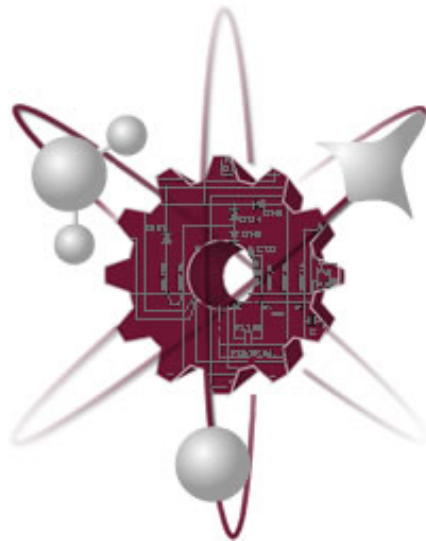


# **Criterion 2: Program Educational Objectives**

## **Engineering Physics**

**Bachelor of Science in Engineering Physics**



## **Self-Study Report**

**New Mexico State University**



**June 2012**

## CRITERION 2. PROGRAM EDUCATIONAL OBJECTIVES

This chapter describes the *Program Educational Objectives* and the processes in place to assess constituency and program needs, as well as the selection and evaluation of the educational objectives and their connection to *Institutional Educational Objectives*.

The Engineering Physics (EP) *Program Educational Objectives* were derived from strategic discussion among the Engineering Advisory Board, faculty members and staff of the Engineering Physics Program, the Mechanical Engineering Department, the Electrical Engineering Department, the College of Engineering and the University. Preparation for the ABET 2012 review has had a significant impact on the development and improvement of the educational objectives for the Engineering Physics program.

### A. Mission Statement

*Provide the institutional mission statement.*

The mission statement for New Mexico State University 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 for the 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 for the Engineering Physics Program is as follows:

*The mission of Engineering Physics at New Mexico State University is to offer an ABET-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 Engineering Physics Program Committee (with input from our External Advisory Board and representatives from the Chemical Engineering, the Mechanical & Aerospace and the Electrical Engineering programs) has recently established a 'new' set of *Program Educational Objectives* in order to best serve the needs of our constituencies and to best achieve the goals stated in the various mission statements above. The current *Program Educational Objectives* of the Engineering Physics program are listed in Table 2.1.

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

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

These *Program Educational Objectives* may be found by the general public on our Engineering Physics website at [engineeringphysics.nmsu.edu](http://engineeringphysics.nmsu.edu).

### **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.*

The *Program Educational Objectives* of the Engineering Physics program are consistent with and supportive of the institutional educational objectives of both, the College of Engineering and New Mexico State University as a whole. NMSU strategic planning activities originate at the highest level of the University in the President's office, and each of the Colleges, departments and supporting units are required to produce their own strategic plan that supports and is consistent with the overall plan of the University. In this section, we will establish the relationship of the strategic mission statements of the University, the College and the Engineering Physics program.

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.

NMSU has long supported and participated in a variety of strategic planning activities. 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 a number of 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 have to be consistent with the overall strategic mission of the University as well as those defined by the *New Mexico Commission of Higher Education (NMCHÉ)* and the *North Central Association (NCA)*.

The program goals and objectives of the University are listed in the *Strategic Directions Pamphlet* distributed to every NMSU employee. In undergraduate education, the University strives to enhance the undergraduate experience and maintain NMSU as *the university of choice* for New Mexico residents. Table 2.2 summarizes the educational objectives of the University designed to achieve this goal.

**Table 2.2. Educational Objectives of NMSU for undergraduate education.**

- **NMSU Objective 1: Academic Recognition.** To be nationally and internationally recognized for its academic programs at all academic levels
- **NMSU Objective 2: Program Quality.** To have high quality, diverse faculty, staff and student body at all academic levels.
- **NMSU Objective 3: Recognition in Research.** To be nationally and internationally recognized in research and creative activity
- **NMSU Objective 4: Economic Engine.** To serve as an engine for economic, social, educational and community development in New Mexico.
- **NMSU Objective 5: Stewardship.** To be an excellent steward of all resources.

