ASTRONOMY PROGRAM REVIEW 2013

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Overview of the Program

The Astronomy Department offers four courses in freshman-level astronomy that fulfill general education requirements for the A.A. and A.S. degrees in natural science:

Astronomy 12: Astronomy Lab
Astronomy 13: Astronomical Optics
Astronomy 20: The Solar System
Astronomy 25: Stars and Galaxies

These courses meet transfer requirements for CSU for physical science, both lecture and lab courses, and are also transferable to UC. The two lecture courses are taught in the 30-foot Planetarium, which houses a cutting-edge star projector. Astro 12 is taught in the evening on a dedicated observing deck with observatory. Astro 13 is a course in telescope making, highly unusual at community colleges, and is taught in a classroom specially designed for the purpose—perhaps the only such classroom on Planet Earth.

The Department currently consists of two full-time instructors and two part-time instructors. There are 30 sections offered every year serving approximately 1200 students. Astronomy is a popular choice for students seeking to fulfill their graduation and transfer requirements in natural science; many will take a second or third course because of their interest in the mysteries of the cosmos.

The program's mission statement is:

> *The Astronomy Department prepares students to become scientifically knowledgeable and contributing citizens. Important to this mission are an improved student perspective on how their lives and new scientific developments fit within the greater context of mankind's knowledge, and an understanding of how new knowledge is achieved.*

The Astronomy Program currently offers no degrees or certificates.

When it comes to outreach to the community, the Astronomy Department is very active. Once a month, we host the meetings of the local astronomy club, the South Bay Astronomical Society, who bring excellent speakers to our campus. Supported by the STEM grant, planetarium shows and telescope observing are offered to the community about once a month. These events are free, open to the public, and exhibit the wonders of the night sky to all. We also participate annually in Onizuka Space Science Day, aimed principally at middle-school and high-school students, when an astronaut comes to campus to speak to the students and a wide variety of activities are offered to inspire them to take an interest in the sciences.

The Astronomy Program supports the College's Mission Statement by providing popular, exciting, and inspiring classes. In alignment with Strategic Initiative A, we use a variety of educational methods and techniques in order to engage students and promote learning, including the realistic display of stars and sky motions in the Planetarium, full-dome video presentations, and lecture-tutorial exercises that promote active learning. In support of Strategic Initiative F, the program utilizes the latest technology, including our star projector, a full-dome video projector with surround sound a four state-of-the-art digital posters. We support Strategic Initiative G by continually promoting the use of cut-off outdoor lighting that saves energy because no light is wasted by going up into the sky.

Status of Previous Recommendations

Non-facilities-related recommendations:

1. *Hire a full-time planetarium manager.*

   No action has been taken.

2. *Convert some Astronomy 25 sections to Astronomy 20.*

   The number of sections of Astronomy 25 has been reduced while the number of sections of Astro 20 has increased slightly:

	Astro 20	Astro 25
2010	17	10
2013	21	6

3. *Offering Supplemental Instruction for Astro 25 or Astro 20.*

   SI was offered for Astronomy 20 in Fall 2012 and Spring 2013 with good success.

4. *Devote a section of Astronomy 20 to teachers.*

   In view of the recent reductions in sections offered, this recommendation is not practicable at the present time.

5. *Create an Astronomy Department chair.*
   The Department is no longer interested in pursuing this proposal.

6. *Create English or Math pre-requisites for Astro 20 and 25.*
   There has been no interest in pursuing this idea.

7. *Compare the student population in astronomy classes at ECC to those across the State.*

No action has been taken, so far as we know.

8. *Reduce the normal class size of Astronomy 25 from 40 students to 30 or 35.*
   Under the current budget environment, this proposal is not feasible. However, instructors have reduced the number of students beyond 40 that they are adding during the first week. A better alternative might be to reduce the class size of Astronomy 20 from 45 to 40, the size it used to be for many years.

9. *Recruit faculty to teach on-line classes.*
   David Pierce, who has been teaching our on-line sections, has retired completely. However, Perry Hacking is planning to take the training for on-line classes this year so he may be able to teach on-line sections in Fall 2014.

Facilities-related recommendations:

1. *Purchase an industrial dehumidifier.*
   Testing has shown that the humidity is within acceptable guidelines.

2. *Replace the water heater.*
   No action taken.

