

## Physics Department Program Review Fall 2010

### 1. Assessment Plan and Summary for Each Program

The Physics Department offers a total of eleven undergraduate and graduate degrees concentrated in five main areas of the program, Physics (BA, BS, MS, MAT and PhD), Applied Physics (BS), Space Physics (MS and PhD), Computational Physics (MS), and General Science (BS and MS). Each of these degrees has its own distinct curricular requirements and intended goals, and hence we conduct separate student learning outcomes assessment (SLOA) for each one of them. However, given the substantial overlap of the core areas and intended outcomes among the different degrees, we took the liberty of submitting one SLOA and one implementation summary for the graduate program and one SLOA and one implementation summary for the undergraduate program.

### 2. Program Review Narrative

#### a. Prospective Market for Graduates

The Physics Department is proud of its excellent undergraduate program with about 65 majors, and graduating about 7 students per year. Based on our records, all of our graduates were successful either in landing a job in an area related to their specialization or continued on to pursue higher education in related fields at excellent institutions. Physics students have excellent background in mathematics and computing, and they are well adapted to a logical approach to solving a scientific problem, and as such easily qualify for jobs, outside the realm of physics, related to engineering, mathematics, computer science, environmental science, finance, management, and teaching. In Alaska, we do not graduate enough engineering students to meet the states needs, and our physics graduates can meet some of that increased demand with little or no training for the job. Alaska Department of Labor ([www.labor.state.ak.us/research/iodata/occproj.htm](http://www.labor.state.ak.us/research/iodata/occproj.htm)) projects an increased (15%) need for atmospheric and space scientists over the next ten year period, and our physics graduates will be in a unique position to fill that need with a higher degree in related fields.

The graduate program in Physics is recognized worldwide for its excellence, and currently averages 25 students per year. Many of our graduate students conduct research in space physics and complex systems, and, based on our records, all of our graduates are employed in the field of their expertise. In the future, American Physical Society ([www.aps.org](http://www.aps.org)) predicts a faster than average growth rate for the physicists, and the US Department of Labor projects an increased (16%) need for physicists over the next ten years. This increased need in manpower is driven mainly due to our renewed interest in renewable energy and the increased federal research funding for NSF and DOE. Our students are easily qualified for other jobs related to applied research, development, and technology.

#### b. Unique and Significant Service Achievement by Faculty

Most of the Physics faculty are engaged in cutting-edge research and known worldwide for their expertise and leadership in the field of their specialization. Some examples of their

service to the scientific community are: Mark Conde served as the Chair of a review panel for proposals submitted to Heliophysics Division of NASA (2010), Hui Zhang, a new faculty member, had the honor of being the Guest Editor of Journal of Atmospheric and Solar-Terrestrial Physics (2009-2010), and the Co-Convenor and Co-Chair of session on Magnetospheric Response to Transient Solar Wind Features (2010 AGU Fall Meeting). Another faculty member, Martin Truffer has been continuing his service as the Associate Editor for the Journal of Geophysical Research- Earth Surface Processes since 2008. Renate Wackerbauer took the leadership role to organize a symposium on “Complex transient dynamics in extended systems”, at SIAM Conference, Utah, May 2009. David Newman provided valuable service as a Co-Editor of the AIP journal, “Computers in Science and Engineering”, and has continued his leadership role as the Co-Organizer of the annual National/International Transport Task Force Meeting.

c. Program Duplication Elsewhere

UAF is the only institution in the state-wide system that has a full-fledged program in physics that offers BA and BS degrees at the undergraduate and MS and PhD at the graduate level. Ours is the only graduate program in the state, and most of our faculty conducts research in the upper atmosphere with major emphasis on the impact of atmosphere on the environment. UAF is one of the few institutions in the US with an excellent program in space physics including rocket launch facilities, which is known nationally and internationally. Because of its unique geographical location, UAF has a distinct advantage to conduct research in space physics in an ideal environment. Our space physics program is one of the few in the nation that takes advantage of our rocket flights to advance their research.

d. Unusual Features in Demand and Productivity

Physics Department has been successful in maintaining an excellent program in physics, but it now faces some serious challenges. (1) We do not have enough faculty to meet our teaching obligations for our service courses due to an ever increasing enrollment in engineering and an increased student influx of Biological Sciences majors who are now required to take college physics for their core. (2) We anticipate that a large number of our faculty will retire in the fairly near future. If we do not get them replaced in a timely manner, it will be impossible for us to meet our teaching and research obligations. (3) It has always been a challenge to provide adequate start-up funding for the new hires.

f. Partnership in Scholarship, Equipment, or In-kind Services

Physics Department is proud to have an in-house source of scholarship, mainly from contributions from alumni, to help out our majors. Physics Department is honored to have a Computer Laboratory which is supported by the John Noyes Computer Equipment and Lab Endowment. This laboratory, although housed in physics, is open to UAF students who enroll in any physics courses and to students who participate in ASRA, and has been a tremendous help for students at CNSM with their computer needs.

