

PROGRAM REVIEW: ASTRONOMY

FALL 2016



Astronomy Program Review Self-Study, Fall 2016

***1.1 Introduction.** Introduce the program. Include the program's catalogue description, its mission, the degrees and certificates offered, and a brief history of the program. Include the number and names of full-time faculty, adjunct faculty, and classified staff. Discuss any recent changes to the program or degrees.*

Astronomy is the study of celestial objects, such as stars, galaxies, planets, moons, asteroids, comets and nebulae, and related processes, such as supernovae explosions, gamma ray bursts, and cosmic microwave background radiation, that occur outside the atmosphere of the Earth.

The Astronomy Program at Solano Community College is part of the School of Mathematics & Science. It is currently composed of four courses: ASTR 010: General Astronomy; ASTR 020: Astronomy Lab; ASTR 030: The Solar System; and ASTR 040: Stars, Galaxies & Cosmology. The Astronomy Department does not currently offer any degrees.

The first Astronomy course at Solano Community College, ASTR 010, was Curriculum approved in 1979. The remaining three courses, ASTR 020, ASTR 030, and ASTR 040, were each Curriculum approved in 2005, and became active in the 2006/07 academic year. All four courses can fulfill the Physical Science major requirements for the AS degree in Physics, and the AS degree in General Science at SCC, as well as the Science and Quantitative Reasoning section for the Associate Degree in Interdisciplinary Studies. All four of our courses are also fully transferable to various of the CSU and UC campuses (IGETC Area 5A, 5C; CSU GE Area B1, B3).

ASTR 010 and ASTR 020 are each offered in the Fall, Spring and Summer; ASTR 030 and ASTR 040 are offered in the Fall and Spring.

As of the writing of this document in the Summer of 2016, the only current full-time faculty member is Alessandro Baldi, who was recently hired on a temporary one-year full-time position to replace Michael Gregg, who resigned from his position after the 2014/15 academic year. Dr. Baldi earned a Ph.D. in Astronomy from the University of Milan in 2003. Michael Gregg was originally hired to replace the longest tenured full-time faculty member of the program, Philip Petersen (Ph.D., UC San Diego, Astrophysics, 1987), who had recently retired. Recent and current adjunct faculty members in the department are Katie Berryhill (M.S., University of North Dakota, Space Studies, 1998; Ph.D., University of Wyoming, Education, 2016), Tracey Johnson, (M.S., Physics, UC Davis, 1996), Tom MacMullen (Ph.D., University of Arizona, Physics, 1979), and Randy Smith (M.S., Astronomy, Swinburne Institute, 2004).

The other staff member associated with the Astronomy Program is Richard Crapuchettes. Richard has a B.S. from San Jose State University, and has been a technician for the Physical Sciences departments at SCC since 1987.

1.2 Relationship to College Mission and Strategic Goals. Describe the program’s relationship to the overall mission of the college.

According to the SCC Mission Statement, “we are committed to helping our students achieve their educational, professional, and personal goals centered in basic skills education, workforce development and training, and transfer-level education”. Furthermore, “Solano Community College’s mission is to educate a culturally and academically diverse student population drawn from our local communities and beyond”.

The Astronomy Program mission closely aligns with that of the college. We help an increasingly ethnically and academically diverse population of students obtain their educational goals. Our mission is to provide quality instruction to students interested in Astronomy and the Physical Sciences, or who are looking to fulfill the general education requirement in the Physical Science area in anticipation of transfer to the CSU or UC Systems. Our faculty members are committed to promoting Institutional Learning Outcomes, particularly the ability to communicate effectively and think critically as well as the development of an understanding and appreciation of the physical world.

Table 1: SCC’s Strategic Directions and Goals

Goal 1: Foster Excellence in Learning	Program Evidence
<p>Obj. 1.1 Create an environment that is conducive to student learning.</p>	<p>Some Astronomy faculty members regularly use classroom technology such as PowerPoint, interactive response systems (e.g., i-clicker), videos, and animations to enhance understanding for learners of all styles. Course lecture notes and relevant course material are shared with students through e-companion shells in the Canvas platform; this serves as a valuable review resource. Laboratory exercises provide opportunities for hands-on learning in a group setting. The varied techniques and strategies of the astronomy faculty members provide students with an enriched learning experience.</p> <p>Many of our astronomy instructors assign online homework through platform such as Canvas or Mastering Astronomy; Canvas is also used for students’ access to class materials.</p> <p>Textbooks are placed on reserve in the library on the main campus.</p>

<p>Obj. 1.2 Create an environment that supports quality teaching.</p>	<p>Astronomy faculty members are dedicated to student learning, as well as to professional development. Flex-Cal opportunities are provided which encourage professional development. In addition, effective communication at regularly scheduled faculty/division meetings allows for planning, interaction and exchange of ideas among faculty. Astronomy faculty members are dedicated to improving their teaching practices.</p>
<p>Obj. 1.3 Optimize student performance on Institutional Core Competencies.</p>	<p>The Astronomy Program Learning Outcomes, PLO, were developed with the Institutional Core Competencies, ICC, or previously named as ILO, in mind. The only ILO measured was:</p> <p>III. Global Awareness: a. Scientific Complexities</p> <p>PLO 1: Students will demonstrate analytical and/or problem solving skills.</p> <p><i>Assessment Results:</i> Students in ASTR 010, ASTR 030, and ASTR 040 courses were assessed for their knowledge of astronomical terminology and on their ability to clarify and apply astronomical concepts. Students did very well on the homework assignments, and above 60%, on average, on the mid-term and final exams, which contained astronomical terminology and astronomical concepts. For ASTR 010 students, exam scores on the Solar System module improved with respect to the previous assessment. ASTR 030 and ASTR 040 students were also assessed for their ability to answer questions correctly on astronomical concepts taken from astronomical writings. In both courses, problems of reading comprehension are evident.</p> <p>PLO 2: Students will learn to carry out experiments and critically assess their data. Students will learn the role of hypothesis, measurement, and analysis in the development of scientific theory as evidenced by laboratory reports.</p> <p><i>Assessment Results:</i> Students in ASTR 020 were assessed in the setup and use of an equatorial mount telescope to locate objects in the sky, on the capability of using a star chart and astronomy software to locate</p>

objects and guide simple astronomical observations, and on their familiarity with the optical components of telescopes and the spectra of elements, as well as conceptually expressing the concepts related to them. Students were successful in all of these activities.

PLO 3: Students will learn how to write a laboratory report or give an oral presentation.

Assessment Results: This PLO links with ASTR 020. Students met the success criteria for the course.

Goal 2: Maximize Student Access & Success	Program Evidence
Obj. 2.1 Identify and provide appropriate support for underprepared students.	The ASTR 010, 030, and 040 courses do not have prerequisites; the SCC Minimum Math Standard is an Advisory for all four Astronomy courses. ASTR 020 is the only course that has a prerequisite, which is to be currently enrolled, or have completed successfully, ASTR 010, 030, or 040. Consequently, many students begin these courses unprepared for the challenge, especially regarding the basic math literacy required in our courses. We actively work to support our students. For example, some faculty members provide lists of student services and study techniques in the course syllabi, or review the basic math required in class. Students may also be referred to specific services (e.g. Tutoring Center) for additional support as necessary. Some instructors hold their office hours in the Academic Success Center to increase their accessibility to students.
Obj. 2.2 Update and strengthen career/technical curricula.	N/A
Obj. 2.3 Identify and provide appropriate support for transfer students.	Our classes can be used to meet IGETC requirements in Physical Science (Area 5A) and/or Laboratory Requirement (Area 5C). For CSU, our courses meet Physical Science (Area B1) and/or Laboratory Courses (Area B3). Our faculty members write letters of recommendation in support of our students' admission to university and graduate programs and internships.