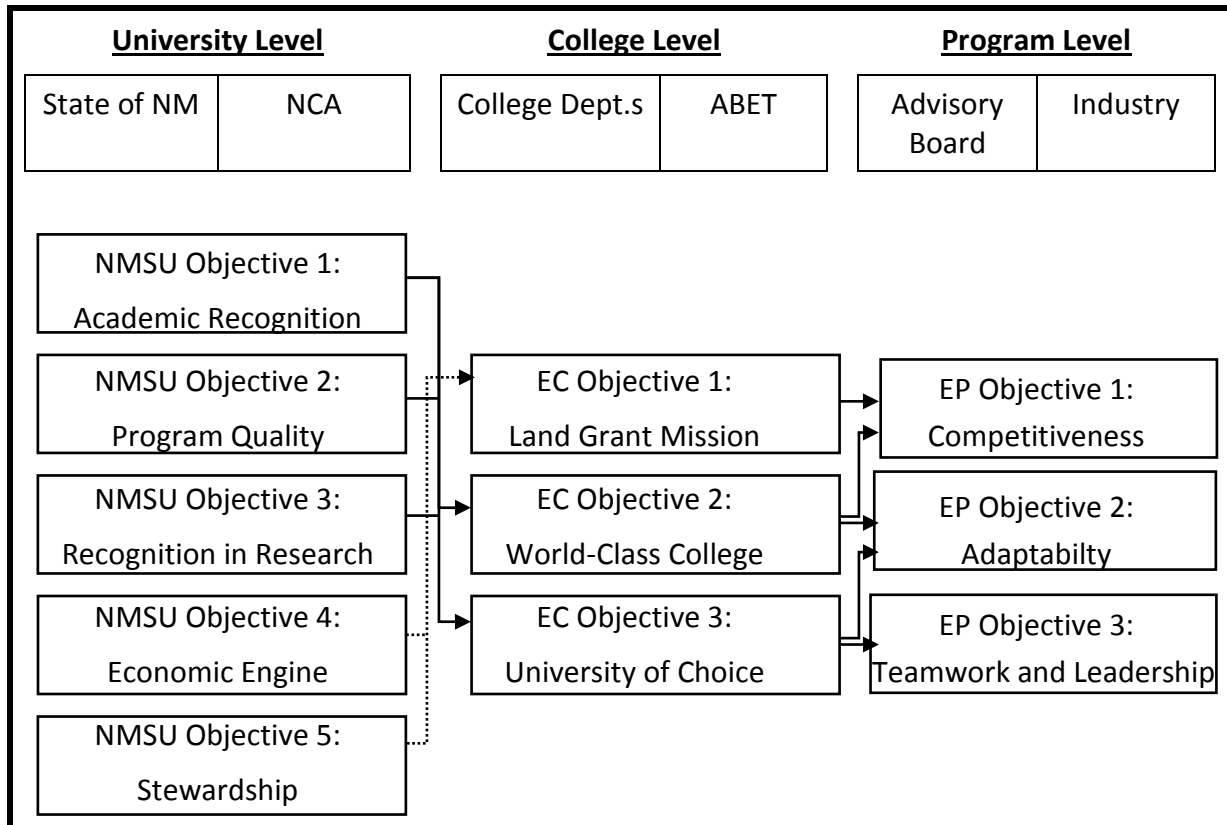
The Engineering Physics degree is administered by the College of Engineering, and as such it ought to be consistent with the educational objectives stated by the College of Engineering. The College of Engineering has established three main engineering-specific educational objectives for undergraduate education, and those are published in the *Strategic Plan of the College*. These objectives are listed in table 2.3

**Table 2.3. Educational Objectives of NMSU’s College of Engineering (EC) or undergraduate education.**

- **EC Objective 1: Land Grant Mission:** The College of Engineering will uphold the land-grant mission of NMSU through nationally recognized programs in education, research, and professional and public service.
- **EC Objective 2: World-Class College.** Provide world-class engineers and engineering technologists for industrial, government, and academic constituents of the College of Engineering.
- **EC Objective 3: University of Choice.** To be the “University of Choice” for undergraduate engineering and engineering technology education in the region.

Diagram 2.1 indicates the relationships between the educational objectives of the University as a whole, the ones of the College of Engineering and the ones of our Engineering Physics program. Obviously, the EP *Educational Objectives* are well aligned with the ones of the university and the college.

**Diagram 2.1: Relationship of institutional university- (NMSU) and college-level (EC) Educational Objectives with the Engineering Physics (EP) Educational Objectives.**



#### **D. Program Constituencies**

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

The NMSU Engineering Physics (EP) program is administered by the College of Engineering, but it is run by the Department of Physics in the College of Arts & Sciences. The EP program is administered by the Department of Physics but is a cooperative program with the Department of Chemical Engineering, Department of Mechanical & Aerospace Engineering and the Department of Electrical Engineering. Students select a specialization (concentrations) in Chemical Engineering (ChE), Mechanical Engineering (ME), Aerospace Engineering (AE) or Electrical Engineering (EE).

The Engineering Physics program has been designed such that students acquire strong fundamental knowledge in physics and the chosen engineering fields, 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 Engineering Physics 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 Engineering Physics

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 Engineering Physics 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.