a. Assessment Plans

<p style="text-align: center;"><b>UNIVERSITY OF ALASKA FAIRBANKS</b>  Department of Physics  Student Outcomes Assessment Plan  Academic Year 2009/2010</p>			
Expanded Statement of Institutional Purpose	Intended Objectives/Outcomes	Assessment Criteria and Procedures	Implementation
<p><b>MISSION:</b>  We shall provide a quality undergraduate and graduate education responsive to the needs of individual students and the diverse population of Alaska.</p> <p><b>GOAL:</b>  To assure that our graduates are adequately prepared to succeed in the job market in their chosen area of expertise.</p>	<p>1) Students will display effective understanding of basic physical principles and their application to the systems and problems of current research</p>	<p><b>ENTRY LEVEL ASSESSMENT:</b>  Undergraduate: Completion of high school prerequisites for entry to UAF</p> <p>Graduate: Formal application including official transcripts and letters of recommendation. The student's records are reviewed by three faculty and the department chair.</p>	<p><b>ENTRY LEVEL:</b>  Undergraduate: UAF Policies and Procedures</p> <p>Graduate: UAF Policies and Procedures plus department review by faculty.</p>
		<p><b>EXIT LEVEL ASSESSMENT:</b>  Undergraduate: Successful completion of the core materials.</p> <p>Graduate, Masters: Successful completion of required courses plot thesis or project.</p> <p>Graduate, PhD: Successful completion of required courses, PhD Comprehensive Exam, production of a thesis and successful defense of thesis presentation and exam.</p>	<p><b>EXIT LEVEL:</b>  Undergraduate: Department advisor plus UAF registrar assessment of UAF requirements plus department requirements for graduation.</p>



# **Outcomes Assessment for Undergraduate Programs in the UAF Physics Department**

1 February 2005

## **1.0 Applicable Degrees**

This assessment program is applicable to all undergraduate degrees for which the UAF Physics Department has responsibility. These are the BS and BA degrees in Physics and the BS degrees in Applied Physics and General Science. No distinction is made for the purpose of implementation, but there are slight differences in wording between the physics and general science questionnaires, as the general science students are concerned with science courses in many other departments other than the Physics Department.

## **2.0 Program Objectives**

The objectives of each degree program in terms of academic achievement should be clearly specified in the UAF Catalog. First, this is a single, widely available document that stipulates all degree requirements and course offerings. Second, by identifying a sole source, the possibility of stale information in a second or additional forgotten sources is eliminated. Any deficiencies in current listings will be corrected at the next opportunity in order to fulfill the needs of the assessment program.

## **3.0 Physics Department's Undergraduate Program Office**

The Physics Department operates an Undergraduate Program Office staffed by the department's administrative assistant. Supervision of the Undergraduate Program Office is the responsibility of the department chair, with leadership for mentoring of physics-related degree majors provided by departmental faculty members. A single faculty member mentors all general science majors and is responsible to the faculty for the general science program. The department's administrative assistant maintains all relevant departmental records and carries out routine communications with the UAF Registrar's Office and all current undergraduate students.

The procedure within the Physics Department for admission of students into a degree program is to accept all students who declare physics or general science as their intended degree major (unless grades are a serious concern). The department's administrative assistant routes the student's name to an assigned departmental mentor (undergraduate advisor) and so informs the student. The undergraduate faculty advisors comprise the department's undergraduate Assessment Review Committee. The department chair can be an ad hoc member if the committee so desires.

## **4.0 The Assessment Plan**

The existing assessment plan is built around a written exit survey (or "interview") that comprises two parts; set questions with numerical answers and optional written comments. The survey is submitted to each student in the last semester of his or her degree program, and can be submitted anonymously if the student so elects. Copies of the physics and general science forms used for the survey at graduation are attached herein.

## Outcomes Assessment for Undergraduate Programs in the UAF Physics Department

A follow up survey is scheduled for five years after graduation. The department's administrative assistant is responsible for organizing completion of all assessment surveys, with assistance from the mentoring faculty.

### **4.1 Yearly Assessment**

The graduation exit survey questions (physics and general science) cover four general areas: UAF, the student's degree program, program faculty, and other. They are further intended to help direct the student's thoughts to subject areas for which written comments might follow, thus providing some background into the students thinking. One historical difficulty in assessing outcomes is the existence of several variations on this survey form over the years, even if the general direction of the questions has been maintained. The form has been stabilized into its present state.

The analysis comprises two different parts. Numerical answers to exit survey questions are tabulated by year or in the case of limited graduations, several contiguous years, and averages are taken to form a compact summary of results for the cohort. Means are derived for each of the four subgroups of question areas and overall. These results are also sorted in order of decreasing mean scores to identify the four best and least appreciated subject areas.

The second part (certainly more recently anyway) comprises a written copy of all comments by the students. The objective is to look for common themes in the comments that can represent the truly outstanding areas of difficulty or areas of current success.

In addition, each student is invited to meet with either the chair of the Physics Department or a member of the Assessment Committee for a private meeting to further discuss the department's programs. This interview can be in confidence or notes can be forwarded to the assessment committee (with or without the student being identified); it is the student's choice.

It is the job of the Assessment Committee to review this information and draft a yearly report to the department chair on what has been learned from the assessment of graduating seniors.

### **4.2 Five-year Follow-up Survey/Interview and Evaluation**

This final step – the individual outcome – is crucial to a complete outcomes assessment plan. To be successful, it is necessary to not lose contact with the student. Successful students are generally easy to follow, as they remain active. Other means include alumni associations and the Physics Department's newly formed undergraduate scholarship program, in which a concerted effort will be made in cooperation with the UAF office for Advancement Services to solicit ongoing contributions to an endowed fund.

Graduates will be contacted for a follow-up interview five years after graduation. The content of each interview along with an assessment of the student's academic performance in the degree program will comprise the information for the follow-up

## Outcomes Assessment for Undergraduate Programs in the UAF Physics Department

assessment. This part of the existing plan does not appear to have been implemented and no survey document has yet been created.

