)**, Los Alamos National Laboratory; Los Alamos, New Mexico, **Mr. Ronald Tafoya**, Intel Corporation, Rio Rancho, New Mexico, **Mr. Luke Wyatt (EP Alumnus)**, Sandia National Laboratory, Albuquerque, New Mexico

2016 EPEAB

On-Campus Visit: May 6 & 7, 2016

Dr. Steven Castillo, Sandia National Laboratory, Albuquerque, New Mexico, **Ms. Laura Dominik**, Honeywell, Minneapolis, Minnesota, **Mr. Jon Haas (Chair)**, NASA Johnson Space Center, Las Cruces, New Mexico, **Dr. Alan Lovell**, Air Force Research Laboratory, Albuquerque, New Mexico, **Mr. Nathaniel Nunley (EP Alumnus)**, University of Texas, Austin, Texas, **Prof. David Probst**, Southeast Missouri State University, Cape Girardeau, Missouri, **Dr. Kurt Schoenberg**, Los Alamos National Laboratory; Los Alamos, New Mexico, **Mr. Ronald Tafoya**, Intel Corporation, Rio Rancho, New Mexico

After the 2016 EPEAB site visit, the *EP Program Committee* had to replace several past EPEAB members due to retirement or resignation, and it also added two additional members (one from industry and from academia). The current members of the EPEAB are listed in Table 2.4.

Table 2.4. Current Members Engineering Physics External Advisory Board (EPEAB).

<p style="text-align: center;">2017 and 2018 Engineering Physics External Advisory Board (EPEAB) <i>2017 On-Campus Visit: April 28 & 29, 2017</i> <i>2018 On-Campus Visit: April 28 & 29, 2018</i></p> <p style="text-align: center;">Dr. Steven Castillo Manager; Intelligence, Surveillance and Reconnaissance Systems Engineering & Decision Sandia National Laboratory, Albuquerque, New Mexico</p> <p style="text-align: center;">Dr. Candi Cook Senior Process Engineer; Technology Development Group Intel, Hillsboro, Oregon</p> <p style="text-align: center;">Ms. Laura Dominik Systems Engineer; Systems; Certified Project Management Professional (PMP) at Honeywell Honeywell, Minneapolis, Minnesota</p> <p style="text-align: center;">Mr. Jon P. Haas Associate Principal Engineer; NASA Engineering & Safety Center NASA Langley Research Center - White Sands Test Facility, Las Cruces, New Mexico</p> <p style="text-align: center;">Dr. T. Alan Lovell (Chair) Research Aerospace Engineer; Space Vehicles Directorate Air Force Research Laboratory, Albuquerque, New Mexico</p> <p style="text-align: center;">Mr. T. Nathaniel Nunley (<i>EP Alumnus</i>) PhD Student; <i>Department of Physics</i> University of Texas, Austin, Texas</p> <p style="text-align: center;">Prof. David Probst Department Chair; <i>Department of Physics & Engineering Physics</i> Southeast Missouri State University, Cape Girardeau, Missouri</p> <p style="text-align: center;">Dr. Kurt Schoenberg Partner; Applied Science Enterprises; and former LANSCE User Facility Director LANSCE, Los Alamos National Laboratory, Los Alamos, New Mexico</p> <p style="text-align: center;">Dr. Katyayani Seal Technical Consultant; Quantum Design International Quantum Design, San Diego, California</p> <p style="text-align: center;">Prof. Michael Strosio Professor; Department of Electrical & Computer Engineering University of Illinois, Chicago, Illinois</p> <p style="text-align: center;">Mr. Travis Willett-Gies (<i>EP Alumnus</i>) Systems Integration & Test Engineer; Space Services Division ATA Aerospace, Albuquerque, New Mexico</p>
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Aside from those permanent tasks, the EPEAB may be asked to provide their input to imminent changes to the curriculum, university administration, or similar. For example, the 2016 EPEAB reviewed the proposed changes to the *General Education* and *Viewing-the-Wider-World*

requirements as well as the possibility the EP degree could be administered in 120 credits without adversely affecting the program quality and accreditation.

