Graduate Degree Program Self-Study:
Department Overview

Department Physics

After evaluating the completed self-study documents for all of the graduate degree programs in your department, what changes, if any, would you recommend? Please respond as concisely as possible in the table box below, limiting your response to no more than 2 pages, 12-point font.

Please use the signature block below to indicate approval by the department head.

Department Head Approval:

Jan J. Sojka	Jan J. Sojka	2/28/12
Printed Name	**Signature**	**Date**

By **March 1, 2012**, submit electronic copies of this department overview document **and** the self-study documents for all graduate degree programs, with a copy to your academic dean, to:

Dr. Mark McLellan
Vice President for Research and Dean of the School of Graduate Studies
Mark.McLellan@usu.edu
Subject: Grad Program Review: (insert department name here)

Graduate Degree Program Self-Study:
Department Overview

Department | Physics

After evaluating the completed self-study documents for all of the graduate degree programs in your department, what changes, if any, would you recommend? Please respond as concisely as possible in the table box below, limiting your response to no more than 2 pages, 12-point font.

Our graduate degree programs consist of PhD in physics, MS in physics and MS in upper atmospheric physics. The PhD program is by far the principal player here. It contains the bulk of our students and is extensively supported by TA and RA funds. Consequently, our analysis and recommendations mainly apply to the PhD program. The MS in physics program allows for plans A, B, C with various degrees of research accomplishment and/or training for specific career goals. The MS in upper atmospheric physics exists to take advantage of a special relationship with the United States Air Force. It is currently dormant.

Recently the Physics Department has initiated a number of changes to its graduate program. These changes were initially motivated by ongoing faculty discussions on how to better the program. The self-assessment and external assessment provided by the 2009 Regents Review process, whose recommendations centered on improving the graduate program, provided impetus to move things forward significantly. Thus the current Graduate Degree Program Self-Study finds us at the beginning of a significant revision of our programs, which we summarize as follows.

In broad terms, the department desires to: (1) increase the quality of its students; (ii) update curricular offerings to be more efficient and more effective for the students (iii) improve faculty-student interaction to enhance student moral and to facilitate their successful progress through our system.

Recruiting

Each research group has made a high quality brochure which can be distributed to potential students and also appears electronically on our website. These brochures highlight exciting aspects of our various research programs and indicate how students can become involved.

Interviews with students have made it abundantly clear that the most significant source of information about the Physics Department for students is the department website. In particular, the website also provides the most common first impression a prospective student will get of the department. We have completely overhauled our website and are still working to optimize it from a recruiting perspective.

We have begun bringing our most promising graduate student applicants for visits to the department. We feel such visits improve our graduate recruiting efforts on two fronts. First, while we regularly get applications from students who seem of high quality and a good match for our programs, often we find we simply cannot compete with comparable schools if only because of our relatively low TA stipends. So we feel we must do something extra for these kinds of students. Second, we find our most successful students are those who come here with their research interests already well-matched with those of our faculty. Visits to USU help us align the students' interests with those of the faculty. Such visits also provide a good way to filter out the students who are not a good match with our program.

It has long been our belief that we lose many good prospective students to peer institutions which are paying anywhere from 50% to 100% more for their TAs. Unfortunatlely, we have no resources to unilaterally increase our TA stipends to make us competitive with our peer universities. However, we are currently experimenting with using departmental F&A money to provide an approximate 25% increase in the TA stipend for incoming students. We are redoubling our efforts to support rapid transition of students from TA to RA.

Curriculum

The new graduate course curriculum, implemented in Fall 2011, consists of a rigorous 2 year sequence of courses which all students must take. Besides the usual core courses needed to give depth and

breadth to potential PhDs, the new physics graduate curriculum includes two new, less traditional types of courses. These courses are meant to facilitate the student's movement into PhD research and to provide valuable skills needed by our students to be competitive for funding before and after they graduate.

Mentorship

At our behest, the graduate students now elect a student representative to the faculty. This student attends faculty meetings (where appropriate) and is a principal contact for formal faculty student interaction. In the past year we have initiated a regular series of graduate student-faculty meetings. These monthly meetings, administered by the Department Head and Assistant Head, are open to all faculty and graduate students. Another way students "learn the ropes" is by interaction with our Graduate Student Tracking committee. Finally, we are now implementing exit interviews with all graduate students as they finish their degrees. This allows us to collect valuable assessment data on student attitudes toward the program, on any specific problems which arise, and on placement of our students in the job market.

Please use the signature block below to indicate approval by the department head.

Department Head Approval:

Printed Name **Signature** **Date**

By **March 1, 2012,** submit electronic copies of this department overview document **and** the self-study documents for all graduate degree programs, with a copy to your academic dean, to:

Dr. Mark McLellan
Vice President for Research and Dean of the School of Graduate Studies
Mark.McLellan@usu.edu
Subject: Grad Program Review: (insert department name here)

Graduate Degree Program Self-Study

Department	Physics
Degree Program	MS - Upper Atmospheric Physics

For each graduate degree program in your department, complete this self-study by entering responses and data in the table boxes in this document. Please respond as concisely as possible. The total length of this completed document should not exceed 14 pages, 12-point font.

The self-study is organized into questions regarding the overall nature of each graduate degree program and the critical components of recruiting, mentoring, management, and funding.

Overall

What is the purpose and mission of this graduate degree program?

This plan A MS degree was created specifically for the United States Air Force (USAF) to provide graduates with physics knowledge of the upper atmosphere and space environment. The USAF has responsibility for weather forecasting for the entire Department of Defense and "weather" includes the upper atmosphere and near space environment. Hence, the USAF was required to educate officers from their weather command to both an MS and PhD level in upper atmospheric physics.

Each Air Force officer candidate for our MS program is carefully screened by the USAF to ensure a high academic standard was maintained. A candidate has 18 to 21 months to complete the MS. The 18-21 months is challenging for most schools since courses must be offered as needed and a bona fide research topic completed to thesis level. USU has the distinction of success in meeting these objectives, both in class preparation and in research often leading to a publication. It is also noteworthy that each officer is sent to USU on assignment and so is expected to "do what it takes" to complete on time. TA activities or employment for funds are not part of these students short tenure here at USU; they are on full USAF salary.

Currently at USU, we still educate the USAF PhD candidates via our regular PhD program. About a decade ago, after our program had successfully graduated almost 40 officers with a Plan A MS in this program, the Air Force decided the number of these officers was large enough such that it was more effective to have their own MS program at the Air Force Institute of Technology (AFIT). Hence, we have not received further influx of USAF officer candidates for this MS program.

At the present time with significant budget reductions in the DoD being planned, there is the possibility that as the number of officers being trained at the MS level decreases, the USAF may decide to outsource its MS degrees once again. In that case, USU's program, its heritage, as well as its ongoing success with the USAF officers graduating at USU with a Physics PhD would likely send such MS candidates to USU as an established, known, high-quality school. For this reason we maintain the existence of this currently dormant program; it costs us no resources to do so.