### **5.0 The Yearly Report**

A yearly report of the assessment effort is prepared by the chair of the Assessment Committee and submitted to the department chair by 1 February. The committee reviews and evaluates the acquired data for the previous academic year and the five-year survey, and, based on the findings and personal judgments as to its relevance, makes recommendations to the department chair for any changes in the academic programs.

Recommendations are to be based upon clearly articulated observations by individual graduates and by themes emerging from multiple sources. An example might be repetitive comments about the basic content of a particular course over years. A more delicate example would be repetitive critical observations on an instructional method. Special handling would be required, but honest assessment by students cannot be ignored.

As to career development, the degree of professional success in later years is never a forgone conclusion. What counts in large part is if the graduate believes that his or her educational experience at UAF and in the major area in particular have been a positive benefit.

The department chair works with the drafting committee on any outstanding areas of concern. Differences of opinion are to be included in the final report. This report, with the chairs contributions, is then forwarded by the chair to the department's faculty for comments. Only then are copies submitted to the Dean of CNSM and to the Vice Provost for Academic Affairs. These are not for public distribution. No students' names are included in the report.

### **6.0 The Four-Year Report**

A formal assessment report at four-year intervals is prepared by the department chair for submission to the Vice Provost for Academic Affairs. This report is based on data collected, content of the yearly reports, Assessment Committee recommendations, and faculty actions that followed from the assessment to improve the academic curriculum and student research.

It would be highly speculative to attempt an outline of how the faculty would respond to a recommendation by the assessment committee, for it would depend in large part on the strength of data leading to the recommendation (or to know what is noise and what is signal).

A first report is expected by March 2005.

# **COVER PAGE**

## **UAF Physics Department's Exit Interview**

### **Graduating Baccalaureate Students in Physics Programs**

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The purpose of this exit interview is to capture your personal evaluation of the physics degree program that you have successfully completed. The results assist us in fulfilling one of our self-imposed obligations as part of UAF's mandated student learning outcomes assessment program, which is designed to create a feedback path from the outcome (your successful degree program) to the input (student selection and program content).

The interview comes in two parts; written and oral. The written part is completed prior to your departure from campus after final exams. It can be done anonymously or openly (by signing your name); the choice is yours. In either case, please return the completed form (in the accompanying envelope) to the department's administrative assistant in the Physics Department Office. She will preserve any requested autonomy and enter the information into a larger anonymous database from which the department will construct its outcomes assessment report for the Vice Provost for Instructional Affairs. A follow-up interview is planned for five years after graduation.

We would be particularly grateful if you would agree to an oral interview with the department chair or a member of the outcomes assessment committee. You can discuss this with the department's administrative assistant, who can arrange a meeting as per your request.

In the end, it is the substantive comments made by you that are most helpful. Positive comments tell us where we are succeeding, while constructive negative comments will be used in seeking improvements in our programs. Benefits of this adventure are that you will have given a gift to future students of our program.

The Physics Department's Undergraduate Outcomes Assessment Committee



# UAF Physics Department's Exit Interview

## Graduating Baccalaureate Students in Physics Programs

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Year Entered Program \_\_\_\_\_ Year Graduating \_\_\_\_\_

Program Degree \_\_\_\_\_ NAME (Optional) \_\_\_\_\_  
B.S. or B.A. in Physics or Applied Physics

Upon graduation, I am:

- ☐ Taking a job related to my major
- ☐ Taking a job unrelated to my major
- ☐ Continuing my studies in a professional/graduate school
- ☐ Other

Please provide an answers using this numerical scheme:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree

1. I can recommend UAF to another student. \_\_\_\_\_
2. In general, the quality of instruction at UAF is high. \_\_\_\_\_
3. In concept, the UAF baccalaureate core curriculum is a good idea. \_\_\_\_\_
4. UAF as a whole provides a stimulating atmosphere for undergraduate study. \_\_\_\_\_
  
5. I can recommend my physics degree program to another student. \_\_\_\_\_
6. I am pleased with the curriculum in my physics degree program. \_\_\_\_\_
7. The quality of instruction in the physics department is high. \_\_\_\_\_
8. Class sizes in the physics classes are appropriate. \_\_\_\_\_
9. Undergraduate research opportunities were available to me. \_\_\_\_\_
10. I had a rewarding undergraduate research experience. \_\_\_\_\_
  
11. Faculty members in the physics department provide a stimulating atmosphere. \_\_\_\_\_
12. Faculty members in the physics department are constructively involved in education. \_\_\_\_\_
13. Faculty members in the physics department are accessible and helpful. \_\_\_\_\_
14. My academic advisor in the physics department was accessible and helpful. \_\_\_\_\_
15. Teaching assistants in my lower-division labs were knowledgeable and helpful. \_\_\_\_\_
  
16. Fellow students were intellectually stimulating. \_\_\_\_\_
17. The physics department staff was accessible and helpful. \_\_\_\_\_
18. I am prepared for the next step in my professional development. \_\_\_\_\_

NEXT PAGE

**WRITTEN COMMENTS (both sides, if needed)**

If you wish, describe an area (or areas) in which the instructional program was; (a) very good; (b) acceptable or in need of minor improvements; and/or (c) sadly lacking.

Are there any general thoughts on the department that you would like to share?