To assist the board with the assessment of *Program Educational Objectives*, the *EP Program Committee* will provide any data that may be available about our alumni, such as employers and job placements. Diagrams 2.3 and 2.4 provide representative examples of data presented to the EPEAB during their site visit.

In general, the *Department of Physics* hosts a 1-2 day on-campus meeting with the EPEAB. The meeting consists of formal presentations to all aspects of the program, including graduation rates, retention, curriculum, staffing and budgets, The EPEAB meets with all faculty members from physics and faculty representatives from the associated engineering programs. The board also meets separately with the EP students of all concentrations and sometimes alumni.

Following the 2012 ABET accreditation, the EPEAB assessment of achievement of our *Program Educational Objectives* has remained very positive, as evidenced by their written report. Excerpts from the 2014, 2016, 2017 and 2018 EPEAB reports are provided below.

The 2014 EPEAB report stated:

The Engineering Physics (EP) degree program, about to begin its fourteenth year, has developed into a successful, accredited, and growing component of the physics and engineering departments at New Mexico State University. The Engineering Physics Program is challenging, and as a result, attracts some of the best and brightest students at the University. Along with high caliber students, the Physics Department faculty members are a major strength of the program, exhibiting a dedication to both program excellence and student achievement. Program objectives, in terms of graduate competitiveness, adaptability, and teamwork and leadership skill, continue to address the curricular interests of the students, while reflecting the needs and desires of the constituencies being served by the program. Graduates of the program have demonstrated success at finding employment within industry and laboratory settings, or moving on to advanced study in physics or engineering.

The 2016 EPEAB report stated:

The variety of data and metrics reviewed all point to a very successful EP Program. The Committee was presented with many good examples of student academic successes and student's abilities to find employment in scientific or technical organizations. In addition, several recent graduates are moving forward with plans for an advanced degree at very respectable scientific or engineering schools. General performance data based on standardized testing shows a skewed distribution where roughly the top 10 percent rank nationally in physics comprehension.

In addition to the program specific educational objectives discussed below, The EP Program contributes towards the broader objectives of NMSU.

EP Objective 1: Competitiveness. Graduates are competitive in internationally recognized academic, government, and industrial environments

The EP Program continues to attract top students into its challenging curriculum, with graduates of the program proving competitive in graduate-level academic, government, and industrial environments. EP Program graduation rates are increasing, with career choices for graduating EP students more diverse than physics department graduates.

EP Objective 2: Adaptability. Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes.

EP Program graduates are entering advanced courses of study, and being hired into a diverse selection of high-tech jobs in industry and government laboratories, with some engaged in entrepreneurship. These not only meet the goals of the program, but of the broader university, and with greater economic impact.

EP Objective 3: Teamwork and Leadership. Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

Preparation for leadership of interdisciplinary teams is a commonly neglected element of focused engineering and science programs, but simultaneously among the most needed skills leading to the success of large engineering and science projects. EP Program graduates are well-prepared to bridge this project integration gap. During the previous review, it was noted that 23% of program graduates list supervisory duties and 92% report working in team environments.

The 2017 EPEAB report stated:

The data and metrics reviewed point to a very successful EP Program. The NMSU EP Program Committee continues to demonstrate good stewardship of the Program through its efforts. Of importance is the Program's proactive assessment of student feedback and attention to the details of changing curricula in connected departments, making course content adjustments as necessary. The EPEAB was presented with many good examples of student academic successes and students' ability to find employment in scientific or technical organizations. Recent graduates are engaged in advanced degree programs at very respectable scientific or engineering schools, or employed in industry, academic, or research lab positions.

The EP Program has three educational Objectives:

EP Objective 1: Competitiveness. Graduates are competitive in internationally recognized academic, government, and industrial environments.