<p>Obj. 2.4 Improve student access to college facilities and services.</p>	<p>ASTR 010 is usually offered at both centers, in addition to the main campus. The Astronomy curriculum includes two courses (ASTR 010 and ASTR 020) that are or have been offered in an on-line format. The online format increases the number of course offerings, as well as student access to courses. In addition, traditional face-to-face astronomy courses often include an e-Companion site (Canvas) that provides course materials online.</p> <p>All of our astronomy students are encouraged to take advantage of the drop-in tutoring at the Academic Success Center.</p>
<p>Obj. 2.5 Develop and implement an effective Enrollment Management Plan.</p>	<p>The astronomy class schedule is designed to meet the many needs of our diverse students. ASTR 010, our course with the largest enrollment, is offered at various times (<i>e.g.</i>, day and evening), at multiple locations (<i>e.g.</i>, the main campus and the centers), and in different formats (<i>e.g.</i>, lecture or on-line). The variety of course offerings helps students plan their schedules according to their individual needs. To optimize the availability of courses, the balance between M-W and T-Th offerings must be maintained.</p>

<p>Goal 3: Strengthen Community Connections</p>	<p>Program Evidence</p>
<p>Obj. 3.1 Respond to community needs.</p>	<p>Our program is geared to support students who desire a career in one of the STEM majors.</p>
<p>Obj. 3.2 Expand ties to the community.</p>	<p>The Astronomy program has several continuing connections with the local community. Faculty members offer extra credit for students who attend local astronomy related events, or visit observatories and science centers in the Bay Area. In addition, we also encourage students to participate in campus events such as blood drives, Coastal Cleanup Day, and Earth Day. Contributions to these events help students connect with the college as well as with the greater community.</p> <p>Technician Richard Crapuchettes regularly participates in outreach activities, such as the EPIC Spring Science Day (annually since 2006), the Kaiser Family Wellness Day</p>

(September 2012), and Celebrate SCC on April 27, 2012, each of which were attended by numerous high school students.

One of the Astronomy Department's long-term goals is to build a domed planetarium. Aside from the well-known educational benefits that this would provide our students (K.C. Yu, K. Sahami, V. Sahami, and L.C. Sessions, Using a Digital Planetarium for Teaching Seasons to Undergraduates, *Journal of Astronomy & Earth Sciences Education*, vol. 2, pp. 33-50, 2015), a domed planetarium would provide a strong and attractive link with local K-12 schools and the community at large. A domed planetarium can also be used for art and biology courses, as is done at many other community colleges.

Goal 4: Optimize Resources	Program Evidence
<p>Obj. 4.1 Develop and manage resources to support institutional effectiveness.</p>	<p>The astronomy classes need a variety of resources to support institutional effectiveness. In particular, ASTR 020 requires using telescopes more frequently and efficiently during the labs. All classes would benefit greatly by the presence of a domed planetarium. Currently all classes offered at the Fairfield campus and Vacaville and Vallejo Centers are in general supported adequately. However, occasional issues arise, such as, for instance, the inadequacy of the current Wi-Fi network that sometimes does not allow the use of i-clickers, and sometimes slows down the pace of the lecture, or the poor condition of the screen projectors which project images with very low contrast and do not allow students to see the astronomical images shown by the instructor with sufficient detail.</p>
<p>Obj. 4.2 Maximize organization efficiency and effectiveness.</p>	<p>All Astronomy courses are scheduled so as to maximize access to students. Offering courses one or two days a week has proven very popular with students, as it makes it easier for them to plan their work schedules. We also offer courses at night, and at the Vallejo Center. The ASTR 010 course, previously taught every term at Vacaville, will henceforth only be taught in the Fall.</p>

Obj. 4.3 Maintain up-to-date technology to support the curriculum and business functions.

Computers that are needed for laboratories are updated every five years. Software and other laboratory equipment are updated as needed. For example, the software for the Starry Night program was recently updated.

1.3 Enrollment. Utilizing data from Institutional Research and Planning (ITRP), analyze enrollment data. In table format, include the number of sections offered, headcounts, the full-time equivalent enrollment (FTES), and the WCSH for each semester since the last program review cycle. If data is available for the number of declared majors in the discipline, please include as well. Compare the enrollment pattern to that of the college as a whole, and explain some of the possible causal reasons for any identified trends.

Overall, the total number of astronomy sections offered in Spring and Fall semesters remained roughly stable over the past five years (see Tables 2 and 3) with the exceptions of Spring 2016, where the number of sections offered, ten, was higher than in any previous semester. The total enrollment and FTES, as well as the WCSH, have steadily decreased in the past five years, with an outlier represented again by Spring 2016. This outlier can be explained by the increased number of sections that were available during that specific semester.

Table 2: Enrollment, Section Count, FTES and WCSH in all astronomy courses during each term of the last five academic years.

	F 11	S 12	F 12	S 13	F 13	S 14	F 14	S 15	F 15	S 16
Sections	6	8	7	9	7	9	7	8	7	10
Headcount	319	395	353	409	329	365	286	288	278	341
FTES	32	40	35	41	33	37	29	29	28	34
WCHS	957	1185	1059	1227	987	1095	858	864	834	1023

It is perhaps easier to interpret this information if the data are binned by academic year, starting in the Fall semester, as is done in the following table:

Table 3: Enrollment, Section Count, FTES and WCSH in all astronomy courses during the last five academic years, binned by academic year.

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016
Sections	14	16	16	15	17
Headcount	714	762	694	574	619
FTES	72	76	70	58	62
WCHS	2142	2286	2082	1722	1857

In this form, it is easy to see that the number of sections offered has been stable, but the headcount and FTES have dropped by about 10-15%. This slight drop of about 10-15%

over the five year period mirrors the data at the overall college level, where enrollment decreased by almost 15% over the same time period (datamart.cccco.edu), and total FTES declined by over 10% (datamart.cccco.edu).

A more detailed breakdown of enrollment data, in each course, term by term, is given in the following four tables, Tables 4-7.

Table 4: Total enrollment for each astronomy course in the past five academic years

	F 11	S 12	F 12	S 13	F 13	S 14	F 14	S 15	F 15	S 16
ASTR 010	227	166	272	190	245	195	211	172	200	228
ASTR 020	36	66	33	80	44	79	27	68	35	74
ASTR 030	56	112	48	103	40	75	48	29	43	19
ASTR 040	-	51	-	36	-	16	-	19	-	20
Total	319	395	353	409	329	365	286	288	278	341

Table 5: Number of sections of each astronomy course in the past five academic years

	F 11	S 12	F 12	S 13	F 13	S 14	F 14	S 15	F 15	S 16
ASTR 010	4	3	5	4	5	4	5	4	5	6
ASTR 020	1	2	1	2	1	2	1	2	1	2
ASTR 030	1	2	1	2	1	2	1	1	1	1
ASTR 040	-	1	-	1	-	1	-	1	-	1
Total	6	8	7	9	7	9	7	8	7	10

Table 6: Total FTES for each astronomy course in the past five academic years

	F 11	S 12	F 12	S 13	F 13	S 14	F 14	S 15	F 15	S 16
ASTR 010	22.7	16.6	27.2	19.0	24.5	19.5	21.1	17.2	20.0	22.8
ASTR 020	3.6	6.6	3.3	8.0	4.4	7.9	2.7	6.8	3.5	7.4
ASTR 030	5.6	11.2	4.8	10.3	4.0	7.5	4.8	2.9	4.3	1.9
ASTR 040	-	5.1	-	3.6	-	1.6	-	1.9	-	2.0
Total	31.9	39.5	35.3	40.9	32.9	36.5	28.6	28.8	27.8	34.1

Table 7: Total WSCH for each astronomy course in the past five academic years

	F 11	S 12	F 12	S 13	F 13	S 14	F 14	S 15	F 15	S 16
ASTR 010	681	498	816	570	735	585	633	516	600	684
ASTR 020	108	198	99	240	132	237	81	204	105	222

ASTR 030	168	336	144	309	120	225	144	87	129	57
ASTR 040	–	153	–	108	–	48	–	57	–	60
Total	957	1185	1059	1227	987	1095	858	864	834	1023

1.4 Population Served. Utilizing data obtained from Institutional Research and Planning, analyze the population served by the program (gender, age, and ethnicity) and discuss any trends in enrollment since the last program review.