*Please return this form to the Physics Department's Office in the NSF using the accompanying self-addressed envelope. It can be mailed or delivered in person. Thank you!*

**This page is to be detached by the Physics Department's Office in the NSF from all other materials in this packet.**

### **FORWARDING ADDRESS**

The outcomes assessment program includes a final interview five years after graduation. Please provide a forwarding address and assist us by letting us know of future address changes. In turn, we will keep you informed of our department's activities.

Name: \_\_\_\_\_

Address:

Email Address:

# COVER PAGE

## **UAF Departmental Exit Interview for Graduating Baccalaureate Students in the General Science Program**

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The purpose of this exit interview is to capture your personal evaluation of the general science degree program that you have successfully completed. The results assist us in fulfilling one of our self-imposed obligations as part of UAF's mandated student learning outcomes assessment program, which is designed to create a feedback path from the outcome (your successful degree program) to the input (student selection and program content).

The interview comes in two parts; written and oral. The written part is completed prior to your departure from campus after final exams. It can be done anonymously or openly (by signing your name); the choice is yours. In either case, please return the completed form (in the accompanying envelope) to the General Science Program's administrative assistant in the Physics Department Office. She will preserve any requested autonomy and enter the information into a larger anonymous database from which the department will construct its outcomes assessment report for the Vice Provost for Instructional Affairs. A follow-up interview is planned for five years after graduation.

We would be particularly grateful if you would agree to an oral interview with the department chair (Physics) or a member of the outcomes assessment committee. You can discuss this with the Physics Department's administrative assistant, who can arrange a meeting as per your request.

In the end, it is the substantive comments made by you that are most helpful. Positive comments tell us where we are succeeding, while constructive negative comments will be used in seeking improvements in our programs. Benefits of this adventure are that you will have given a gift to future students of our program.

The General Science Program's Outcomes Assessment Committee

# UAF Departmental Exit Interview for Graduating Baccalaureate Students in the General Science Program

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Year Entered Program \_\_\_\_\_ Year Graduating \_\_\_\_\_

Program Degree \_\_\_\_\_ NAME (Optional) \_\_\_\_\_  
B.S. or B.A. in General Science

Upon graduation, I am:

- ☐ Taking a job related to my major
- ☐ Taking a job unrelated to my major
- ☐ Continuing my studies in a professional/graduate school
- ☐ Other

Please provide an answers using this numerical scheme:

1= strongly disagree 2= disagree 3= neutral 4= agree 5= strongly agree

1. I can recommend UAF to another student. \_\_\_\_\_
2. In general, the quality of instruction at UAF is high. \_\_\_\_\_
3. In concept, the UAF baccalaureate core curriculum is a good idea. \_\_\_\_\_
4. UAF as a whole provides a stimulating atmosphere for undergraduate study. \_\_\_\_\_
5. I can recommend my general science degree program to another student. \_\_\_\_\_
6. I am pleased with the curriculum in my general science degree program. \_\_\_\_\_
7. The quality of instruction in the various science departments is high. \_\_\_\_\_
8. Class sizes in the science classes are appropriate. \_\_\_\_\_
9. Faculty members in the science departments provide a stimulating atmosphere. \_\_\_\_\_
10. Faculty members in the science department are constructively involved in education. \_\_\_\_\_
11. Faculty members in the science departments are accessible and helpful. \_\_\_\_\_
12. My academic advisor was accessible and helpful. \_\_\_\_\_
13. Teaching assistants in my lower-division labs were knowledgeable and helpful. \_\_\_\_\_
14. Fellow students were intellectually stimulating. \_\_\_\_\_
15. The science department staffs were accessible and helpful. \_\_\_\_\_
16. I am prepared for the next step in my professional development. \_\_\_\_\_

NEXT PAGE

**WRITTEN COMMENTS (both sides, if needed)**

If you wish, describe an area (or areas) in which the general science instructional program was; (a) very good; (b) acceptable or in need of minor improvements; and/or (c) sadly lacking. You can be specific to individual science departments in your program.

*At UAF, the Physics Department administers the General Science Program. Please return this form to the Physics Department's Office in the NSF using the accompanying self-addressed envelope. It can be mailed or delivered in person. Thank you!*

**This page is to be detached by the Physics Department's Office in the NSF from all other materials in this packet.**

### **FORWARDING ADDRESS**

The outcomes assessment program includes a final interview five years after graduation. Please provide a forwarding address and assist us by letting us know of future address changes.

Name: \_\_\_\_\_

Address:

Email Address:

Table 1: Undergraduate physics outcome assessments implementation summary

**Physics Department**

**BS, BA in Physics, BS in Applied Physics, BS in General Physics**

	<u>2007-2008</u>	<u>2008-2009</u>	<u>2009-2010</u>
<b>Assessment Information Collected</b>	Questionnaire and request for written comments.		
<b>Conclusions drawn from this information</b>	<ol style="list-style-type: none"> <li>1. Students were highly pleased with the quality of instruction, small classes, stimulating atmosphere, faculty care and accessibility.</li> <li>2. Students thought the UAF Baccalaureate Core Curriculum is a good idea.</li> <li>3. One of the respondents was not satisfied with research opportunities in the department.</li> <li>4. Students were highly satisfied with personal care, advising, and guidance of faculty advisors.</li> <li>5. Students expressed extreme satisfaction for services and help from department staff.</li> <li>6. Students suggested that the one-credit module courses need better organization, should be less involved and more fun.</li> <li>7. One of the students was not satisfied with Physics Advanced Lab (PHYS 381/382) due to out-dated equipment, lack of funding, and the method of teaching. This particular student was also not happy with PHYS 342, as the instructor did not follow the textbook.</li> <li>8. The number of responses from the graduating students is very small.</li> </ol>		