The EP Program continues to attract top students into its challenging curriculum, with approximately one-quarter each of EP Program graduates engaged in graduate-level academic programs, government-related careers, and industrial or business environments (others are teaching or unknown). Unemployment in science and engineering fields is generally low. EP Program graduation rates have been trending with enrollment, indicating good retention, with career choices for graduating EP students more diverse than for either physics or engineering graduates.

EP Objective 2: Adaptability. Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes.

EP Program graduates are entering advanced courses of study, and being hired into a diverse selection of high-tech jobs in industry and government laboratories, with some engaged in entrepreneurship. The employment rates and diversity of opportunities not only demonstrate that the goals of the program are being met, but this also addresses the goals of NMSU. Engineering Physics graduates demonstrate ongoing contributions to New Mexico and the nation with greater economic impact. More than 10% of the employed (i.e., not continuing in a program of study) EP graduates report Systems Engineer as their current job title, indicating an interdisciplinary career; the remainder report 16 additional job titles, highlighting the diversity of professional opportunity open to EP graduates.

EP Objective 3: Teamwork and Leadership. Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

In this area, students with EP preparation excel. Preparation for leadership of interdisciplinary teams is a generally neglected element of university preparation for engineering and science careers. Simultaneously, the ability to lead interdisciplinary teams and perform complex system

integration functions are among the most necessary skills for the success of large engineering and science development projects. EP Program graduates are well-prepared to address this gap. Recent Program statistics record that more than 20% of program graduates list supervisory duties and greater than 90% report working in team environments.

The 2018 EPEAB meeting was mostly dedicated to reviewing the draft of this Self Study Report; however, the board also provided feedback with respect the *Program Educational Objectives* by stating:

The EP Program has three educational Objectives:

EP Objective 1: Competitiveness. Graduates are competitive in internationally recognized academic, government, and industrial environments

The EP Program continues to mold and shape its students into capable performers; approximately one-third of EP Program graduates go on to pursue graduate-level studies, while the remainder enter government-related or industrial careers, or engage in business opportunities. The Program maintains good contact with graduates, having regular correspondence with 50 of the 58 past graduates. Unemployment in science and engineering fields is generally very low, with high starting salaries. EP Program graduation rates have been trending, with enrollment indicating good retention (with the exception of 2017). Career choices for graduating EP students are more diverse than for either physics or engineering graduates I.

EP Objective 2: Adaptability. Graduates exhibit success in solving complex technical problems in a broad range of disciplines subject to quality engineering processes.

EP Program graduates are entering advanced programs of graduate study and being hired into a diverse selection of high-tech jobs in industry and government laboratories, with some engaged in entrepreneurship. The employment rates and diversity of opportunities not only demonstrate that the goals of the program are being met, but this also addresses the goals of NMSU. Engineering Physics graduates demonstrate ongoing contributions to New Mexico and the nation with great economic impact. More than 10% of the employed (i.e., not continuing in a program of study) EP graduates report Systems Engineer as their current job title, indicating an interdisciplinary career; the remainder report 16 additional job titles, highlighting the diversity of professional opportunity open to EP graduates.

EP Objective 3: Teamwork and Leadership. Graduates have a proven ability to function as part of and/or lead interdisciplinary teams.

Preparation for leadership of interdisciplinary teams is a generally neglected element of university curricula for engineering and science majors. Simultaneously, the ability to lead interdisciplinary teams and perform complex system integration functions are among the most necessary skills for the success of large engineering and science development projects. EP Program graduates are well-prepared to address this gap. Recent Program statistics record that more than 20% of program graduates list supervisory duties and greater than 90% report working in team environment

Diagram 2.3. Career Choices of NMSU EP Alumni (data from Summer 2018). Career choices are separated into broad categories shown by capital letters, individual choices are given in brackets and total number of all EP alumni for each of the career categories are provided at the end. The individual career choices list the last known affiliations of the alumni.