As shown below in Table 8, the proportion of Astronomy students who are women has remained within the range of about 50-60%, for each of the past five years. This proportion is roughly in line with, but only a few percent below, the student population at SCC overall (<http://scorecard.cccco.edu/scorecardrates.aspx?CollegeID=281>), which has been quite stable at about 58-59% female over this period. There does not seem to be any strong trend, upwards or downwards, with regards to gender. Note that the “not reported” category, which is generally about 1-3%, has been removed, so that the Male and Female percentages always add to 100%.

Table 8: Enrollment by % female for the Astronomy program and SCC as a whole.

	F 11	S 12	F 12	S 13	F 13	S 14	F 14	S 15	F 15	S 16
ASTR	49%	54%	57%	58%	50%	61%	53%	58%	52%	58%
SCC	59%	58%	59%	58%	59%	59%	59%	58%	58%	59%

Table 9 shows the ethnic breakdown of our Astronomy students over the past five years, as compared to the statistics for SCC as a whole. The SCC-as-a-whole data are for the academic year 2013-14, which is in the middle of the 2011-16 reporting period; this was done to simplify the table and make the comparisons more transparent (<http://scorecard.cccco.edu/scorecardrates.aspx?CollegeID=281>). The category of “other/unknown” has been removed, and the percentages have been recalculated so as to always add up to 100%. (However, the percentages shown in each column do not always add to exactly 100%, due to round-off).

Table 9: Enrollment by ethnic group for the Astronomy program and SCC as a whole.

	2011-12	2012-13	2013-14	2014-15	2015-16	SCC
White	39%	33%	31%	30%	32%	36%
Hispanic	20%	25%	27%	29%	32%	28%
Black	21%	18%	19%	20%	15%	18%
Asian or PI	20%	24%	21%	21%	18%	17%
Amerindian	1%	1%	2%	1%	1%	0.3%

This table shows that the Astronomy student population is very diverse, and mirrors almost perfectly the diversity of the college as a whole. The percentage of students from each ethnic group has remained relatively stable over the past five years, as has been the case for the college as a whole. These data show that white, black, Hispanic and Asian students take our Astronomy classes at rates very nearly equal to their representation in the College as a whole, whereas Amerindian students take our Astronomy classes at a rate in excess of their proportion of the College population.

There are numerous clubs and programs on campus, such as Mathematics, Engineering, Science Achievement (MESA) and the Society for the Advancement of Chicanos & Native Americans in Science (SACNAS), that are active in recruiting members of ethnic minority groups to study physical sciences, and aiding them in reaching their goals.

The age profile of students taking Astronomy classes is shown in Table 10 below. As with the data presented above for ethnicity and gender, the age data have been grouped by academic year, and then binned by age group. The right-most column shows the data for SCC as a whole, averaged over the reporting period. (<http://californiacommunitycolleges.cccco.edu/collegeDetails.aspx?collegeID=281&txt=Solano%20Community%20College>). Note that the percentages in each column do not always add to 100%, due to round-off.

Table 10: Enrollment by age group for the Astronomy program and SCC as a whole.

Age group	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	SCC
0-17	1%	1%	1%	1%	2%	5%
18-25	54%	46%	42%	50%	44%	59%
26-30	27%	33%	34%	30%	30%	11%
31-35	7%	7%	8%	7%	10%	6%
36-40	6%	6%	7%	6%	8%	5%
41-45	3%	5%	4%	4%	4%	4%
46+	2%	2%	3%	2%	2%	9%
Total	100%	100%	100%	100%	100%	100%

Table 10 shows that the age profile of Astronomy students is older than that of the College as a whole, although the differences are not uniform over all age groups. For example, about 51% of students taking Astronomy classes are twenty-six years old or older, whereas only 36% of the total SCC student body falls into this age group. Only 1% of students taking Astronomy classes are seventeen years old or younger, whereas 5% of the total SCC student body falls into this age group. However, only 6% of Astronomy students are over forty years of age, whereas 13% of all SCC students are in this oldest age group.

1.5 Status of Progress toward Goals and Recommendations. Report on the status of goals or recommendations identified in the previous educational master plan and program review.

Table 11. Educational Master Plan

Educational Master Plan	Status
1. Assess the need for an Astronomy & Physics Instructor and make appropriate recommendations for hiring.	Ongoing. A full-time faculty member has been hired in Fall 2014; however, he resigned after Spring 2015. A full-time temporary replacement on a one-year contract was hired for 2015-16. However, there will be no full-time faculty member covering Astronomy classes for the 2016-17 year, as all courses will be taught by adjuncts. It is highly desirable that this void be filled for 2017-18, by advertising a full-time, permanent position.
2. Establishing a Physics AS-T degree can enable Astronomy majors in Astrophysics to move on to university level.	Completed. A Physics AS-T degree has been established since the 2014-15 academic year. This will improve and promote transfer opportunities for both Physics and Astronomy students.

Table 12. Program Review Recommendations

This is the first stand-alone Astronomy program review. In previous years, Astronomy was included in the Physical Science program review. The following recommendations that are relevant to the Astronomy program are therefore taken from the 2010 Physical Science Program Review.

2010 Program Review	Status
1. One new Astronomy instructor is greatly needed.	Not completed. As of the 2016-2017 academic year, there is no full-time Astronomy faculty member.
2. Increase the general education courses offered at Vallejo and Vacaville centers for transferable courses such as ASTR 010.	Completed. ASTR 010 has been offered on a consistent basis at both the Vallejo and Vacaville Centers, in both the Spring and Fall semesters. As of Spring 2017, the Spring offering at Vacaville has been discontinued by the Dean of the Vacaville Center.

1.6 Future Outlook. Describe both internal and external conditions expected to affect the future of the program in the coming years.

At the time of this report (Fall 2016), there is no full-time faculty member teaching any of the Astronomy classes for the 2016-17 year; all courses are being taught by adjuncts. The “main” instructor in Astronomy (*i.e.*, the instructor teaching the largest number of sections in a given academic year) has changed in each of the past four years: Phil Petersen, 2013-14; Michael Gregg, 2014-15; Alessandro Baldi, 2015-16; Randy Smith,

2016-17). It is highly desirable that this void be filled for 2017-18, by advertising a full-time, permanent position, to add some stability to the department.

The Astronomy department attracts the largest number of students of all of the Physical Science departments at SCC. In the US as a whole, 10% of all undergraduates take at least one Astronomy course (“Improving Introductory Astronomy Education in American Colleges and Universities: A Review of Recent Progress”, W. H. Waller and T. F. Slater, *Journal of Geoscience Education*, vol. 59, pp. 176–183, 2011). The number of students taking Astronomy courses at SCC could be further increased if a domed planetarium were included as part of a new Physical Sciences Building, the construction of which has been proposed by the Astronomy, Physics and Engineering faculty.