Conventional (non-USAF) MS students can achieve upper atmospheric specialization through the conventional Physics MS degree. The 18-21 month MS, from BS level, for regular students is an unreasonable requirement.

What are the core strengths of this graduate degree program?

USU has a tenured and research faculty and curriculum well-prepared to meet the tight timeline imposed by the USAF for completion of this degree. The officers sent to enter this program have all been screened for academic aptitude at threshold levels significantly higher than would normally be

applied for entry to our Physics MS program. Hence, this MS cohort was always at a uniformly high ability level.

What are the primary needs to achieve and advance the purpose/mission of this degree program?

The USAF along with other departments of the DoD, are developing plans to absorb significant fiscal cuts. The AFIT MS program may well have too few students to remain viable at AFIT. In that scenario, the USU MS program would be able to meet the USAF studen demand. Hence, keeping this dormant MS available is a strategic move by USU.

Recruiting

Recruiting criteria include, but are not limited to, academic preparedness (GPA, standardized test scores, prerequisite degrees); diversity (gender, race, ethnicity, citizenship); number of applied/admitted/enrolled students

What types and numbers of students are you targeting for this graduate degree program?

USAF students

What recruiting strategies are you currently using?

None - this is a dormant program until the USAF uses us again

How effective are these strategies?

How do you evaluate recruiting effectiveness?

What would be required to be more effective in recruiting students for this graduate degree program? (list in rank order)

1.
2.
3.

Extend list as needed

Mentoring

Mentoring criteria include, but are not limited to, preparation for future career; scholarly development; professional community participation; appreciation for diversity; collaborative opportunities

Please provide the following supporting data on students in this graduate degree program:

	2008-2009	2009-2010	2010-2011
Number of research/scholarly presentations (or exhibitions, performances, etc. as appropriate) made by students in this program at state, regional, national, or international meetings			
Total number of peer-reviewed publications whose primary author is a student in this program			
Total number of peer-reviewed publications where a student in this program is a co-author			
Number of students from the previous year's graduating class that have found employment in the field			

Comment on data relevant to mentoring students in this degree program not captured in the table above.

This program is currently dormant

What mentoring strategies are you currently using?

How effective are these strategies?

How do you evaluate mentoring effectiveness?

What would be required to be more effective in mentoring students in this graduate degree program? (list in rank order)

1.
2.
3.

Extend as needed

Management

Management data and criteria include, but are not limited to, the faculty and their scholarship, opportunities for and placement of graduates; average time to degree completion; degree completion rates; frequency of course offerings; graduate enrollment numbers (headcount and FTE); retention; number of degrees conferred; credit requirements; specializations offered; faculty resources

Please provide the following supporting data on faculty with a terminal degree who teach courses or mentor students in this graduate degree program:

	2008-2009	2009-2010	2010-2011
Number of faculty			
Average number of peer-reviewed publications (or books, exhibitions, performances, etc. as appropriate) per faculty member			
Number of faculty who received extramural grants for research			
Average dollar amount per faculty member of extramural grants received			

Comment on the data relevant to managing this graduate degree program not captured in the table above.

This program is currently dormant.

What are the professional/career opportunities for graduates of this degree program? Comment on the need for and viability of this program in terms of the graduate placement market.

Graduates from this program continue their USAF career.

How is this information communicated to potential and current students?

What strategies are used to keep this degree program current in terms of its:

a) Philosophy?

b) Methodology?

c) Technology?

What is the targeted time to completion for students in this degree program?

How is this information communicated to potential and current students?

In the past 3 years, how many students have completed their degrees within this targeted time? (numbers of students completing on time vs. total number of students)

What are the factors that affect completion?

If improvements are needed, what are they?

What is the minimum number of credits currently required for this graduate degree program?

30, per USU requirement

How does the number of required credits comply with standards in the discipline/field (e.g., accrediting agency, professional certification board and/or peer degree program)? Would you increase or decrease required credits to degree, and why?

This is a typical credit load.

What changes, if any, should be made to the current specializations offered for this degree?

What would be required to make this graduate degree program more effective?

Funding

Funding criteria include, but are not limited to, funding sources (departmental, institutional, contracts, grants); percentage of students receiving support via tuition awards, assistantships, fellowships; average level and duration of support; selection process for tuition awards, fellowships, assistantships

Please fill in the following chart to show the number of students funded by type and level of funding (FTE), and the average amount of funding per student for 2008-2009, 2009-2010, and 2010-2011:

		2008-2009	2009-2010
Number of students funded by type and level of funding (FTE) per year		#	#
a) Externally funded fellowships, traineeships, & internships only	Full support (0.5 FTE)		
	Partial support (<0.5 FTE		
b) USU fellowships only	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
c) Teaching assistantships (departmental) only	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
d) Research assistantships from internal sources only (UWRL, UAES, department, etc.)	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
e) Research assistantships from external grant/contract sources only	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
f) Administration or other assistantships only	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
g) Combination of external support (a) with fellowships (b), or assistantships (c, d, e, &/or f)	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
i) Combination of USU fellowships (b) with assistantships (c, d, e, &/or f))	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
j) Combination of different types of assistantships (c, d, e, &/or f)	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
k) Other Describe:	Full support (0.5 FTE)		
	Partial support (<0.5 FTE)		
Number of self-funded students per year			
Total numbers of students per year			
Average amount of funding per student per year		**$**	**$**
a) Full support (0.5 FTE)			
b) Partial support (<0.5 FTE)			

Comment on data relevant to funding students in this graduate degree program not captured in the table above.

This MS degree is currently dormant. All funding for students comes via the USAF.

Comment on the sources and relative proportions of funding available to students in this graduate degree program.

Describe the adequacy and appropriateness of the current level of funding for recruiting and retaining graduate students to completion in this degree program.

Describe the adequacy and appropriateness of the current level of funding for recruiting and retaining faculty to build and sustain this degree program.

What could be done to more effectively fund graduate students in this degree program? (list in rank order)

1.
2.
3.

Extend list as needed

Are there any important aspects in evaluating this graduate degree program that have not been captured in the information above? If so, please comment.

Graduate Degree Program Self-Study

Department	Physics
Degree Program	MS in Physics

For each graduate degree program in your department, complete this self-study by entering responses and data in the table boxes in this document. Please respond as concisely as possible. The total length of this completed document should not exceed 14 pages, 12-point font.

The self-study is organized into questions regarding the overall nature of each graduate degree program and the critical components of recruiting, mentoring, management, and funding.

Overall

What is the purpose and mission of this graduate degree program?

(1) To train professional physicists who are needed worldwide in pure research, applied research and education. (2) To support the department's educational mission via Teaching Assistants. (3) To support the department's research mission via Research Assistants.