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 Engineering Physics program.

**Engineering Physics (EP) students**

Students provide feedback to the program through mandatory student evaluations of each course taken, interviews with the Engineering Physics advisor each semester and senior exit interviews with the department head.

**Potential Employers (Industry, Academia, Government)**

This is probably the most important constituency group, and it is strongly represented on our External Advisory Board. The external advisory board meets once every year, typically in the spring semester. These meetings began in 2004. Members of the board provide important feedback to all aspects of the Engineering Physics program, such as required skills of graduates, educational objectives and outcomes assessment. The advisory board 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 advisory board, many of our faculty and staff members have close interactions with representatives from industry and national laboratories, and their comments and suggestions are taken into account as well. The present members of the Engineering Physics External Advisory Board (EPAB) are listed in Table 2.4.

**Table 2.4: Members of the 2011/2012 External Advisory Board of Engineering Physics program at NMSU.**

Dr. Steven Castillo, Sandia National Laboratories, Albuquerque, New Mexico
Dr. Jon Haas (Acting 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
Dr. Mark Schraad, Los Alamos National Laboratory; Los Alamos, New Mexico
Dr. John Schaub ( <i>Alumnus</i> ); Valparaiso University, Indiana
Dr. Ronald Tafoya, Intel Corporation; Albuquerque, New Mexico

Complete memberships of past External Advisory Boards are provided in *Supplementary Documentation*. In general, the Engineering Physics program hosts a 1-2 day on-campus meeting with the External Advisory Board annually.

### **Physics Faculty and Staff**

The Department of Physics holds an annual retreat 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 Engineering Physics program, the Department of Physics has created an Engineering Physics 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 Teaching are *ex-officio* members of this committee. Current membership of the Engineering Physics Program Committee can be found in the first section of this Self-Study Document (*Background Information*). The Engineering Physics 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. Although the Engineering Physics Program Committee ultimately directs all aspects of the Engineering Physics program, it relies heavily on the involvement of other faculty members in the Department of Physics and the participating Engineering Department for the ABET accreditation process as well as progress within the program. For example, this ABET Self-Study Report was produced by a collective effort involving all of the faculty members in the Department of Physics in order to ensure broad faculty participation and support. Members of the Engineering Physics Program Committee then merged individual contribution into a single document that is presented here.

### **Faculty of affiliated Engineering Programs**

The Department of Mechanical & Aerospace Engineering, Chemical Engineering and Electrical Engineering have representatives on the Engineering Physics 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 Engineering Physics program at their respective home departments in the College of Engineering.

### **Alumni**

Since its inception, the Department of Physics has tried to keep an updated list of its alumni, their addresses and their present occupation. In many cases, the department has succeeded to keep close contact with past alumni as it performs annual alumni surveys. Moreover, each of the External Advisory Boards has had alumni representation on the board.

### **Peer Institutions that offer Engineering Physics or similar majors**

We are in close contact with other academic institutions (for example, the Colorado School of Mines and Southeast Missouri State University) that also offer an Engineering Physics Programs, accredited by ABET. The External Advisory Board has a representative from such peer institutions, and we built on their experience for program progress and accreditation purposes.

## Graduate Schools

Graduate schools are an important potential destination for our students. Several of our alumni pursued advanced graduate studies in physics or engineering following their graduation from the Engineering Physics program. The curricula of the pre-existing physics and engineering programs are therefore tailored for the needs of students seeking graduate education. The External Advisory Board could benefit from some representation from graduate programs.