Our current course ASTR 020, and the new course that is being developed (ASTR 050), require the assistance of a skilled, dedicated technician. The current technician, Richard Crapuchettes, will probably retire within the next ten years, if not the next five years. It is imperative for the continued health of the Astronomy Program that he be replaced by an equally experienced and skilled technician who will work exclusively for the Physical Sciences Departments (Physics, Astronomy, Engineering, Geology), and not be shared with other departments.

In addition, if we are successful in building a domed planetarium, we will need to hire someone who can run the planetarium, and coordinate outreach to K-12 schools, as well as presentations to the community at large.

CURRICULUM DEVELOPMENT, ASSESSMENT, AND OUTCOMES

Program Level Outcomes

As the Astronomy Department does not currently have any degree programs, there are no *official* Program Level Outcomes. This will change if/when the new Astronomy AS degree is approved.

2.1 Using the chart provided, list the Program Level Outcomes (PLOs) and which of the “core four” institutional learning outcomes (ILOs) they address.

2.2 Report on how courses support the Program Level Outcomes at which level (introduced (I), developing (D), or mastered (M))

2.3 Utilizing Table 6, describe the results of the program level assessments and any changes/planned actions made based on the outcomes of program level student learning assessments.

2.4 Describe any changes made to the program or courses that were a direct result of program level assessments.

Student Learning Outcomes

2.5 Describe the current status of SLOs in your program. Are the SLOs being updated as necessary? What is the planned assessment cycle (SLOs need to be assessed twice within the program review cycle). Are assessment results driving course-level planning? If deficiencies are noted, describe planned actions for change. How have courses with multiple sections been aligned so that a common tool is used to assess student learning outcomes? Describe any steps taken to standardize measures.

Each Astronomy course has a fully updated set of SLOs. The SLOs for each course are revisited each year, and updated as necessary. Each SLO is assessed according to the School of Math and Science schedule. If deficiencies are uncovered, modifications to the course are made by the instructor, as they deem fit.

All Astronomy courses that have multiple sections use a common assessment tool, so that all sections can compare the success rates of their students. We have a high level of student learning success among all sections.

2.6 Review the course level SLOs completed by the program in the last year to ensure accuracy of information provided.

The SLOs for all Astronomy courses are working very well. They are constantly reviewed, in case any changes need to be made.

2.7 Describe any changes made to the program or courses that were a direct result of student learning outcomes assessments.

As an example of a change in a course that was made as a result of analysis of the SLOs, in ASTR 010, one instructor decided to include the use of i-clickers in his class to increase the amount of student interaction in the class.

Curricular Offerings

2.8 Course offerings. Attach a copy of the course descriptions from the most current catalogue. Describe any changes to the course offering since the last program review cycle (course content, methods of instruction, etc.), and provide rationale for deletion or addition of new course offerings. Also state whether a transfer degree has been established in accordance with SB 1440. Include a discussion of courses offered at Centers (Vacaville, Vallejo, Travis) and any plans for expansions/contraction of offerings at the Centers.

The following four courses are taught in the Astronomy Department:

ASTR 010 3.0 Units

General Astronomy

Course Advisory: Eligibility for English 001 and SCC minimum Math standard.

An introductory study of the universe, including the properties and evolution of galaxies, stars, pulsars, black holes, quasars, the sun, planets, and life in the universe. Field trip may be required.

Three hours lecture.

ASTR 020 1.0 Unit

Astronomy Laboratory

Prerequisites: ASTR 010, 030, or 040 (courses may be taken concurrently).

Course Advisory: Eligibility for English 001 and SCC minimum Math standard.

Students will gain familiarity with the sky, telescopes, and other astronomical equipment. They will do experiments in Physics related to Astronomy. Topics will cover the moon, planets, stars, galaxies, and cosmology. Field trips may be required.

Three hours lab.

ASTR 030 3.0 Units

The Solar System

Course Advisory: Eligibility for English 001 and SCC minimum Math standard.

An introductory study of solar system astronomy, the physics related to that astronomy, the planets and their moons, the sun, solar system debris, and the possibility of extraterrestrial life. Field trips may be required.

Three hours lecture.

ASTR 040 3.0 Units

Stars, Galaxies and Cosmology

Course Advisory: Eligibility for English 001 and SCC minimum Math standard.

An introductory study of stars, galaxies, the universe, and the physics related to these topics. This includes an examination of the facts relating to the sun, stellar lifetimes, supernovae, black holes, and cosmology. Field trip may be required.

Three hours lecture.

All of our Astronomy courses were already active when the 2010 Physical Sciences program review was done – which included Astronomy. In addition more online sections were added for ASTR 010 in the past five years. ASTR 010 has also been offered in both Fall and Spring, at the Vallejo Center since 2012, and at the Vacaville Center since 2014. The current plan is to keep offering this class at Vallejo in both Fall and Spring, but the Spring offering at Vacaville has been discontinued by the Dean of the Vacaville Center, as of 2017. We also plan to add a section of ASTR 020 at Vallejo.

The Astronomy Department currently offers no degrees or certificates. Currently, there is no ADT degree in Astronomy, nor are there any drafts under consideration by the state. However, we plan to create an Astronomy AS degree; the work required to set up this degree will be done in 2017 (see section 5.2, Short-Term Goals, below). We plan to create a new course, ASTR 050, “Astronomical Optics”. We also plan to add another face-to-face section of ASTR 010 in Fairfield, and another face-to-face section of ASTR 020 in Vallejo.

2.9 Fill rates/Class size. Discuss the trends in course fill rates and possible causes for these trends (include comparison/analysis of courses by modality if applicable). Address how the size of classes affects courses, and if there are any necessary adjustments to course classroom maximums. If there are courses that are historically under-enrolled, discuss strategies that might increase enrollment.

Fill rates for all Astronomy courses, for each term over the past five years, are shown in the following Table 13. The fill rates are reported as percentages rounded to two figures, for ease of reading. Note that the average fill rates are weighted according to the number of sections taught; these numbers are listed in Table 5, above.

Table 13: Fill rates for Astronomy courses, term by term, over past five years

	F 11	S 12	F 12	S 13	F 13	S 14	F 14	S 15	F 15	S 16
ASTR 010	114%	111%	109%	95%	98%	98%	84%	86%	80%	76%
ASTR 020	120%	110%	110%	133%	147%	132%	90%	113%	117%	123%
ASTR 030	112%	112%	96%	103%	80%	75%	96%	58%	86%	38%
ASTR 040	-	102%	-	72%	-	32%	-	38%	-	40%
Average	114%	110%	107%	103%	102%	93%	87%	83%	86%	78%

Over the past five years, our program-wide fill rate by semester has decreased gradually and continuously from 114% to 78%, with an average of 96%. The drop-off has occurred mainly in ASTR 030 and 040. One possible reason for this may be the retirement of the longest-tenured member Philip Petersen, who was well known (and beloved) by students. If this trend is to be reversed, the hiring of a new full-time faculty member is vital to offer stability to the students.

2.10 Course sequencing. Report on whether courses have been sequenced for student progression through the major, how students are informed of this progression, and the efficacy of this sequencing.

This issue is not applicable to Astronomy, as there is no Astronomy major or degree. Students who take the laboratory course ASTR 020 must also take at least one of the three other Astronomy courses, ASTR 010, ASTR 030, or ASTR 040, either prior to, or concurrently with, taking ASTR 020. However, students may take any of these three Astronomy lecture courses without taking ASTR 020.

2.11 College Preparedness / Basic Skills (if applicable). Describe the basic skills component of the program, including how the basic skills offerings prepare students for success in transfer-level courses. If your program doesn't have designated basic skills courses, then explain how your courses support fundamental writing and/or mathematic competencies. Analyze courses with course advisories, prerequisites and/or co-requisites to see whether this level of preparation supports student success.