In Physics the MS degree is not generally needed by those pursuing the PhD degree. The MS degree is usually sought by students who need to have some additional training beyond the bachelors degree to support their profession, e.g., as an instructor or laboratory technical specialist.. Some students engage the MS program because they are trying to see if they are interested in investing themselves in PhD level work. Some of our undergraduates remain here to get an MS in order to be more competitive in application to other schools for the PhD degree.

The MS in physics program allows for plans A, B, C with various degrees of research accomplishment and/or training for specific career goals.

What are the core strengths of this graduate degree program?

We are a relatively small program with considerable flexibility to meet students' needs. Our research groups all are nationally prominent and externally funded. A number of our researchers interact extensively with various types of technology in their experimental apparatus. Such researchers can easily provide the technical training many MS students need.

What are the primary needs to achieve and advance the purpose/mission of this degree program?

Continued external funding for our core research groups. University support in the areas of TA stipends and tuition awards.

Recruiting

Recruiting criteria include, but are not limited to, academic preparedness (GPA, standardized test scores, prerequisite degrees); diversity (gender, race, ethnicity, citizenship); number of applied/admitted/enrolled students

What types and numbers of students are you targeting for this graduate degree program?

Because we generally have no tuition remission for MS students, nor can we guarantee TA stipends, we cannot be very aggressive with our recruiting here. We can easily accommodate MS students who bring their own funding, but we generally do not go out and look for them per se. Having said that, we have had a number of MS students who were supported externally, e.g., by the military or via our own researchers' grants and contracts where a student can fulfill a technician's role.

In general, we look for students with an overall solid academic record, some evidence of research prowess, and interests which dovetail with our own research strengths. We try to be a flexible program and we are able to accommodate students whose academic record has shortcomings if we deem the student to have significant raw talent.

We have had excellent MS students who stayed on after completing their BS here in order to get additional preparation for PhD work or while waiting for personal conditions (family, financial, etc.) to become right for a subsequent move away from USU.

What recruiting strategies are you currently using?

Many of our students come here via personal contacts: referrals by other/former students and referrals by colleagues at other institutions. We advertise in the "Grad School Shopper", provided by the American Institute of Physics. This is the canonical method for students to find graduate programs in physics. We have recently re-designed our departmental website so that is serves as a recruiting tool. In particular, our graduate students and their research are featured on this website. We are currently encouraging our students to present their work via USU's Digital Commons, which is linked to our website. Prospective students can then see what physics grad students at USU are doing. This recruiting strategy was suggested to us by our graduate students. We are finding that our grad students are a great recruiting resource.

How effective are these strategies?

See next question.

How do you evaluate recruiting effectiveness?

(We would like to answer these two simultaneously.)

Generally speaking, we do not rely upon MS students to make our graduate program go. MS students are a bonus for our graduate program, so the fact that we get any at all is satisfactory for us.

What would be required to be more effective in recruiting students for this graduate degree program? (list in rank order)

1. Increase TA funding. Or at least restore it to its level before the recent budget cuts.
2. Supply adequate tuition awards to support MS students.

Mentoring

Mentoring criteria include, but are not limited to, preparation for future career; scholarly development; professional community participation; appreciation for diversity; collaborative opportunities

Please provide the following supporting data on students in this graduate degree program:

	2008-2009	2009-2010	2010-2011
Number of research/scholarly presentations (or exhibitions, performances, etc. as appropriate) made by students in this program at state, regional, national, or international meetings	2	3	0
Total number of peer-reviewed publications whose primary author is a student in this program	0	0	0
Total number of peer-reviewed publications where a student in this program is a co-author	0	0	0
Number of students from the previous year's graduating class that have found employment in the field	1/1	0/0	5/6

Comment on data relevant to mentoring students in this degree program not captured in the table above.

Where appropriate, and if our TA budget will permit it, we try to give our MS students some teaching experience as this can be advantageous for some career paths. Our MS degrees involve plans A, B, and even C. Thus publication level research is not always in play.

What mentoring strategies are you currently using?

Of course, we employ the standard Faculty Supervisor/Student model of mentorship. In addition to these, we do the following.

For several years now we have used our "Graduate Student Tracking Committee". This committee was originally formed as a means to keep track of and ensure student progress through our program. This committee, which meets with all graduate students each year, is built with a representative from each of our research areas. In many ways this committee has become a significant source of mentoring for the student. Members of the committee give advice to the student on research projects, jobs, experience that needs to be acquired, etc. Recently we have added a course to our graduate curriculum, entitled, "The Profession of Physics". Its job is to mentor the student in three main areas: job opportunities, funding opportunities, ethical considerations. While this course is not required for MS students, they can still take advantage of it if their schedule permits. Another recent development in mentoring: at 1-2 month intervals we hold a faculty-grad student meeting. All faculty and graduate students are invited. Snacks are provided to make it more appealing. The agenda is determined by a dialog between our graduate student representatives and the department administration. Pretty much anything can be discussed, from advice on career paths, to breaking physics news, to TA assignments, to the university's health plan. This year we will hold one of these meetings as a social and include our visiting graduate student prospects in the activities.

How effective are these strategies?

See next answer.

How do you evaluate mentoring effectiveness?

(We would like to answer this and the preceding question together.)

First, it is important to emphasize that many of our mentoring strategies are quite new. It will take several years to truly evaluate their efficacy. Our current students, as indicated in the survey and in various other discussions, have indicated satisfaction with the new strategies. With this as background...

For us, the effectiveness of our mentoring system is evaluated according to (i) whether students move through coursework in a successful, timely manner; (ii) whether students are able to successfully take the next step in their chosen career path after graduating. In previous years, criterion (i) has been a problem for some students. However, the advent of the Graduate Student Tracking committee, along with a newly revised curriculum (described elsewhere) should guarantee a timely passage through coursework. In recent years our MS students have successully moved on to graduate school or jobs aligned with their expectations, so we feel that criterion (ii) is satisfied.

What would be required to be more effective in mentoring students in this graduate degree program? (list in rank order)
1. According to our criteria, and according to student opinions, our mentoring appears to be effective at this time. As mentioned above, a number of our strategies are brand new and will take some years to evaluate. In about 5 year's time we will have to take stock.
2.
3.
Extend as needed

Management
Management data and criteria include, but are not limited to, the faculty and their scholarship, opportunities for and placement of graduates; average time to degree completion; degree completion rates; frequency of course offerings; graduate enrollment numbers (headcount and FTE); retention; number of degrees conferred; credit requirements; specializations offered; faculty resources

Please provide the following supporting data on faculty with a terminal degree who teach courses or mentor students in this graduate degree program:

	2008-2009	2009-2010	2010-2011
Number of faculty	16	16	15
Average number of peer-reviewed publications (or books, exhibitions, performances, etc. as appropriate) per faculty member	2.8	3.2	2.0
Number of faculty who received extramural grants for research	12	11	10
Average dollar amount per faculty member of extramural grants received	$130k	$95k	$154k

Comment on the data relevant to managing this graduate degree program not captured in the table above.