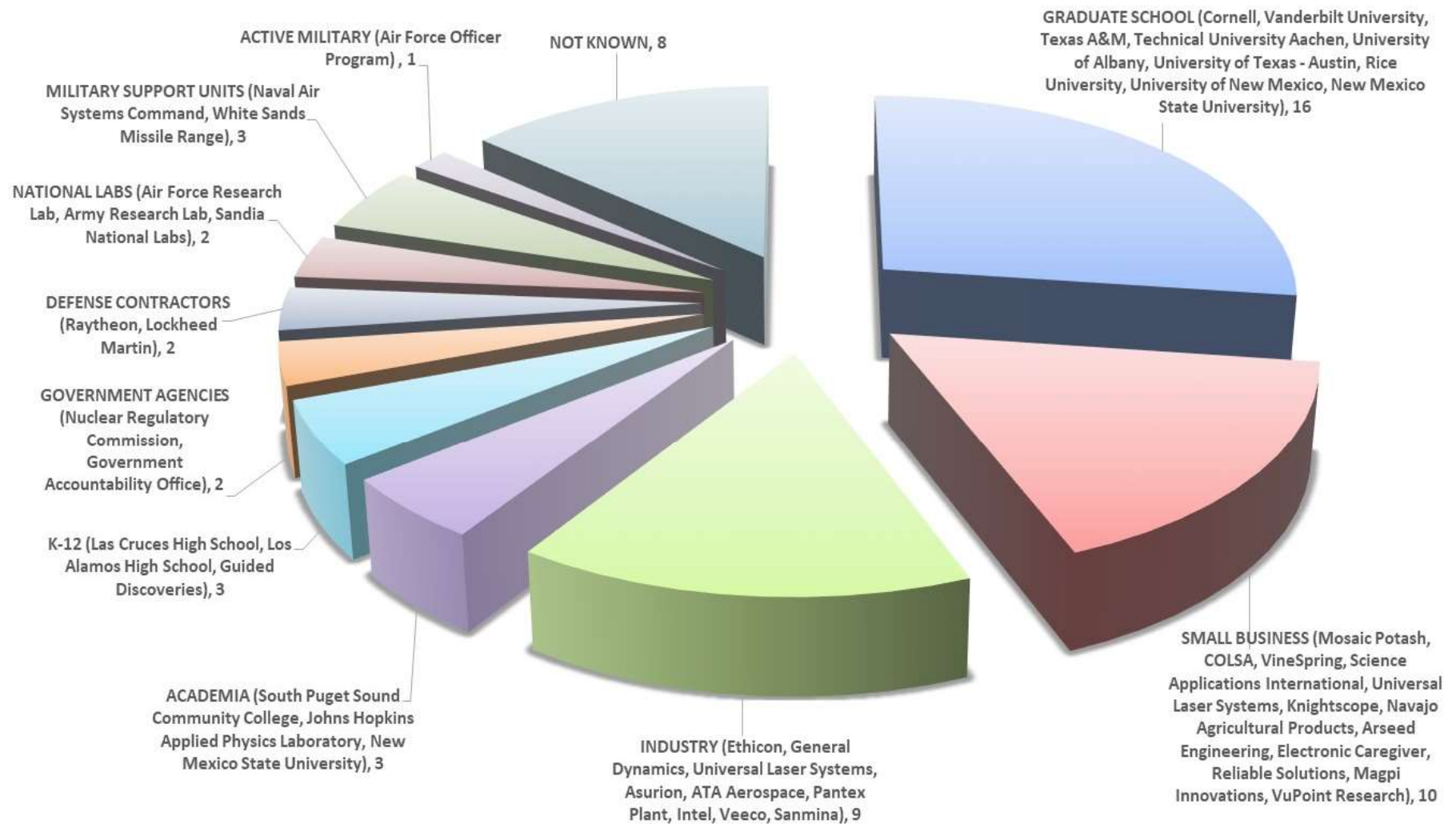