The Astronomy Program does not offer basic skills courses; however, our courses serve many underprepared students. We support our students in a number of ways including: Providing lists of student services available through the college; Providing lists of study techniques in the course syllabus; Providing students with a learning styles inventory; and Referring students to specific services (e.g., the Tutoring Center) for additional support as necessary.

Some astronomy faculty members also review the basic math skills that are required in each particular class.

2.12 Student Survey. *Describe the student survey feedback related to course offerings. In terms of the timing, course offerings, and instructional format, how does what your program currently offer compare to student responses?*

In accordance with the Program Review Handbook, student surveys were distributed in Fall 2015. The overall response rate was only 13% (36/278). Although the percentage of students answering the survey is very low, some interesting trends can be discerned from the results.

Eighty percent of the respondents were not majoring in a physical science. About 50% are taking their class to transfer, and 80% were taking the class as a general education requirement. A large majority (86%) preferred to take their astronomy classes at Fairfield Main Campus, although a non-negligible percentage were also interested in taking astronomy classes at Vacaville Center (29%) or at Vallejo Center (18%). Note that students were allowed to indicate more than one “preferred location”, and so the total adds up to 133%.

The majority of students (59%) expressed an interest in utilizing an Astronomy/Science learning center/computer lab, if it were made available. The need for such a learning center is confirmed by the fact that only 17% of the students felt “very prepared” when attending an astronomy course; 48% felt “somewhat prepared”, and 35% felt “not prepared at all”. Some students also complained about the fact that the astronomy lab class does not involve any observations of the moon, stars, or planets performed outside. This comment could be addressed if a dedicated observing area were to be set up on the Fairfield campus, as part of the suggested new Physical Science building.

2.13 Four-year articulation (if applicable). *Utilizing the most current data from the articulation officer, and tools such as ASSIST.org, state which of your courses articulate with the local four-year institution and whether additional courses should be planned for articulation.*

All four of the courses taught in the Astronomy Department, ASTR 010, ASTR 020, ASTR 030, and ASTR 040, articulate to most campuses of the CSU and UC systems (IGETC Area 5A, 5C; CSU GE Area B1, B3). ASTR 010, ASTR 020, and ASTR 040 each satisfy the IGETC requirements that allow community college transfer students to fulfill lower-division general education requirements either at the UC or the CSU system, and satisfy the CSU General Education pattern.

2.14 High school articulation (if applicable). Describe the status of any courses with articulation/Tech Prep agreements at local high schools.

As all four of the courses taught in the Astronomy Department are college-level, we have no articulation agreements with local high schools.

2.15 Distance Education (if applicable). Describe the distance education courses offered in your program, and any particular successes or challenges with these courses. Include the percentage of courses offered by modality and the rationale for this ratio. Discuss your program's plans to expand or contract distance education offerings, and state how you ensure that your online courses are comparable to in-class offerings

The largest enrollments in the Astronomy department come from ASTR 010 face-to-face at Fairfield, and ASTR 010 online. Currently we have one section of ASTR 010 face-to-face at Fairfield, which fills to capacity as soon as enrollment opens. Another face-to-face section of ASTR 010 is needed at Fairfield, and possibly two.

ASTR 010 is the only Astronomy course currently offered online. Three on-line sections of ASTR 010 are usually taught in the Fall and Spring. These sections fill to capacity as soon as enrollment opens. As the adjunct faculty member who teaches these courses cannot carry any more classes without being overloaded, we may be unable to offer these classes in the coming year. We have also taught one on-line section of ASTR 010 in the summer; this can be increased to two.

Phil Petersen (currently re-hired as an adjunct) is in the process of getting his on-line section of ASTR 010 approved by the Distance Education Committee, and it will be offered in the Summer of 2017.

The shells of our online courses are regularly reviewed to make sure that they are up to date and functional.

2.16 Advisory Boards/Licensing (CTE) (if applicable). Describe how program curriculum has been influenced by advisory board/licensing feedback.

The Astronomy Program currently has no external advisory board. In the absence of an Astronomy major or degree, such a board would not be necessary or meaningful.

STUDENT EQUITY & SUCCESS

3.1 Course Completion and Retention. Anecdotally describe how the program works to promote student success.

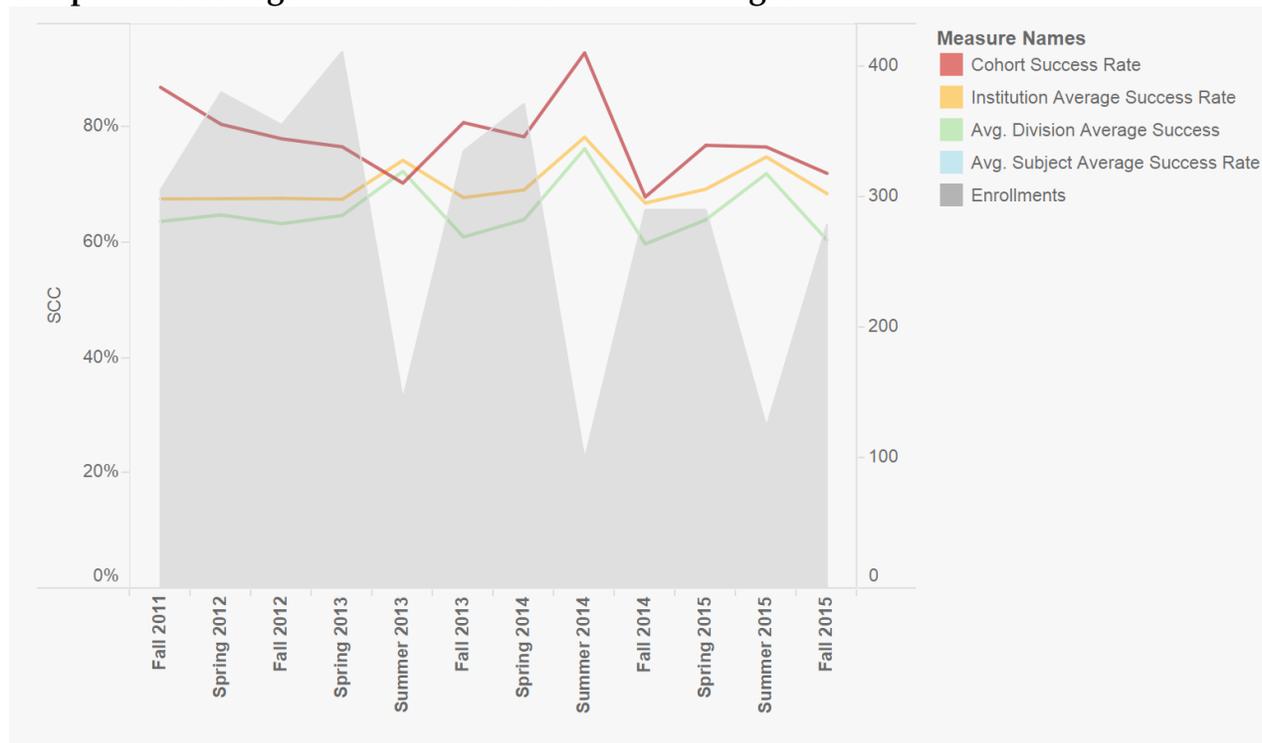
Faculty members who teach in the Astronomy program use a variety of techniques to promote student learning. At the beginning of a semester, many faculty members provide their classes with an overview of techniques that promote student success. In

addition, some faculty members review the basic math skills required to succeed in astronomy classes. As the semester progresses, many instructors refer students to the campus-wide Student Success Workshops (*e.g.*, time management, test anxiety, *etc.*) and the campus Tutoring Center. Furthermore, many instructors offer review sessions and encourage the forming of study groups between students.