The number of faculty identified in the table, represent the tenure and tenure-track faculty only. Physics (and CASS) also have research faculty both at the research professor line and as research scientists. Some of these researchers are fully funded via the grantsmanship identified in the

table, while some bring in their own grants and yet others are funded by other sources. In some cases, these researchers are actively involved in mentoring graduate students, as well as providing fiscal support for them. About 60% of these funds are administered through CASS (a cost center) and 40% through physics. This in turn identifies how the F & A will be redistributed, which is relevant, e.g., for our incoming graduate student TA stipends.

Regarding publication rates, it is not unusual for 2 or 3 CASS scientists to be co-authors on a paper, hence, the total count per faculty member is slightly higher than the total number of unique papers published by CASS-Physics.

What are the professional/career opportunities for graduates of this degree program? Comment on the need for and viability of this program in terms of the graduate placement market.

MS degree recipients in physics are generally employed by industrial or government laboratories as either physicists or engineers. Some are hired as teachers by high schools and by two-year colleges.

How is this information communicated to potential and current students?

Prospective students learn about career paths via our website and via personal discussion with our departmental advisor and with faculty. Existing students can take advantage of these same opportunities, of course, but we have a newly instituted course: "The Profession of Physics", which, among other things, addresses the issue of career opportunities.

What strategies are used to keep this degree program current in terms of its:

a) Philosophy?

See (c).

b) Methodology?

See (c).

c) Technology?

(We feel these three areas cannot be clearly separated in our program so we have one answer for all three.)

We have a small program compared to many of our peers (see additional comments at the end of this document). This has drawbacks, of course, but it has the advantage of allowing for great flexibility in the way we educate, mentor, and collaborate with our students. Consequently, we are able to optimize a student's experience relative to their goals and the realities of life after graduate school. Our faculty are quite active in research, many of us travel extensively, serve on national review panels, etc. This provides constant feedback on the latest trends in research methodology, technology, goals, "hot topics", job opportunities, etc.

About 4 years ago the two of us (Jan Sojka and Charles Torre) attended a national conference on graduate education sponsored by our national professional society (American Physical Society). There we had presentations and discussion sessions on what is going on around the country, what are current best practices, etc. Although (somewhat to our surprise) we found that our program was considered somewhat on the progressive side, we took careful note on what the best (or most successful) programs were doing with regards to curriculum, assessment, research specialization,

mentoring, managing, funding, etc. This experience has been used as a guide for many of the recent revisions we have made to our program.

What is the targeted time to completion for students in this degree program?

2-3 years.

How is this information communicated to potential and current students?

Via our departmental advisor, via the Graduate Student Tracking Committee, and via the faculty mentor.

In the past 3 years, how many students have completed their degrees within this targeted time? (numbers of students completing on time vs. total number of students)

Four out of nine.

What are the factors that affect completion?

Timely completion of required courses. For plan A: Timely acquisition of a faculty mentor and research project. Timely completion of the research project.

A number of our students obtain their MS degrees while working a full or part time job. This can delay the time to completion significantly.

If improvements are needed, what are they?

In the past year or so we have significantly modified our system to address various perceived shortcomings. In particular:

We have converted the core course requirements for all students into a fixed 2 year required curriculum. We use the graduate tracking committee to make sure no one is "slipping through the cracks" and to mentor students along the way to their degree.

What is the minimum number of credits currently required for this graduate degree program?

30 credits, per USU requirements.

How does the number of required credits comply with standards in the discipline/field (e.g., accrediting agency, professional certification board and/or peer degree program)? Would you increase or decrease required credits to degree, and why?

This is comparable to our peers.

What changes, if any, should be made to the current specializations offered for this degree?

Because of faculty turnover, our current specializations are considerably out of date. A current list of specializations would be as follows.

* Complexity
* Fields, astrophysics and spacetime theory
* Plasma physics
* Quantum devices and nano-scale physics
* Surface physics
* Atmospheric and space physics

What would be required to make this graduate degree program more effective?

As described previously, we have in the past year made a number of changes to our program including changes to curriculum, funding models, organization and procedures. These changes were precipitated by the Regents Review of our programs a couple of years past and were the result of a year-long faculty and student conversation. The over-riding conclusion of these conversations was that our goal was not to increase the size of our program so much as to increase its quality, both in terms of the students we attract and in terms of the program we offer to them. It will take several years to assess the efficacy of these changes.

Funding

Funding criteria include, but are not limited to, funding sources (departmental, institutional, contracts, grants); percentage of students receiving support via tuition awards, assistantships, fellowships; average level and duration of support; selection process for tuition awards, fellowships, assistantships

Please fill in the following chart to show the number of students funded by type and level of funding (FTE), and the average amount of funding per student for 2008-2009, 2009-2010, and 2010-2011:

			2008-2009	2009-2010	2010-2011
Number of students funded by type and level of funding (FTE) per year			#	#	#
a) Externally funded fellowships, traineeships, & internships only		Full support (0.5 FTE)	1	1	1
		Partial support (<0.5 FTE			
b) USU fellowships only		Full support (0.5 FTE)			
		Partial support (<0.5 FTE)			
c) Teaching assistantships (departmental) only		Full support (0.5 FTE)		1	
		Partial support (<0.5 FTE)		2	1
d) Research assistantships from internal sources only (UWRL, UAES, department, etc.)		Full support (0.5 FTE)			
		Partial support (<0.5 FTE)			
e) Research assistantships from external grant/contract sources only		Full support (0.5 FTE)			
		Partial support (<0.5 FTE)			1
f) Administration or other assistantships only		Full support (0.5 FTE)			
		Partial support (<0.5 FTE)			
g) Combination of external support (a) with fellowships (b), or assistantships (c, d, e, &/or f)		Full support (0.5 FTE)			
		Partial support (<0.5 FTE)			
i) Combination of USU fellowships (b) with assistantships (c, d, e, &/or f))		Full support (0.5 FTE)			
		Partial support (<0.5 FTE)			
j) Combination of different types of assistantships (c, d, e, &/or f)		Full support (0.5 FTE)			
		Partial support (<0.5 FTE)			
k) Other	Describe: Lab technician	Full support (0.5 FTE)	1	1	1
		Partial support (<0.5 FTE)			
Number of self-funded students per year			2	2	4
Total numbers of students per year			4	7	8
Average amount of funding per student per year			**$**	**$**	**$**
a) Full support (0.5 FTE)				13,663	
b) Partial support (<0.5 FTE)				5,674	4,021

Comment on the sources and relative proportions of funding available to students in this graduate degree program.

Describe the adequacy and appropriateness of the current level of funding for recruiting and retaining graduate students to completion in this degree program.

Although there are exceptions, for the most part we do not support MS students with TAs or tuition awards. Students either find their own funding or, occasionally, find RA support.