## **Resulting Curricular Changes**

1. Continue the good effort and work for a fulfilling academic experience.
2. No action needed.
3. More than 90% of our majors have had research experience before they graduate. The department should explore ways to make research opportunity possible for any student who would like to participate.
4. Physics Department has every student assigned to a member of the faculty for academic advising.
5. No action needed.
6. One-credit modules have been recently introduced in the physics curriculum, and the faculty are continuously striving to improve the quality, method of delivery, and format of these courses. For example, faculty members recently voted to re-structure these modules into sets of three showing a more cohesive correlation of their course subject matter.
7. The department does not have the resources to replace the old (but functional) equipment. The department needs to make a concerted effort to seek funding outside the department.
8. The department needs to explore ways to increase student participation, and contemplate other direct means of outcome assessments for student learning. The department is already exploring different possible options to implement. A facebook page has been created by one of our faculty members to try and keep connected to physics alumnus. Some ideas under consideration are: (1) request graduating student for email address outside of the UAF domain to keep in touch with students after graduation; (2) creating an alumni email distribution list or blog-type bulletin webpage for alumni to keep in touch with both department and other alumnus; (3) or creating a 'secure' form submittal on our webpage(s) for assessments.

**Note:** Because of low responses, the review committee did not differentiate by year, but presents assessments for the full period (2007-2010).

# Outcomes Assessment for Graduate Programs in the UAF Physics Department

10 February 2004

## 1.0 Applicable Degrees

This assessment program is applicable to all graduate degrees for which the UAF Physics Department has responsibility. These are the MS degrees in Computational Physics and General Science and MS and PhD degrees in Physics and Space Physics. It also includes interdisciplinary degree programs for which the Physics Department is the home base. No distinction is made for the purpose of implementation.

## 2.0 Program Descriptions and Objectives

The objectives of each degree program in terms of academic and research achievement should be clearly specified in the UAF Catalog. First, this is a single, widely available document that stipulates all degree requirements and course offerings. Second, by identifying a sole source, the possibility of stale information in second or more forgotten sources is eliminated. Any deficiencies in current listings will be corrected at the next opportunity in order to fulfill the needs of the assessment program.

The graduate physics curriculum at UAF is based on core foundation physics courses and specialty courses directed to areas of local interest. For the MS and PhD physics programs, the academic subjects include such core areas as classical and quantum mechanics, electromagnetic theory, and mathematical physics, as well as specialty courses such as fluid and statistical mechanics, numerical simulations, and time-series analysis. In the MS and PhD space-physics program, the focus is more on the physics of upper atmosphere, ionospheres, magnetospheres, and the interplanetary medium, with emphasis on Earth and its near environment. Here the program includes core foundation academic courses in classical mechanics, electromagnetic theory, and mathematical physics, and specialty courses such as plasma physics, auroral physics, aeronomy, magnetospheric physics, numerical simulations, and time-series analysis. The MS computational physics program places greater emphasis on computational modeling and simulation techniques, with local emphasis on processes in Earth's environment and a reduced breadth of exposure to the core physics program. Students in all programs are provided an introduction to instructional issues through one-year service as teaching assistants in a mentored environment.

Students in the MS program elect a thesis or non-thesis (i.e., project) track. The thesis track is recommended when the short-term objective includes a good grounding in the fundamentals of physics and its applications to physical problems in a selected area of concentration, and an introductory exposure to research techniques and scientific and technical writing. In this case the longer-term objective is frequently advanced work, as in a PhD program, but can also include academic teaching at institutions in which research does not have a strong presence. The project-oriented track is recommended for students whose objective interest is in the MS as a final degree and careers that do not emphasize research but focus more on technical knowledge and writing. Here, careers include aerospace industry and government laboratories.

## Outcomes Assessment for Graduate Programs in the UAF Physics Department

The PhD program requires the same solid grounding in the fundamentals of physics or space physics, and its applications, but adds an intense exposure to research techniques and scientific and technical writing. Included is a challenging requirement that demonstrates greater depth of acquired knowledge in the fundamentals through an intense written examination. Career opportunities are much broader, including academic positions at colleges and universities, and positions that lead to leadership roles in government and industrial laboratories.

### **3.0 Physics Department's Graduate Program Office**

The Physics Department operates a Graduate Program Office staffed by one half-time administrative secretary. Supervision of the Graduate Program Office is the responsibility of the department chair, with leadership for review of graduate applications presently provided by two faculty members (co-chairs of the graduate admissions review committee). All other faculty members participate as members of the review committee by providing individual reviewers. The program secretary maintains all departmental graduate records and carries out routine communications with the UAF Graduate School, the UAF Admissions Office, applicants for the physics graduate programs, and all current graduate students.

The well-established procedure within the Physics Department for selection of graduate students begins with a review of all submitted materials. The review committee chairs route an applicant's complete file to three faculty members, who provide independent reviews that are based on the breadth and success of the undergraduate experience, with emphasis on outcomes in physics, mathematics, and relevant other courses (e.g., astronomy, astrophysics, etc.), the cumulative GPA, content of the applicant's personal letter, the strength of three outside letters of recommendation, and results of the GRE examination, including the examination in physics (and the TOEFL where applicable). Each faculty member's review is centered on substantive comments concerning the applicant's strengths and weaknesses. No further faculty effort is requested at this stage, unless special circumstances are warranted for early research work and concomitant funding. The review committee chairs then make a recommendation for acceptance or rejection based in largest part on the content of the file and the substance of the three independent faculty reviews. The department chair confirms the decision or works with the committee chairs if another outcome is suggested. The program secretary communicates to the applicant the committee's decision.