Furthermore, our instructors often use one or more companion websites as a means to provide course material, such as Powerpoint slides of lectures, online homework, and other useful resources.

Student success rates in Astronomy are shown in detail in Figures 1 and 2. These data cover the years 2011-2015, and are broken down by ethnicity in Figure 2. In both figures, they are compared with average success rates for the Division of Math and Science, and the College as a whole.

Figure 1: Student success rate in astronomy courses, over the past five years, compared to college-wide and division-wide averages.



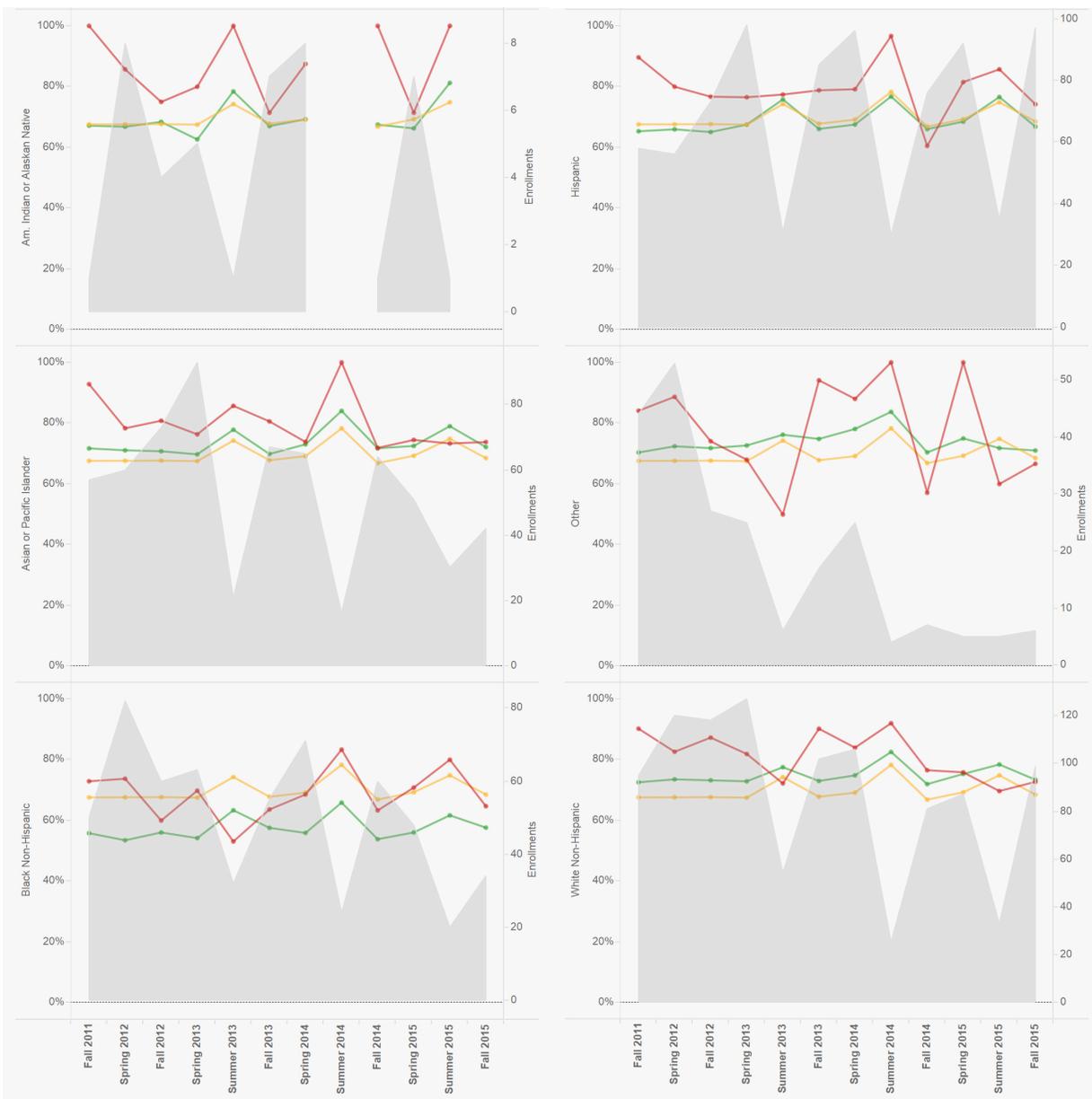
Student success rates for students in astronomy courses are systematically higher than the success rates found college-wide. Student success rates exhibit some variation based on subject taught, ethnicity, and instruction method used.

Traditional face-to-face classes have in general a much higher success rate than online classes. This trend may be due to several factors, many of which are external to the classroom. For instance, online learning environments require additional motivation and responsibility by the students, who cannot receive the same guidance received in a traditional face-to-face learning environment. As this trend is common in online courses, this issue would be best addressed by the Distance Education Committee.

Success rates between female and male students do not appear to differ significantly. During the period considered in this review, the average success rate for female students was 77.9% (standard deviation = 7.1%) and for male students, the success rate was 78.3% (standard deviation = 7.6%).

Success rates between ethnic groups differed significantly, with the white (non-Hispanic) group having the highest success rate (75.0%), and black (non-Hispanic) group having the lowest success rate (57.7%). However, the success rate for each ethnic group is well above the college-wide average success rate relative to that ethnic group.

Figure 2: Student success rate by ethnicity: ethnicity success rate in astronomy courses (red), institutional average success rate (yellow), ethnicity success rate at the college level (green), and enrollment by ethnicity (gray shaded area) are shown.



Although the success rate in Astronomy courses is higher than the corresponding success rate observed at the college level for each of the categories examined, these trends in success are in agreement with campus-wide and nation-wide trends. Much of this success can be attributed to the ancient human yearning to understand the night sky.

Even though Astronomy courses in general show a high success rate, Astronomy faculty continue to take actions to improve some of the weak spots that our students may encounter, such as, for instance, unpreparedness for our courses, especially regarding basic math skills (as shown also by the student survey).

In the student survey that was distributed in all Astronomy classes in the Fall of 2015, students expressed an interest in utilizing an Astronomy/Science learning center/computer lab, if one was made available. Although such a learning center is not currently available, faculty members are encouraging students to take advantage of existing support, such as the drop-in tutoring center. An additional effort to improve the success rate of students belonging to the black (non-Hispanic) ethnic group has been made by Astronomy faculty who are encouraging the best African-American students to become tutors for their peers, and are promoting programs such as Umoja Program Scholars (UPS), which is actively serving students and promotes academic success for all, with a special emphasis on African-American students.

3.2 Degrees/Certificates Awarded (if applicable). *Include the number of degrees and certificates awarded during each semester of the program review cycle. Describe the trends observed and any planned action relevant to the findings.*

As mentioned above, at the time of the preparation of this program review self-study, SCC does not award any degrees or certificates in Astronomy.

3.3 Transfer (if applicable).

Not applicable to the Astronomy program.

3.4 Career Technical Programs (if applicable).

The Astronomy Department does not run a technical training program.

PROGRAM RESOURCES

4.1 Human Resources. *Describe the adequacy of current staffing levels and a rationale for any proposed changes in staffing (FTES, retirements, etc.). Address how current staffing levels impact the program and any future goals related to human resources.*

The Astronomy program is currently in a state of extreme instability and uncertainty. The only full-time faculty member in the Astronomy Department, Phil Petersen, retired after the Spring 2014 term. A full-time temporary replacement, Alessandro Baldi, was

hired for the 2015-2016 academic year; this appointment ended in Spring 2016. Consequently, no full-time faculty member will be teaching any of the Astronomy classes during the 2016-17 academic year; all Astronomy classes will be taught by adjuncts.