Describe the adequacy and appropriateness of the current level of funding for recruiting and retaining faculty to build and sustain this degree program.

Current levels of funding for recruitment and retaining faculty are only one reason why the physics department has highly productive and nationally recognized faculty. To a very large extent, USU has leaned on other, more individual reasons why their faculty members come here and stay here. We say this because it is demonstrably true that, for our Physics faculty of 15, the overall compensation level is not favorable compared to any grouping of peers! Still, there is no point even discussing this here as there appears to be no help in sight.

Perhaps a more reasonable discussion can be made with respect to attracting and affording the researchers' facility needs. Physics researchers fall into two broad categories, experimental-laboratory scientists and theoretician-modeler. The former category, which is the principal type of researcher and is normally the principal source of graduate student support, requires significant start-up and ongoing facilities. The availability of adequate start-up is a huge looming problem for this department. To date, the model used to generate start-up funds was a 50%: 25%: 25% distribution between VPR: Dean: Department. This model is currently under attack. Historically, and the last time physics had a major start-up, ($800 K) the department was able to cannabalize a retired faculty salary to meet its $200 K obligation. Obviously, this is not a sustainable funding model. A reasonable source of such funds is, at least in part, departmental F&A. In the previous sections it has been stated that the department is using its F&A funds to ensure adequate incoming graduate student stipends. Hence, given this ongoing reduction, if not exhaustion, of F & A availability, the department of physics cannot feasibly generate $200 K level of start-up funds on any reasonable time scale! The bulk of our MS students need training in a laboratory environment for their subsequent careers in industrial or laboratory settings. Therefore, for us, this is a key problem of faculty recruitment and retention which has significant bearing on our graduate program. It is a problem that can only be solved by involving all administrative levels.

What could be done to more effectively fund graduate students in this degree program? (list in rank order)

1. Resolve the problem of start-up funds so that we can maintain an experimental research program adequate to support the needs of MS students.
2. Increase the Department TA pool.
3. Add tuition awards for MS students.

Are there any important aspects in evaluating this graduate degree program that have not been captured in the information above? If so, please comment.

Graduate Degree Program Self-Study

Department	Physics
Degree Program	PhD in Physics

For each graduate degree program in your department, complete this self-study by entering responses and data in the table boxes in this document. Please respond as concisely as possible. The total length of this completed document should not exceed 14 pages, 12-point font.

The self-study is organized into questions regarding the overall nature of each graduate degree program and the critical components of recruiting, mentoring, management, and funding.

Overall

What is the purpose and mission of this graduate degree program?

(1) To train professional physicists who are needed worldwide in pure research, applied research and education. (2) To support the department's educational mission via Teaching Assistants. (3) To support the department's research mission via Research Assistants.

What are the core strengths of this graduate degree program?

We are a relatively small program with considerable flexibility to meet students' needs. Our research groups all are nationally prominent and externally funded.

What are the primary needs to achieve and advance the purpose/mission of this degree program?

Continued external funding for our core research groups. University support in the areas of TA stipends and tuition awards.

Recruiting

Recruiting criteria include, but are not limited to, academic preparedness (GPA, standardized test scores, prerequisite degrees); diversity (gender, race, ethnicity, citizenship); number of applied/admitted/enrolled students

What types and numbers of students are you targeting for this graduate degree program?

Our graduate population fluctuates between 20-30 students. In a typical year we have 2-5 openings for students via TA support. Occasionally there is an opportunity for an incoming student to begin with an RA, but this is somewhat exceptional. So, in general we are looking for 2-5 students fresh from their undergraduate degrees. MS degree is not necessary. The GRE scores are helpful, but not significant enough to make or break a student. Mostly we look for an overall solid academic record, some evidence of research prowess, and interests which dovetail with our own research strengths. We try to be a flexible program and we are able to accommodate students whose academic record has shortcomings if we deem the student to have significant raw talent. Sometimes we are able to recruit students who prove to be excellent but because of one or more defects in their record are unable to get into highest-tier schools.

We have a special relationship with the United States Air Force: they supply us with PhD students (who already have an MS) studying upper atmospheric and space environmental physics. The understanding is that we can get them through our program in three years. Over the past two decades this program has graduated 10 USAF officers with physics PhDs.

What recruiting strategies are you currently using?

Many of our students come here via personal contacts: referrals by other/former students and referrals by colleagues at other institutions. We advertise in the "Grad School Shopper", provided by the American Institute of Physics. This is the canonical method for students to find graduate programs in physics. We have recently re-designed our departmental website so that is serves as a recruiting tool. In particular, our graduate students and their research are featured on this website. We are currently encouraging our students to present their work via USU's Digital Commons, which is linked to our website. Prospective students can then see what physics grad students at USU are doing. This recruiting strategy was suggested to us by our graduate students. We are finding that our grad students are a great recruiting resource. We use departmental funds and a grant from the School of Graduate Studies to bring prospective domestic students to USU for a personal visit with the faculty and existing students. This year we will bring all the students at once for a single day of interaction with the department. We will finish the day by holding one of our monthly faculty-grad student meetings as a social at Caine House so that the recruits can interact with faculty and students in a relaxed, social environment. We use departmental F&A return to boost their TA stipend to about $12,000 and to add a "Research Stipend" of about $3000 to an incoming student's TA stipend. This presents the prospective student with a more competitive financial award number and also promises immediate contact with research. (The research stipend lasts for the first two years after which the student is expected to make the transition to RA support.)

How effective are these strategies?

See next question.

How do you evaluate recruiting effectiveness?

(We would like to answer these two simultaneously.)

Faculty consensus is that we are not really needing to grow our program in numbers, but we would like to keep constant pressure to raise the quality of our students. Recruiting effectiveness is then based upon two principal criteria: (1) Are we getting enough new students to keep our program stable and support our TA needs? (2) Are our faculty finding enough students with sufficient proficiency to participate in their research programs with successful outcomes?

Based upon these criteria, we generally have enough applicants of sufficient quality to rate our recruiting as "effective". In recent years we have become more successful in matching students with our researchers right away (thanks, e.g., to the student visits), so that the student's tend to have an optimized path through our program. However we sometimes struggle to get sufficient students (of good quality) to actually commit to our program from our applicant pool. It is difficult to always find out where students go if they do not choose USU, but our impression is that they tend to go to comparable programs which have a more favorable financial package. Average stipends for incoming students nationally was about $15,000, almost a decade ago. Our incoming students get a TA award of just over $11,000. We need to be able to compete with these kinds of national numbers. We have already taken steps in this direction with out "Research Stipend", mentioned earlier. And we are currently experimenting with an increase of the base TA stipend to $12,000. Unfortunately, both of these strategies are being paid for from our F&A return, which is a serious drain on this resource. Moreover, in the last round of budget cuts we lost a TA position, making the resource problem more acute. For us, recruitment can be tricky because our program is (necessarily) small and we have fairly large fluctuations in the number of available RAs and TAs during each admission cycle. Moreover, some of these fluctuations take place after the usual time for admitting students has passed. It is hard to know how many students to accept each year. If we accept more students than we have money for, in anticipation that not all students will attend, we have no financial cushion to handle the possibility that too many students will matriculate. This problem is now potentially exacerbated by the shortfall in tuition awards. Hopefully current efforts to mitigate this problem will be successful. Speaking of tuition awards, the current situation with these awards appears to preclude attracting international students since one international student costs us about 4x what a domestic student costs. We simply cannot pay for their tuition; needless to say, they will go to any number of other schools where tuition waivers are routine.