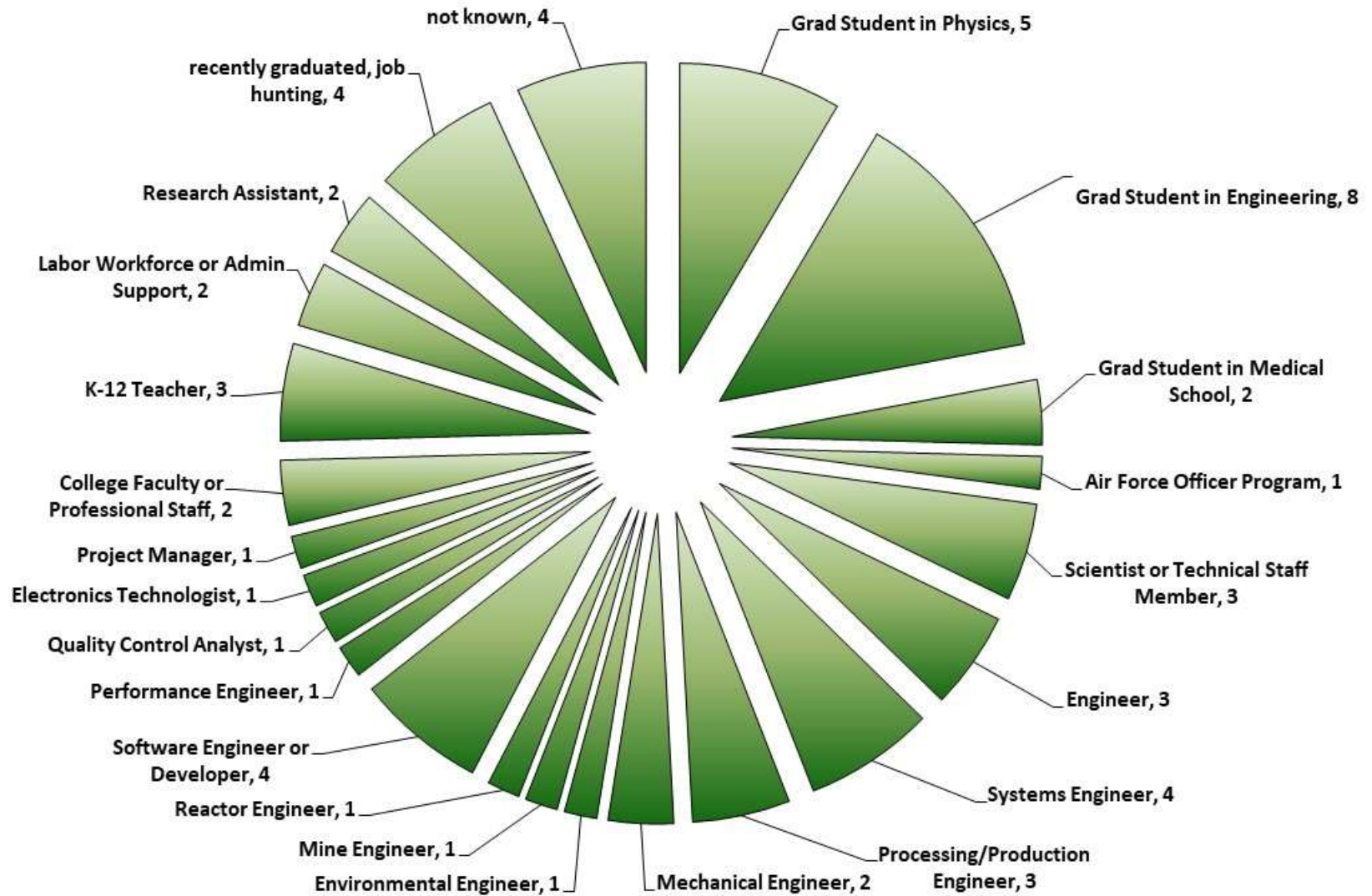