During the past five years, adjunct faculty have carried 55% of the FTEF in Astronomy. However, the trend indicates that increasingly more teaching load is being carried by adjuncts, with the proportion of FTEF for the 2015-2016 academic year carried by adjuncts being 77%, which is far from the standard norm of 25%. Hiring one or more full-time faculty on a permanent basis would be vital to enhance the strength of the Astronomy program, by ensuring long-term stability, and a high quality educational experiences for our students.

4.2 Current Staffing. *Describe how the members of the department have made significant contributions to the program, the college, and the community.*

Most of the teaching in the Astronomy Department has typically been shouldered by a small number of faculty – one full-time faculty and four adjuncts. The faculty have maintained a department that has served between 600-700 students each year, providing a large fraction of SCC's general education physical science courses.

Several contributions were made by Astronomy faculty that extended beyond the walls of SCC. Full-time Physics/Astronomy Instructor Phil Petersen published a book entitled "The Quantum Shield" (Empyrean Quest Publishers, 2011). Instructor Alessandro Baldi was a co-author of a scientific paper "The morphologies and alignment of gas, mass and the central galaxies of CLASH clusters of galaxies", M. Donahue, A. Baldi *et al.*, *Astrophysical Journal*, vol. 819, paper 36, 2016. Adjunct Astronomy instructor Katie Berryhill presented a paper entitled "Impact of Prior Astronomy Learning Experiences on TOAST Scores" at the Summer Annual Meeting of the American Association of Physics Teachers, Sacramento, CA, July 16-20, 2016.

4.3 Equipment. *Address the currency of equipment utilized by the program and how it affects student services/success. Make recommendations (if relevant) for technology, equipment, and materials that would improve quality of education for students.*

Although most of our telescopes are old, they are still functional, and suitable for their purpose. This equipment needs to be maintained and upgraded as needed.

As the telescopes are only used in ASTR 020, and can only be used effectively in night classes, the majority of Astronomy students don't really get an appreciation for the night sky, except through computer labs. The best way to expose all Astronomy students to the night sky, and to enhance their understanding of its motion through the year, would be by investing in a digital domed planetarium, that all Astronomy students could experience, day or night.

4.4 Facilities. *Describe the facilities utilized by your program. Comment on the adequacy of the facilities to meet program's educational objectives.*

Astronomy is the largest department within the Physical Sciences, by a factor of two if measured by the number of students served, yet it is the only department not to have any dedicated space.

The workhorse of the Astronomy program, and the largest generator of FTES, is ASTR 010. This class has a class maximum of 50, and all sections taught on the Fairfield campus have perfectly adequate space in Building 300 (room 308), which was recently remodeled with Measure G funds, and provides an excellent space for this course.

The smaller Astronomy classes, ASTR 020, ASTR 030, and ASTR 040, can be taught in either rooms 301 or 302. The new course, ASTR 050 will be taught in room 301. These spaces are more than satisfactory for the foreseeable future.

For the longer term, the Astronomy Department faculty, along with the Physics and Engineering Departments, have been advocating the construction of a new dedicated Physical Sciences building, which would include a domed planetarium. Astronomy is a growth area for the college, and can serve as an entry port into all of the physical sciences. It has been found that access to a domed planetarium increases student understanding of astronomical concepts by 24%, and leads to an 11% increase in student interest in pursuing a career in science (C. Sumners, Quantification of Student Learning in the Planetarium, *International Planetarium Society Conference*, Montreal, 12 July 2000.) Controlled studies have shown that students exposed to a domed planetarium perform significantly better on subsequent tests of their astronomical knowledge than do students who were instructed by other means (K.C. Yu, K. Sahami, V. Sahami, and L.C. Sessions, Using A Digital Planetarium For Teaching Seasons To Undergraduates, *Journal of Astronomy & Earth Sciences Education*, vol. 2, pp. 33-50, 2015). An e-mail was sent to the Bond Manager and Governing Board on 12/18/15, and to President Esposito-Noy on 2/4/16, explaining faculty support for this initiative.

4.5 Budget/Fiscal Profile. *Provide a five year historical budget outlook including general fund, categorical funding, Perkins, grants, etc. Discuss the adequacy of allocations for programmatic needs. This should be a macro rather than micro level analysis.*

The following table shows the general funds budget for the Astronomy Department over the past five years. As this table clearly shows, almost the entire budget has gone towards salaries and benefits, and almost none towards maintaining or updating our equipment. Although the present state of our astronomy equipment is adequate in the short term, a major capital expenditure is needed in the longer term to provide SCC with the type of planetarium that will attract and inspire students, and the community, for decades into the future.

Table 14: Budget for the Astronomy Department, year by year, over past five years.

Category	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015
Academic Salaries	\$69,022.47	\$73,861.44	\$66,529.89	\$76,119.40	\$83,390.88
Classified Salaries	\$0	\$0	\$0	\$0	\$0
Benefits	\$18,980.75	\$23,380.31	\$18,600.85	\$16,917.87	\$19,518.49
Supplies	\$0	\$15.00	\$15.00	\$20.72	\$5.25
Other operating	\$0	\$0	\$0	\$0	\$0
Capital outlay	\$0	\$0	\$0	\$0	\$0
Total	\$88,003.22	\$97,256.75	\$85,145.74	\$93,057.99	\$102,914.62

PROGRAMMATIC GOALS & PLANNING

5.1 Summarize what you believe are your program's strengths and major accomplishments in the last 5 years. Next, state the areas that are most in need of improvement.

The main strength of our program is the excellent instruction and the popularity of our classes, especially ASTR 010. Students who are pursuing a General Science A.S. degree, typically choose an Astronomy course to fulfill their Physical Science course requirement, more frequently than any other Physical Science course offering, by a factor of 2 to 1.

In addition to fulfilling a General Science requirement, the new Astronomy A.S. degree will attract even more students who are interested in pursuing Astronomy as their major at a four-year college or university.

The most important need for the future is to hire a full-time Astronomy/Physics faculty member. The program needs someone with a strong Astronomy background to shepherd the program forward, and to help design the future space for the Physical Sciences that will include both a digital domed planetarium, as well as a viewing platform. If we do not build such a facility, we will miss a huge potential for growth for the Physical Sciences at SCC, for the rest of the 21st century, by not seizing this moment, and allowing Astronomy to blossom as a portal into the Physical Sciences.

Our current space in building 300 is quite suitable for our needs for the foreseeable future, and will serve us well as we put plans in place for our new home in a future Physical Sciences Building.

5.2 Based on the self-study analysis, prioritize the program's short (1-2 years) and long term goals (3+ years). In the source column denote "SP" for Strategic Proposals, "DB" for Department Budget, "P" for Perkins or "NR" for No Additional Resources Needed.

As explained and motivated in various sections above, the short-term goals of the Astronomy program include hiring a full-time Astronomy/Physics faculty member, creating a new course in telescope design, creating an Astronomy AS degree, adding another face-to-face section of ASTR 010 in Fairfield, adding another face-to-face section of ASTR 020 in Vallejo, and keeping/maintaining our space in Building 300 in Fairfield.

Longer-term goals include replacing the Physical Science technician when he retires, and building new facilities for our program, which will include a domed planetarium and viewing platform, as part of a future new Physical Sciences Building.

Bakersfield City College, which is similar in size to SCC and located in a similar semi-rural area, attracts 4500 K-12 students each year to their planetarium (<http://www2.bakersfieldcollege.edu/nstrobels/physsci/whole-dept-EMP5.htm>).