It should be mentioned that some of our recruitment strategies have only been recently implemented in response to a recent external review (Regents Review). We are therefore still determining their effectiveness.

What would be required to be more effective in recruiting students for this graduate degree program? (list in rank order)

1. Increase TA funding. Or at least restore it to its level before the recent budget cuts.
2. Stabilize and/or increase Tuition Award Support
3.

Extend list as needed

Mentoring

Mentoring criteria include, but are not limited to, preparation for future career; scholarly development; professional community participation; appreciation for diversity; collaborative opportunities

Please provide the following supporting data on students in this graduate degree program:

	2008-2009	2009-2010	2010-2011
Number of research/scholarly presentations (or exhibitions, performances, etc. as appropriate) made by students in this program at state, regional, national, or international meetings	27	23	33
Total number of peer-reviewed publications whose primary author is a student in this program	1	3	4
Total number of peer-reviewed publications where a student in this program is a co-author	6	3	4
Number of students from the previous year's graduating class that have found employment in the field	4 (100%)	3 (100%)	4 (100%)

Comment on data relevant to mentoring students in this degree program not captured in the table above.

Many of our students are heading for an academic career. This means it is important to extend mentoring to include teaching. Our students have requested this, as well. With this goal in mind, we have revamped our Physics 2200 series labs (our principal TA assignment - involving virtually all of our TAs at one time or another) such that (1) they are standalone classes run and graded by the assigned TA, (2) within the lab the TAs are responsible for delivering a micro-course in data/error analysis, (3) the TAs work directly with the students on scientific writing via enhanced lab reporting. We have assigned a faculty member to mentor the TAs in these lab assignments. The goal here is to prepare the students for more substantial teaching roles in their subsequent careers.

What mentoring strategies are you currently using?

Of course, we employ the standard Faculty Supervisor/Student model of mentorship And there is the teaching mentoring described above. In addition to these, we do the following.

For several years now we have used our "Graduate Student Tracking Committee". This committee was originally formed as a means to keep track of and ensure student progress through our program. This committee, which meets with all graduate students each year, is built with a representative from each of our research areas. In many ways this committee has become a significant source of mentoring for the student. Members of the committee give advice to the student on research projects, jobs, experience that needs to be acquired, etc. Recently we have added a required course to our graduate curriculum, entitled, "The Profession of Physics". Its job is to mentor the student in three main areas: job opportunities, funding opportunities, ethical considerations. During the first two years each student is required to engage in some (possibly very introductory) research experiences with various faculty members. This very new feature of our program is intended to better acquaint the student with our research program and to greatly facilitate the students' transition from course work to research. Another recent development in mentoring: at 1-2 month intervals we hold a faculty-grad student meeting. All faculty and graduate students are invited. Snacks are provided to make it more appealing. The agenda is determined by a dialog between our graduate student representatives and the department

administration. Pretty much anything can be discussed, from advice on career paths, to breaking physics news, to TA assignments, to the university's health plan. This year we will hold one of these meetings as a social and include our visiting graduate student prospects in the activities.

How effective are these strategies?

See next answer.

How do you evaluate mentoring effectiveness?

(We would like to answer this and the preceding question together.)

First, it is important to emphasize that many of our mentoring strategies are quite new. It will take several years to truly evaluate their efficacy. Our current students, as indicated in the survey and in various other discussions, have indicated satisfaction with the new strategies. With this as background...

For us, the effectiveness of our mentoring system is evaluated according to (i) whether students move through coursework and begin research in a successful, timely manner; (ii) whether students are able to complete their research projects in a timely manner; (iii) whether students are able to successfully take the next step in their chosen career path after graduating. In previous years, criterion (i) has been a problem for some students. However, the advent of the Graduate Student Tracking committee, along with a newly revised curriculum (described elsewhere) - particularly the required research experiences early on - have virtually guaranteed that all students will be ready to make the transition to research after two years. Over the past few years, time to completion for physics PhD students averages at or slightly below the national average of about 6 years - and this indicates that criterion (ii) for mentoring effectiveness is satisfied. According to our records, over the past 3 years, our 11 PhD graduate all had employment in their chosen field, which indicates criterion (iii) is satisfied. Finally, we note that one of our mentoring strategies – the monthly grad student & faculty meetings – has shown substantial signs of success. Specifically: initially, this meeting was run by the faculty with with the students participating rather passively as if they were in a class. In less than two years time, the meeting is now largely run by the students with faculty serving as participants.

What would be required to be more effective in mentoring students in this graduate degree program? (list in rank order)

1. According to our criteria, and according to student opinions, our mentoring appears to be effective at this time. As mentioned above, a number of our strategies are brand new and will take some years to evaluate. In about 5 year's time we will have to take stock.
2.
3.

Extend as needed

Management

Management data and criteria include, but are not limited to, the faculty and their scholarship, opportunities for and placement of graduates; average time to degree completion; degree completion rates; frequency of course offerings; graduate enrollment numbers (headcount and FTE); retention; number of degrees conferred; credit requirements; specializations offered; faculty resources

Please provide the following supporting data on faculty with a terminal degree who teach courses or mentor students in this graduate degree program:

	2008-2009	2009-2010	2010-2011
Number of faculty	16	16	15
Average number of peer-reviewed publications (or books, exhibitions, performances, etc. as appropriate) per faculty member	2.8	3.2	2.0
Number of faculty who received extramural grants for research	12	11	10
Average dollar amount per faculty member of extramural grants received	$130k	$95k	$154k

Comment on the data relevant to managing this graduate degree program not captured in the table above.

The number of faculty identified in the table, represent the tenure and tenure-track faculty only. Physics (and CASS) also have research faculty both at the research professor line and as research scientists. Some of these researchers are fully funded via the grantsmanship identified in the table, while some bring in their own grants and yet others are funded by other sources. In some cases, these researchers are actively involved in mentoring graduate students, as well as providing fiscal support for them. About 60% of these funds are administered through CASS (a cost center) and 40% through physics. This in turn identifies how the F & A will be redistributed, which is relevant, e.g., for our incoming graduate student TA stipends.

Regarding publication rates, it is not unusual for 2 or 3 CASS scientists to be co-authors on a paper, hence, the total count per faculty member is slightly higher than the total number of unique papers published by CASS-Physics.