Because of its close association with all materials related to the application and its review, the review committee chairs and the department chair comprise the department's assessment review committee.

#### **4.0 Outline of the Assessment Plan**

A program that evaluates educational outcomes must have a beginning, should, for perspective, follow the student's progress within a degree program, and must have an ending, successful or not. It must be based upon a process that is not onerous to a heavily burdened faculty and administrative staff, or it will simply fail. Lastly, the plan must provide a viable means through which a committee can routinely obtain and summarize relevant information for the assessment of its educational practices and provide suggestions for improvements.

The plan previously implemented by the Physics Department is improved and further clarified herein to capture and evaluate relevant data gained within a period from first contact through a final review five years after graduation. The data-gathering requirements are based largely on processes already in place and on data that must be obtained in the post-graduation period of professional development by the former graduate student. There are two objectives; (1) provide a student-based assessment of the academic and research programs in the educational experience and (2) provide a faculty-based assessment of a student's development from acceptance into a graduate program through establishment of a post-graduate career. Collectively, these assessments form the bases for recommendations to the departmental faculty for any modifications to the degree program and its processes.

The first parts of this plan are the most mature in that many parts have been functioning for decades. It is the latter parts of the plan that are less well developed and may well evolve during implementation. For example, no five-year surveys have yet been gained.

#### **5.0 Details of the Plan**

##### **5.1 Student File at Entrance into a Degree Program**

###### **5.1.1 Process**

A student's entry into a physics or general science graduate degree program is accompanied by the automatic creation of an assessment file into which is compiled all reviewers' evaluations of strengths and weaknesses and a synopsis of undergraduate performance (as assembled by the assessment committee). The program secretary transcribes the relevant data into individual files. Assessment of outcomes is independent of assessment of academic progress, and does not constitute an element of the student's academic file.

###### **5.1.2 Assessment**

During the application and review period (usually beginning in the fall and extending through the following spring semester), it is generally possible, based on experience, to classify applicants in four categories: excellent (3); acceptable (2); marginal (1); and unacceptable or rejected (0). For applicants in the highest classification, offers are generally issued immediately upon completion of the review process, and, at a more

## Outcomes Assessment for Graduate Programs in the UAF Physics Department

deliberate pace, as many offers as are necessary from the second classification may be made to fulfill the total number of open teaching and research positions. It is not unheard of to make a few offers within the third classification. Upon completion of all graduate acceptances for the fall semester, the cohort classification (3,2,1) is reviewed and made final. This classification along with the substantive statements on strengths and weaknesses by the three initial departmental faculty reviewers and the other supporting information are entered into the department's assessment file for each applicant that enrolls in the physics program at UAF.

### **5.2 Tracking Student Performance**

#### **5.2.1 Process**

The first year of a graduate student's career is nominally spent in academic coursework and as a teaching assistant to the lower-division undergraduate courses. This work is supervised by the department's teaching laboratory supervisor. It is expected that each graduate student will become associated with a faculty mentor by the end of the second semester and will immediately form a graduate advisory committee. Failure to do so is considered by CSEM to be grounds for dismissal from the graduate program.

Beginning with formation of the graduate advisory committee, a graduate student meets formally with his or her graduate advisor (research mentor) and graduate advisory (thesis) committee once a year to review academic and research progress towards the intended degree. Written substantive comments by the committee provide snapshots of the student's development from the perspective of the mentor and the committee. Individual substantive comments are encouraged. These comments are especially informative and pertinent for outstanding successes or difficulties in a year or over years, and especially in case of an unsuccessful outcome. It is important that the mentor and committee members understand and appreciate the importance of their obligations to the assessment process.

#### **5.2.2 Assessment**

Substantive comments by the graduate advisory committee and the committee's overall evaluation of progress as satisfactory, conditional, or unsatisfactory are used by the assessment review committee to classify the cumulative history of annual reviews as excellent (3), acceptable (2), marginal (1), or unacceptable (as in termination) (0). This classification, supportive summary statements by the assessment committee, and yearly substantive comments by the advisory committee in its yearly reports are entered into the student's assessment file and updated yearly.

In the event that a graduate student does not meet the college and university requirements for good standing, the student can be removed from the degree program. In this case, the assessment committee will enter a brief explanation into the file.

### **5.3 Exit Survey/Interview and Evaluation**

#### **5.3.1 Process**

An exit survey instrument has been in existence for many years and while it appears to be somewhat viable, a faculty review is warranted. This survey is conducted when the thesis or project has been completed and approved by the student's graduate advisory committee. The department chair and college dean are not supposed to sign the final thesis or project documents until the exit survey has been completed. The program secretary organizes completion of the written survey. The assessment committee carries out any personal interview. There is some question about multiple exit interviews: department, CSEM dean, and the Graduate School. Are we collectively overdoing it?

#### **5.3.2 Assessment**

This third stage comprises two different aspects. As part of the faculty evaluation, the assessment committee uses the student's immediate plans and success of the thesis or project as a measure of outcome from the faculty perspective. The assessment committee relies on substantive comments by the graduate advisory committee following the thesis (or project) defense and on answers provided by the student in a standardized exit survey document. Again, a simple 4-level scoring system is used: excellent (3), acceptable (2), poor (1), or unacceptable (as in termination) (0).