Diagram 2.4. Last known Job Titles of NMSU EP Alumni (data from Summer 2018).



Aside from the *Engineering Physics External Advisory Board (EPEAB)*, the *Department of Physics* has a separate *Physics External Advisory Board (EAB)*, which meets annually every fall semester. The EAB looks at the department as whole and reviews all physics programs, undergraduate and graduate, offered in the *Department of Physics*. Their review is not limited to a particular degree program, such as the EP undergraduate program, and the EAB provide a more focused evaluation of research strength and opportunities as well as graduate education. The current members of the *Physics External Advisory Board* are provided in Table 2.5.

Table 2.5. *Current Members Physics External Advisory Board (EAB).*

<p style="text-align: center;">2017 Physics External Advisory Board (EAB) <i>On-Campus Visit: November 10 & 11, 2017</i></p> <p style="text-align: center;">Prof. Nina Abramzon Professor in Physics California State Polytechnic Institute, Pomona CA</p> <p style="text-align: center;">Dr. Richard Carreras Division Deputy Technical Advisor Air Force Research Laboratory, Albuquerque NM</p> <p style="text-align: center;">Dr. Benjamin Gibson Scientist 4, Theory Division Los Alamos National Laboratory, Los Alamos NM</p> <p style="text-align: center;">Dr. Mary Hockaday Associate Director, ADEPS Division Los Alamos National Laboratory, Los Alamos NM</p> <p style="text-align: center;">Dr. Mark Holtz (Co-Chair) Department Head, Physics Texas State University, San Marcos TX</p> <p style="text-align: center;">Dr. Alan Hurd NSEC/NMC Executive Advisor Los Alamos National Laboratory, Los Alamos NM</p> <p style="text-align: center;">Dr. Andrea Palounek (Co-Chair) Physicist and Secretary of the Four-Corners Section of the American Physical Society Los Alamos National Laboratory</p> <p style="text-align: center;">Dr. Leon Radziemski Owner Piezo Energy Technologies LLC, Tuscon AZ</p> <p style="text-align: center;">Prof. Joseph Shinar Department of Physics & Astronomy Iowa State University, Ames IA</p> <p style="text-align: center;">Dr. Michael Valley Senior Manager, Materials Science R&D Group Materials Science and Engineering Center Sandia National Laboratories, Albuquerque NM</p>

On occasion, the EAB reports comment on the processes and procedures that were specifically implemented for the *EP Program*. For example, the 2016 EAB report recommended:

Tracking of Engineering Physics (EP) students is very good. The efforts of [the Engineering Physics Program Chair] are appreciated, and present a model to follow. The Accreditation Board for Engineering and Technology (ABET) of that program requires that EP graduates be tracked after graduation. With this effort in place, tracking should be extended to all Physics undergraduate and graduate students.

Aside from feedback from both advisory boards, the *EP Program Committee* performed (voluntary) alumni surveys in 2014 and 2017, which included questions to the alumni whether the EP Program achieves its three *Educational Objectives*. The two surveys were sent to students who graduated between 3 and 10 years prior to the survey. The results of these two surveys are provided in Table 2.5. The results of those two surveys provide further evidence that the EP Program generally achieves its *Educational Objectives*.

Table 2.5. *Results of the 2014 and 2017 alumni response to survey questions whether the NMSU EP Program achieved its stated Educational Objectives.*

Survey	Educational Objectives	Number of Responses	Strongly Agree	Agree	No Opinion	Disagree	Strongly Disagree
2014	<i>Objective 1: Competitiveness</i>	10	2	5	2	1	
	<i>Objective 2: Adaptability</i>	10	5	5			
	<i>Objective 3: Teamwork & Leadership</i>	10	5	5			
	<i>Overall Satisfaction with Learning Experience</i>	10	3	7			
2017	<i>Objective 1: Competitiveness</i>	11	2	8	1		
	<i>Objective 2: Adaptability</i>	11	5	6			
	<i>Objective 3: Teamwork & Leadership</i>	11	3	6	1	1	
	<i>Overall Satisfaction with Learning Experience</i>	11	7	4			

All materials connected to the *Educational Objectives* of the *EP Program* are compiled in the so-called '*Black*' *Educational Objectives Notebooks* ('black' refers to the color of the notebooks). The contents of the '*Black*' *Notebooks* are listed in *Appendix E – Supplementary Documents*.