What are the professional/career opportunities for graduates of this degree program? Comment on the need for and viability of this program in terms of the graduate placement market.

Holders of the PhD in physics will generally be hired as research and development physicists by industrial or government laboratories and as professorsinstructors in universities (though this may require additional postdoctoral research experience), colleges, and 2 year schools. All of our recent graduates have found employment commensurate with their career goals and abilities. Consequently, we feel our program is viable.

How is this information communicated to potential and current students?

Prospective students learn about career paths via our website and via personal discussion with our departmental advisor and with faculty. Existing students can take advantage of these same opportunities, of course, but we have a newly instituted course: "The Profession of Physics",

which every student is required to attend and which, among other things, addresses the issue of career opportunities.

What strategies are used to keep this degree program current in terms of its:

a) Philosophy?

See (c).

b) Methodology?

See (c).

c) Technology?

(We feel these three areas cannot be clearly separated in our program so we have one answer for all three.)

We have a small program compared to many of our peers (see additional comments at the end of this document). This has drawbacks, of course, but it has the advantage of allowing for great flexibility in the way we educate, mentor, and collaborate with our students. Consequently, we are able to optimize a student's experience relative to their goals and the realities of life after graduate school. Our faculty are quite active in research, many of us travel extensively, serve on national review panels, etc. This provides constant feedback on the latest trends in research methodology, technology, goals, "hot topics", job opportunities, etc.

About 4 years ago the two of us (Jan Sojka and Charles Torre) attended a national conference on graduate education sponsored by our national professional society (American Physical Society). There we had presentations and discussion sessions on what is going on around the country, what are current best practices, etc. Although (somewhat to our surprise) we found that our program was considered somewhat on the progressive side, we took careful note on what the best (or most successful) programs were doing with regards to curriculum, assessment, research specialization, mentoring, managing, funding, etc. This experience has been used as a guide for many of the recent revisions we have made to our program.

What is the <u>targeted</u> time to completion for students in this degree program?

Nationally, the most likely time to completion for a PhD in physics is about 6 years. We like to see our students finish in 5-6 years. This does not include an MS along the way; in physics the MS is considered superfluous if you are going for the PhD.

How is this information communicated to potential and current students?

Via our departmental advisor, via the Graduate Student Tracking Committee, and via the faculty mentor.

In the past 3 years, how many students have completed their degrees within this targeted time? (numbers of students completing on time vs. total number of students)

7/11

According to our records:
2008-2009: 4 PhD degrees, completion times 3, 5, 4.5, 3 years.
2009-2010: 3 PhD degrees, completion times 4.8, 5.5, 5.5 years.
2010-2011: 4 PhD degrees, completion times from 5.6, 6.7, 11.4, 8.2 years.

We note that the data supplied to us seem to be erroneous in this regard.

What are the factors that affect completion?

Timely completion of required courses. Timely acquisition of a faculty mentor and PhD project. Timely completion of the candidacy examination. Timely completion of the research project.

If improvements are needed, what are they?

In the past year or so we have significantly modified our system to address the above factors. In particular:

We have converted the core course requirements for all students into a fixed 2 year required curriculum. We have required all students to engage with our faculty in (possibly very elementary) research experiences during their first two years at USU. This acquaints the students with our faculty and their research programs and begins the process of finding the best fit for the student and mentor. We use the graduate tracking committee to enforce timely completion of the candidacy examination and to help with any obstructions the student may face in our program.

What is the minimum number of credits currently required for this graduate degree program?

90 credits, per USU requirements.

How does the number of required credits comply with standards in the discipline/field (e.g., accrediting agency, professional certification board and/or peer degree program)? Would you increase or decrease required credits to degree, and why?

This is generally a good bit higher than many comparable institutions. A more reasonable requirement would be about 72 credits, based upon an informal survey of several institutions. (We looked up the minimum requirements for a PhD in physics at the official USU-comparison schools and then with 6 western land grant institutions. Only one school, Texas A&M, requires more credit hours: 96 compared to USU's current requirement of 90. VPI also requires 90. All others are significantly less with 72 being the total required by 5 of the schools. Some schools also identify the number of course credits required, with which we could then also compare. USU physics requires a minimum (core) of 32 with most students being required to take a few extra courses in their field of research. This course requirement is consistent most of the institutions we examined.)

What changes, if any, should be made to the current specializations offered for this degree?

Because of faculty turnover, our current specializations are considerably out of date. A current list of specializations would be as follows.

* Complexity
* Fields, astrophysics and spacetime theory
* Plasma physics
* Quantum devices and nano-scale physics
* Surface physics
* Atmospheric and space physics

What would be required to make this graduate degree program more effective?

As described previously, we have in the past year made a number of changes to our program including changes to curriculum, funding models, organization and procedures. These changes were precipitated by the Regents Review of our programs a couple of years past and were the result of a year-long faculty and student conversation. The over-riding conclusion of these conversations was that our goal was not to increase the size of our program so much as to increase its quality, both in terms of the students we attract and in terms of the program we offer to them. It will take several years to assess the efficacy of these changes.

Funding

Funding criteria include, but are not limited to, funding sources (departmental, institutional, contracts, grants); percentage of students receiving support via tuition awards, assistantships, fellowships; average level and duration of support; selection process for tuition awards, fellowships, assistantships

Please fill in the following chart to show the number of students funded by type and level of funding (FTE), and the average amount of funding per student for 2008-2009, 2009-2010, and 2010-2011:

		2008-2009	2009-2010	2010-2011
Number of students funded by type and level of funding (FTE) per year		#	#	#
a) Externally funded fellowships, traineeships, & internships only	Full support (0.5 FTE)	3	1	1
	Partial support (<0.5 FTE			
b) USU fellowships only	Full support (0.5 FTE)			
	Partial support (<0.5 FTE)			
c) Teaching assistantships (departmental) only	Full support (0.5 FTE)	8	7	9
	Partial support (<0.5 FTE)	6	7	7
d) Research assistantships from internal sources only (UWRL, UAES, department, etc.)	Full support (0.5 FTE)			
	Partial support (<0.5 FTE)			
e) Research assistantships from external grant/contract sources only	Full support (0.5 FTE)	7	6	7
	Partial support (<0.5 FTE)	4	4	5
f) Administration or other assistantships only	Full support (0.5 FTE)			
	Partial support (<0.5 FTE)			
g) Combination of external support (a) with fellowships (b), or assistantships (c, d, e, &/or f)	Full support (0.5 FTE)	18	14	17
	Partial support (<0.5 FTE)	10	11	12
i) Combination of USU fellowships (b) with assistantships (c, d, e, &/or f))	Full support (0.5 FTE)	15	13	16
	Partial support (<0.5 FTE)	10	11	12
j) Combination of different types of assistantships (c, d, e, &/or f)	Full support (0.5 FTE)	15	13	16
	Partial support (<0.5 FTE)	10	11	12
k) Other | Describe:	Full support (0.5 FTE)			

		Partial support (<0.5 FTE)			
Number of self-funded students per year					
Total numbers of students per year			25	24	26
Average amount of funding per student per year			**$**	**$**	**$**
a) Full support (0.5 FTE)			15,702	16,679	17,121
b) Partial support (<0.5 FTE)			6,334	3,407	5,265

Comment on data relevant to funding students in this graduate degree program not captured in the table above.