The second part comprises the student's evaluation of the program in the standardized exit survey and an optional personal interview with a member of the assessment committee. This information represents the first formal assessment of the program from the student's perspective. Again, the assessment committee will review the survey and interview results and then score the results using the simple 4-level scoring system excellent (3), acceptable (2), poor (1), or unacceptable (0), but in this case to rank the program from the former student's perspective. Written, substantive comments by the graduate are encouraged to provide context for responses to survey questions.

### **5.4 Five-year Follow-up Survey/Interview and Evaluation**

#### **5.4.1 Process**

This fourth and final step is crucial to a complete outcomes assessment plan; the professional outcome. To be successful, it is necessary to not lose contact with the student. Successful students are generally easy to follow, as they remain professionally active. Other means include alumni associations and the Physics Department's newly formed undergraduate scholarship program, in which a concerted effort will be made in cooperation with the UAF Development Office to solicit ongoing contributions to an endowed fund.

The current plan is retained for now; graduates will be contacted for a follow-up interview five years after graduation. This part of the existing plan does not appear to have been implemented. [There is no known document for this survey, so one is being created.]

## Outcomes Assessment for Graduate Programs in the UAF Physics Department

### **5.4.2 Outcomes Assessment**

This fourth and final stage also comprises two different aspects; faculty evaluation and graduate evaluation. Each evaluation is based upon the willing participation by the graduate. The graduate's assessment of the graduate program is gained using a standardized five-year survey and an optional interview with a member of the assessment committee (presumably by telephone). The same four-level scale is used to summarize the standardized survey. Substantive comments by the graduate are encouraged.

The assessment committee's evaluation is based upon the success of the graduate in his or her further professional development (e.g., advancement to a Ph.D. program in the case of a MS degree student; employment satisfaction, etc.), again using a four-level scale and substantive comments.

A successful outcome does not necessarily mean that the graduate is professionally employed and actively using his educational experiences from physics. The question is more subjective; do the faculty and the student each perceive that the educational experience has further developed the individual intellectually to his or her personal and economic benefit; does the student look upon the department's program as having been a positive influence on his or her life? This is probably not quantifiable in any simple manner.

### **6.0 The Yearly Report**

A yearly report of the assessment effort is prepared by the chairs of the assessment review committee and submitted to the department chair by a date not yet established. The committee reviews and evaluates the acquired data and, based on the findings and personal judgment as to its relevance, makes recommendations for any changes in the academic or research programs.

Recommendations are to be based upon clearly articulated observations by individual students and graduates and by themes emerging from multiple sources. An example might be repetitive comments regarding the basic content of a particular course over years. A more delicate example would be repetitive critical observations on an instructional method. Special handling would be required, but honest assessment by students cannot be ignored. The faculty assessment of students provides a means by which relative weights can be assigned to individual student assessments; e.g., overall excellent performance and highly successful career development versus a long-term minimalist effort to just get by. The degree of professional success in later years is, however, not a forgone conclusion. Equally important can be suggestions for changes in the process of graduate student selection; e.g., insufficient undergraduate performance in a key physics course.

The department chair works with the assessment committee on any outstanding areas of concern. Differences of opinion are to be included in the final report. This report is then forwarded by the chair to the department's faculty for comments. Only then are copies

## Outcomes Assessment for Graduate Programs in the UAF Physics Department

submitted to the Dean of CSEM dean and to the Vice Provost for Academic Affairs. These are not for public distribution. No students' names are included in the report.

### **7.0 The Four-Year Report**

A formal assessment report at four-year intervals is prepared by the department chair for submission to the Vice Provost for Academic Affairs. This report is based on the data collected, content of the yearly reports, assessment committee recommendations, and faculty actions that followed from the assessment to improve the academic curriculum and student research.

It would be highly speculative to attempt an outline of how the faculty would respond to a recommendation by the assessment committee, for it would depend in large part on the strength of the data leading to the recommendation; to know what is noise and what is signal.

A first report is expected by March 2004.



# **COVER PAGE**

## **UAF Physics Department's Exit Interview**

### **Graduating M.S. and Ph.D. Students in Physics Programs**

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The purpose of this exit interview is to capture your personal evaluation of the physics degree program that you have successfully completed. The results assist us in fulfilling one of our self-imposed obligations as part of UAF's mandated student learning outcomes assessment program, which is designed to create a feedback path from the outcome (your successful degree program) to the input (student selection and program content).

The interview comes in two parts; written and oral. The written part is completed prior to the department chair signing your final paperwork; e.g., MS thesis or PhD dissertation. For a MS project, it may have to be completed before signing the Report of Examination. It can be done anonymously or openly (by signing your name); the choice is yours. In either case, please return the completed form (in the accompanying envelope) to the department's administrative secretary in our Graduate Program Office. She will preserve any requested autonomy and enter the information into to a larger anonymous database from which the department will construct its outcomes assessment report for the Vice Provost for Instructional Affairs.

We would be particularly grateful if you would agree to an oral interview with a member or members of the outcomes assessment committee. You can discuss this with the GPO administrative secretary, who can arrange a meeting as per your request.

In the end, it is the substantive comments made by you that are most helpful. Positive comments tell us where we are succeeding, while constructive negative comments will be used in seeking improvements in our programs. Benefits of this adventure are that you will have given a gift to future graduate students of our program.