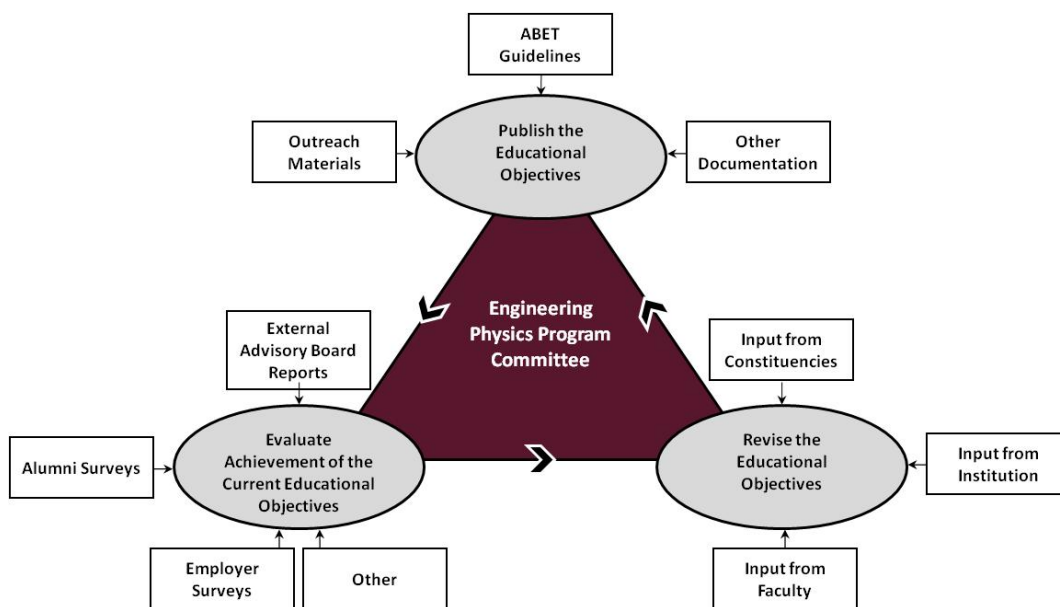
Each of the constituency groups plays an important, and often complementary, role in both the evaluation and the improvement of our Engineering Physics program. Input from our constituencies is included in the assessment of the program and we aggressively solicit their assistance in further development of our program.

### **E. Process of Evaluating and Improving Educational Objectives**

Describe the process that periodically reviews and revises, as necessary, the program Educational Objectives including how the program's various constituencies are involved in this process. Include the results of this process and provide a description of any changes that were made to the program educational objectives and the timeline associated with those changes since the last general review.

The process of defining and revising the *Program Educational Objectives* for our Engineering Physics program is an ongoing and continuous process. The Engineering Physics Program Committee is committed to continually measure, analyze and improve the *Educational Objectives*. The *Program Educational Objectives* need to be embedded into the educational goals and objectives of the institution, as stated in its mission plan. The process for establishing the *Program Educational Objectives* is shown in Diagram 2.2. The process involves three major steps, which are described next.

**Diagram 2.2. Process flow-chart for establishing and evaluating the *Program Educational Objectives* of the Engineering Physics program.**





### **Evaluate Achievement of the Current Educational Objectives**

There is a need to implement the constituency needs into the program such that it is consistent with and supportive of the strategic mission of the university and its units. Each year, program needs are addressed by the Engineering Physics Program Committee, involving faculty of the Engineering Physics program and participating engineering departments and with the advice of the Engineering Physics External Advisory Board. Alumni Surveys are probably the most important measure of achievement. Another important indicator may be Employer Surveys or other data.

### **Revise the Educational Objectives**

If needed, adjustments and improvements to the educational objectives are discussed by the Engineering Physics Program Committee, which will suggest changes and/or modifications to the objectives. Prior to implementing such changes, we will seek the advice and input from our constituencies, faculty members and institutional entities. The development of the *Program Educational Objectives* is closely tied to the departmental and institutional strategic plans.

### **Publish the Educational Objectives**

The Engineering Physics Program Committee formulates and publishes any revisions of the Program Educational Objectives, if changes have been made since the previous year. The Educational Objectives are formulated such that they capture the spirit of ABET's guidelines for Educational Objectives. The Program Educational are prominently displayed on any kind of outreach material, such as the engineering physics website, recruitment fliers etc.

Material directly connected to the *Educational Objectives* is filed in the '*Black*' *Objectives Notebook* (called 'black' because of the color of its binder). The contents of the *Objectives Notebook* are listed below.

- **'Black' Objectives Notebook** (filled in as needed)
  - Engineering Physics Program Committee meeting minutes
  - External Advisory Board Reports and meeting minutes
  - Survey Interviews
  - Exit interviews for graduating Engineering Physics students
  - Other material (employer surveys, statistics etc.)

### **Educational Objectives – Corrective Action**

In the fall of 2011, the Engineering Physics Program Committee realized that the previously stated *Educational Objectives* were no longer fully consistent with the most current definition for *Program Educational Objectives* by ABET.

Prompted by this change, the Engineering Physics Program Committee called an External Advisory Board to seek input into how to re-define the program's educational objectives. The External Advisory Board met on the NMSU campus with members of the Engineering Physics Program Committee and other faculty in January 2012. The External Advisory Board was tasked in particular to come up with some recommendation for the revision of the program's educational objectives. After a presentation given to the board outlining the need for modifications and a subsequent review of the various mission statements, the board members

can up with some initial recommendation. The board's recommendation were then condensed and summarized by the Engineering Physics Program Committee, and then put up for discussion with the rest of the physics faculty. The final version of the new set of *Program Educational Objectives* (that were introduced here) was completed soon thereafter.