In response to the physics department regents review, the department has undertaken an aggressive approach to enhancing the graduate student fiscal situation. This involves three distinct innovations (i) raise incoming TA stipends to $12,000 with an additional Research Stipend of $3,000 for graduate students in their first two years. Departmental F&A funds are used to increase the TA stipend from a little over $11,300; these funds completely pay for the Research Stipend. (ii) All graduate students are required in their first two years to be working with researchers; this speeds up the probability of shared TA/RA support. (iii) Based on successful TA/RA partnerships, we encourage funded researchers to support a graduate student during summer at a targeted $5,000 in their first two years. Achieving all of these goals would provide about $20,000 per year for our incoming graduate students over their first two years. When the graduate student is in a research area not adequately funded, the plan is to provide summer teaching opportunities. This is in step with the USU plan to rejuvenate the summer school semester. Using this model, we expect that all incoming graduate students will receive stipends of $15,000 and grow this towards $20,000. The statistics for 0.5 FTE (full time) in the table indicates an increasing average stipend consistent with this plan. Finally, our newly instituted required course "The Profession of Physics" require each student to write a proposal for external funding to one of various scholarship and fellowship sources. Even if only one student were to be successful here this would significantly impact the sustainability of this new funding model.

Comment on the sources and relative proportions of funding available to students in this graduate degree program.

The grantsmanship from the department and CASS is consistent with the above plan to grow graduate student stipends. As mentioned above, the department is currently trying a procedure whereby the growth in incoming student stipend is generated from the department's F & A return. In a following response, the possibility of a very negative implact of this strategy is described. At this time the department is not considering decreasing the number of TAs in order to increase the TA stipend from a fixed $ pool as we just had to do this during the recent budget cuts and our number of TA slots is already small. Our overarching effort is to move incoming graduate students to RA positions as soon as possible. The down side of this plan being the availability of sufficient TAs to meet the department's teaching needs.

Describe the adequacy and appropriateness of the current level of funding for recruiting and retaining graduate students to completion in this degree program.

The average full-time graduate student stipend identified in the table shows a growth from $15,702 to $17,121 over the past three years. Our full-time RA stipend ranges from $18,000

to $24,000. However, at the present time, USU is experiencing a significant problem in providing graduate student tuition awards or tuition fellowships. The projected shortfall in tuition funds inevitably leads to a reduction in the availability of department teaching assistant (TA) and research (RA) funds. The department is already using its F & A returns to provide over $3,000 per student for stipends. Projected shortfalls for outlying years will require tuition amounts of this order or larger! Departmental initiatives are bringing stipends up towards national median values, though we aren't there yet. The new burden of tuition awards will likely destroy this improvement.

Describe the adequacy and appropriateness of the current level of funding for recruiting and retaining faculty to build and sustain this degree program.

Current levels of funding for recruitment and retaining faculty are only one reason why the physics department has highly productive and nationally recognized faculty. To a very large extent, USU has leaned on other, more individual reasons why their faculty members come here and stay here. We say this because it is demonstrably true that, for our Physics faculty of 15, the overall compensation level is not favorable compared to any grouping of peers! Still, there is no point even discussing this here as there appears to be no help in sight.

Perhaps a more reasonable discussion can be made with respect to attracting and affording the researchers' facility needs. Physics researchers fall into two broad categories, experimental-laboratory scientists and theoretician-modeler. The former category, which is the principal type of researcher and is normally the principal source of graduate student support, requires significant start-up and ongoing facilities. The availability of adequate start-up is a huge looming problem for this department. To date, the model used to generate start-up funds was a 50%: 25%: 25% distribution between VPR: Dean: Department. This model is currently under attack. Historically, and the last time physics had a major start-up, ($800 K) the department was able to cannabalize a retired faculty salary to meet its $200 K obligation. Obviously, this is not a sustainable funding model. A reasonable source of such funds is, at least in part, departmental F&A. In the previous sections it has been stated that the department is using its F&A funds to ensure adequate incoming graduate student stipends. Hence, given this ongoing reduction, if not exhaustion, of F & A availability, the department of physics cannot feasibly generate $200 K level of start-up funds on any reasonable time scale! For us, this is a key problem of faculty recruitment and retention which has significant bearing on our graduate program. It is a problem that can only be solved by involving all administrative levels.

What could be done to more effectively fund graduate students in this degree program? (list in rank order)

1. We are currently mentoring our students (via our `Profession of Physics' course) to apply for external fellowship/scholarship support. We are continuing to encourage our faculty to increase external funding of graduate students. We will see over the next few years how effective this is.
2. Increase the Department TA pool.
3. Increase the Department TA pool.

Are there any important aspects in evaluating this graduate degree program that have not been captured in the information above? If so, please comment.

In the documentation provided in preparation for the graduate program review, a graph was generated from the NRC database as an indication-comparison with other physics department graduate programs. That NRC database is ten years old. However, we believe it is still reasonably representative of today's status.

The report shows that our department was 150 out of 161 by number of faculty. We are a small department. Consistent with this, we are 131 out of 161 by average number of PhDs awarded per year. Clearly 131 is an improvement over 150th, which indicates our efficiency over others. In fact, converting these numbers into PhDs per year, per faculty, gives USU physics a rate of 0.171 compared to the 161's school average of 0.166. With this one measure we are in the top half of the NRC rankings!

The NRC database has been dissected in 3 other ways to provide comparison information.

(1) From the 22 public institutions in the NRC smallest-quartile physics programs.
USU-Physics ranks 12 (out of 22) on R scale.
USU-Physics ranks 11 on "citation per paper" scale.
USU-Physics ranks 10 on "percent of faculty with grants" scale.
USU-Physics ranks first on "graduate enrollments per faculty."
USU-Physics ranks third "average number of PhDs per year, per faculty."

(2) Considering the USU peer institutions in the NRC database and AIP graduate directory we find:
These schools are larger by faculty number with a median faculty size of 32 versus USU's 15.
USU ranks 7 (out of 11) "grant $ per faculty."
USU ranks 6 (out of 11) "average PhDs per year per faculty."

a) Considering land-grant institutions in the Western peer group, we find:
These schools have a median faculty size of 16, which is consistent with ours.
USU ranks 8 (out of 11) "grants $ per faculty."
USU ranks 4 (out of 11) "average PhDs per year per faculty."

Overall, the USU Physics Department is a productive research department generating PhDs at rates that put us in the top half of all physics departments. With regards to grantsmanship, we are also at the median value in the same national group of schools.