The Graduate Outcomes Assessment Committee:  
Scott Bailey, Martin Truffer, and John Craven

# UAF Physics Department's Exit Interview

## Graduating M.S. and Ph.D. Students in Physics Programs

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Year Entered Program \_\_\_\_\_

Year of Graduation \_\_\_\_\_

Program Degree \_\_\_\_\_ NAME (Optional) \_\_\_\_\_  
M.S. or Ph.D. in Physics, Space Physics, Computational Physics

- Upon graduation, I am:
- ☐ Taking a job related to my area of specialization
  - ☐ Taking a job unrelated to my area of specialization
  - ☐ Continuing my studies in a professional/graduate school
  - ☐ Taking a post-doctoral position
  - ☐ Other

Please provide answers using this numerical scheme:

1= strongly disagree    2= disagree    3= neutral    4= agree    5= strongly agree

1. I can recommend UAF to another student. \_\_\_\_\_
2. UAF as a whole provides a stimulating atmosphere for graduate study. \_\_\_\_\_
3. I can recommend my graduate physics degree program to another student. \_\_\_\_\_
4. I am pleased with the curriculum within my degree program. \_\_\_\_\_
5. The quality of instruction in the physics department is high. \_\_\_\_\_
6. Faculty members in the physics department provide a stimulating atmosphere. \_\_\_\_\_
7. Faculty members in the physics department are accessible and helpful. \_\_\_\_\_
8. The quality of research work in the physics department and/or GI is high \_\_\_\_\_
9. I am pleased with the research experience in my degree program. \_\_\_\_\_
10. My graduate advisor was constructively involved in my research \_\_\_\_\_
11. My graduate advisory committee contributed to my research experience. \_\_\_\_\_
12. I had access to modern equipment in my research program. \_\_\_\_\_
13. My research work was adequately funded. \_\_\_\_\_
14. My experience as a TA was rewarding. \_\_\_\_\_
15. Fellow students were intellectual stimulating. \_\_\_\_\_
16. The Graduate Program Office was accessible and helpful. \_\_\_\_\_
17. I am prepared for the next step in my professional development \_\_\_\_\_

NEXT PAGE

27 april 2004 / jdc

**WRITTEN COMMENTS (both sides, if needed)**

If you wish, describe an area (or areas) in which the instructional program was; (a) very good; (b) acceptable or in need of minor improvements; and/or (c) sadly lacking. Comments regarding the TA program can be included here; e.g., faculty participation, lab organization, etc.

If you wish, describe an area (or areas) in which the research program was; (a) very good; (b) acceptable or in need of minor improvements; and/or (c) sadly lacking.

**Please return this form to the Physics Department's Graduate Program Office using the accompanying self-addressed envelope. It can be mailed or delivered in person. Thank you!**

**This page is to be detached by the GPO from all other materials in this packet.**

**FORWARDING ADDRESS**

The outcomes assessment program includes a final interview five years after graduation. Please provide a forwarding address and assist us by letting us know of future address changes. In turn, we will keep you informed of our department's activities

Name \_\_\_\_\_

Address

Table 1: Graduate physics outcome assessments implementation summary

**Physics Department**

**MS, PhD in Physics and Space Physics, MS in Computational Physics, MS in General Science**

	<u>2007-2008</u>	<u>2008-2009</u>	<u>2009-2010</u>
<b>Assessment Information Collected</b>	Questionnaire and request for written comments.		
<b>Conclusions drawn from this information</b>	<ol style="list-style-type: none"> <li>1. Most of the students were highly pleased with their research experience, degree program, advisor and faculty.</li> <li>2. Some of the students expressed dissatisfaction with some elements of instruction concerning graduate courses PHYS 631/632 and PHYS 622.</li> <li>3. A small fraction of students were not happy with available research funding.</li> <li>4. Some students were not pleased with department website for not having enough information about the research activities of the faculty and information about student body.</li> <li>5. One of the participating students was not happy about the inter-departmental communication between the faculty and students regarding personnel changes in the department.</li> <li>6. Some of the students expressed dissatisfaction over not having advanced courses in Quantum Mechanics and Plasma Physics (outside the curriculum) taught by the department.</li> <li>7. Some of the students would have liked more faculty involved teaching the graduate courses.</li> <li>8. A small fraction of the respondents were dissatisfied with the fact that the faculty are not more involved in managing the labs, TAs and Lab Supervisor.</li> </ol>		

## **Resulting Curricular Changes**

1. Continue with what we are doing with our research programs and quality of instruction.
2. Assessment Committee will re-visit the issue, examine the reasons for dissatisfaction, and, if necessary, will suggest remedies to the instructor(s) concerned.
3. Every effort is made by the faculty to support all graduate students on research assistantship, but the department needs to make a concerted effort to bring more funding, so that all students can have financial support to continue research.
4. The department is already working to improve the website to attract prospective students and provide more information about the continuing students.
5. The department will make every effort to have a better communication between the faculty and students through our website.
6. The department would be happy to expand its curriculum to include more courses to meet students' interest, but because of small size of faculty and the limited number of graduate students, it is extremely difficult to offer courses outside of our core.
7. Given the nature of faculty appointment (half-time, quarter-time), it is extremely difficult to spread the teaching in a more uniform manner, although we do try to rotate faculty when possible.
8. The department has hired a new Lab Supervisor and has a committee to oversee the labs and lab related matters. The instructors for the lab courses are now involved, along with the Lab Supervisor and TAs, in an effort make the labs more effective for the students.

**Note:** Because of low responses, the review committee did not differentiate by year, but presents assessments for the full period (2007-2010).

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