Glendale Community College attracted 5400 K-12 students to their planetarium in the 2015-16 academic year (“Stars and passion for learning align at Glendale Community College planetarium”, *Glendale News Press*, May 13, 2016). These examples show the level of engagement with schools that we could achieve if a domed planetarium were to be built at SCC.

Funds from Measure Q have already been fully allocated to the new Science Building, which has no space allotted to Astronomy. But perhaps the huge new influx of funds that will be available from California State Proposition 51, approved by the voters on November 8, 2016, which “authorizes \$9 billion in general obligation bonds for new construction and modernization of K–12 public school facilities, charter schools and vocational education facilities, and California Community Colleges facilities”, could be tapped into for a new Physical Sciences Building that includes a domed planetarium.

Table 15: Short-Term and Long-Term Goals

Short-Term Goals	Planned Action	Target Date	Person Responsible	Source
1. Return the Fairfield ASTR 010 and ASTR 040 sections to their traditional M-W timeslots	Address this in the Spring 2018 scheduling	Fall 2017	Melanie Lutz	NR
2. Hire a full-time Astronomy/Physics faculty member	Submit paperwork for new position to Dean	November 1, 2016	Melanie Lutz	SP
3. Add new course, ASTR 050, Astronomical Optics	Enter course details into CurricUNET	Spring 2017	Randy Smith	NR
4. Create an Astronomy AS degree	Enter degree details into CurricUNET	Spring 2017	Phil Petersen	NR

5. Retain current space (rooms 301, 302, 308, plus prep/storage space)	Constant vigilance on the part of our faculty	Ongoing	All faculty	NR
6. Add another face-to-face section of ASTR 010 in Fairfield	Requires hiring of new full-time instructor (see Short Term Goal 1)	Fall 2017	Melanie Lutz	DB
7. Add another face-to-face section of ASTR 020 in Vallejo	Requires hiring of new full-time instructor (see Short Term Goal 1)	Fall 2017	Melanie Lutz	DB
8. Purchase three new laser projectors	Purchase with Astronomy allotment of General Funds	Spring 2018	Astronomy faculty	DB

SP = Strategic Proposal, DB = Department Budget, P = Perkins, and NR = No Additional Resources Needed.

Long-Term Goals	Planned Action	Target Date	Person Responsible	Source
1. Create new space, including a domed planetarium, in a future Physical Science/Math building	Forcefully advocate for this plan	Approx'ly 2025	Faculty and Administration	SP
2. Replace technician upon his retirement	Will address when time comes	TBD	Administration	NR
3. Create a maintenance fund for Astronomy classrooms in Bldg 300	A portion of Measure Q funds should be allocated for this purpose	Ongoing	Administration	DB

SP = Strategic Proposal, DB = Department Budget, P = Perkins, and NR = No Additional Resources Needed.

Solano College Astronomy Program Student Survey.

The Astronomy Program in the School of Math and Science is undergoing program review and we are interested in the four courses (General Astronomy, Astronomy Lab, The Solar System, Stars, Galaxies, and Cosmology) that are currently offered at SCC (in Fall 2015 and/or Spring 2016). The following questions are designed to help the department evaluate the overall program and its offerings. **If your current class is the only course you have taken in the subject of Astronomy, please respond to the questions based on this course. If you have taken more than one Astronomy course, consider the questions in light of all the courses you have taken in Astronomy.**

If you have recently completed and submitted this survey in another Astronomy class, please do **not** complete a second survey. The information provided will remain strictly confidential.

1. Which Astronomy courses have you successfully completed with a C or better at Solano College? (Check all that apply).

- ASTR 010 General Astronomy
- ASTR 020 Astronomy Lab
- ASTR 030 The Solar System
- ASTR 040 Stars, Galaxies, and Cosmology

2. In which Astronomy course(s) are you currently enrolled? (Check all that apply).

- ASTR 010 General Astronomy
- ASTR 010 Astronomy Lab
- ASTR 030 The Solar System
- ASTR 040 Stars, Galaxies, and Cosmology

3. Is your major in the physical sciences? (includes: General Science, Physics, Physics for transfer, Chemistry, etc.)

- Yes
- No
- Undecided

4. What is your reason(s) for taking your current class? (Check all that apply)

- General education requirement
- Required for major
- Transfer
- Professional development
- Required for my current job
- Prerequisite
- General interest
- Fits my schedule
- Other: _____

5. At which campus do you prefer to take your Astronomy classes? (Check as many as apply)

- Fairfield (Main)
- Vacaville
- Vallejo

6. What were your reasons for choosing Solano College?

- Location
- Good programs/reputation
- Childcare available
- Availability of classes
- Other: _____

7. How do you choose your classes? Rank your choices on 1 through 6, one being the most important!

- Fits my schedule
- Needed for my Major
- By instructor reputation
- By friends advice
- By Rate My Professor
- By Location

8. How satisfied are you with the availability of Astronomy classes?

- Very Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very Dissatisfied

9. What would be your preferred time(s) for courses to be offered? (Check all that apply)

a. Weekday Start Times

- Early Morning (8am)
- Morning (9am-noon)
- Afternoon (1-4pm)
- Evening (\geq 5pm)
- No preference

b. Weekend labs

- Saturday morning
- Saturday afternoon
- Would not attend on Saturdays

10. If evening courses are offered, please check your preferred start time.

- 5:00pm
- 5:30pm
- 6:00pm
- 6:30pm

11. Would you take an online/hybrid Astronomy course? Hybrid classes combine on-line lectures with in-person labs.

- Yes
- No

12. Would you utilize a Astronomy/Science learning center/computer lab if it were available?

- Yes
- No

13. Have you had to repeat any of these classes at Solano College?

- ASTR 010 General Astronomy
- ASTR 020 Astronomy Lab
- ASTR 030 The Solar System
- ASTR 040 Stars, Galaxies, and Cosmology
- None of the above

14. Have you attempted any class in one of these subjects (specify the course number)?

- Chemistry (CHEM)
- Geography (GEOG)
- Geology (GEOL)
- Physical Science (PHSC)
- Physics (PHYS)
- None of these

15. Have you passed either of these classes with a C or better (specify the course number)?

- Chemistry (CHEM)
- Geography (GEOG)
- Geology (GEOL)
- Physical Science (PHSC)
- Physics (PHYS)
- None of these

16. How satisfied are you with the quality of textbooks and instructional materials utilized in the Astronomy classes?

- Very Satisfied
- Satisfied
- Neutral

- Dissatisfied
- Very Dissatisfied

17. How satisfied are you with the quality of the instructor(s) teaching your Astronomy class(es)?

- Very Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very Dissatisfied

18. How satisfied are you with the quality of the classrooms Astronomy courses are taught in?

- Very Satisfied
- Satisfied
- Neutral
- Dissatisfied
- Very Dissatisfied

19. Rate how your academic background prepared you for Astronomy. 1= very prepared, 3 = not prepared at all.

- 1
- 2
- 3

20. What are the Astronomy program's greatest strengths?

21. What are the Astronomy program's weaknesses?

Thank you! We appreciate your time & your opinions are valuable to us.

SIGNATURE PAGE

The undersigned faculty in the Astronomy Department have read, and concur with, the findings and recommendations in the attached program review self-study, dated November 14, 2016.

Dr. Alessandro Baldi
(full-time, Astronomy/Physics, 2015-16)



Signature

Dr. Katie Berryhill
(adjunct, Astronomy)



Signature

Dr. Tom MacMullen
(adjunct, Astronomy/Physics)



Signature

Dr. Philip Petersen
(full-time, Astronomy/Physics, 2004-14; now adjunct)



Signature

Mr. Randy Smith
(adjunct, Astronomy/Physics)



Signature