3. *Replace the LCD projector.*
   Done.

4. *Fix the heating/cooling in the Planetarium.*
   No action taken.

5. *Purchase equipment to enable LCD wall displays.*
   Done.

6. *Purchase and install display cases.*
   No action taken.

7. *Replace the wireless microphone.*
   Done.

8. *Add the planetarium computer to the campus "replace computer" rotation.*
   Obsolete. A new computer has been installed as part of Recommendation #5.

9. *Replace tables and chairs in the Planetarium.*
   The chairs have been replaced, although the old tables remain.

Analysis of Program Statistics

The complete report of program statistics from Institutional Research is included as Appendix A. The following discussion summarizes the most significant data.

Enrollment

Enrollment in the Astronomy Program has been on a roller coaster the last 8 years. Starting in 2005-2006, enrollment rose from 1243 to a peak of 1726 in 2008-2009 and has since dropped back down to 1304 in 2011-2012. The recent decline is entirely due to the reduction in number of sections offered from 41 in 2008-2009 to 30 in 2011-2012 and 2012-2013. Fill rates are consistently above 100%. Every semester we turn away dozens of students wanting to add. The demand for our classes exceeds the supply. The Astronomy Department feels that we could easily fill 40 sections at this time.

YEAR	SECTIONS	SEATS FILLED
2005-06	*31*	1243
2006-07	*30*	1323
2007-08	*38*	1510
2008-09	41	1726
2009-10	35	1621
2010-11	31	1368
2011-12	30	1304
2012-13	30	

Grade Distribution

The grade distribution for all classes from Fall 2008 to Spring 2012 is shown below (Ws are excluded):

A	22%
B	27%
C	29%
D	10%
F	14%

There are roughly equal numbers of As, Bs, Cs, and D/Fs. In the absence of a College grading policy, this seems like a fairly reasonable distribution. We lament the number of Fs, which mostly go to students who stop attending after the last withdrawal date.

There is no big difference in grade distribution among Astronomy 12, Astronomy 20, and Astronomy 25. Astronomy 13, the telescope-making course, is unusual in that most students who complete the course get As, which is not surprising since the course attracts the top astronomy students.

Success and Retention

Success and retention rates in Astronomy go up and down. The overall retention rate has remained about 75%. The Success rate, however, does seem to be inching up, going from 54% in Fall 2008 to 62% in Fall 2012. There is no difference between fall and spring semesters. The Success rate for the online sections is much lower, about 45%.

Semester	Enrollment	Success	Retention
Fall 2008	831	54%	78%
Spr 2009	809	58	81
Fall 2009	802	56	76
Spr 2010	710	64	77
Fall 2010	658	56	72
Spr 2011	614	58	71
Fall 2011	706	58	76
Spr 2012	520	62	74
Fall 2012	613	62	77

The 5-year Success average is 57.5%, significantly lower than the College standard of 65.0%, but similar to that in other science departments. This reflects the fact that science courses, including astronomy, are challenging for many of our students. Students who sign up for astronomy may not always realize that they will be expected to learn many basic concepts of physics.

The Preliminary Success Standard for Astronomy is 56.4%. We accept this figure as the Program Standard, noting that the Program has exceeded this standard for the last four semesters.

Compared with comparable districts around the State, our Astronomy success and retention rates are on the low end of the range. They are, however, similar to the rates in the Los Rios district, which has a similarly diverse student population. The table below compares our program with astronomy programs at other urban districts around the State.

District	Enrollment	Success	Retention
El Camino	613	62	77
Foothill	1188	78	94
Los Rios	1309	62	83
Peralta	245	73	87
Santa Monica	598	72	86

Comparison of comparable districts, Fall 2012

Success and retention rates are higher during the summer session. Here are the statistics for Summer 2011–2013:

Course	Enrollment	Success	Retention
Astro 20	44	66%	91%
Astro 25	207	75%	91%

The higher retention rate may be due to the shorter length of the summer term. During long terms, it's more likely that events will occur to cause students to drop out.

Comparison of courses

In our last review, we noted that Astronomy 25 (Stars and Galaxies) had lower success and retention rates than Astronomy 20 (Solar System). This difference has continued. The following table shows the combined statistics for Fall 2008 through Spring 2012 (not counting summer session). Only 16-week lecture (classroom) sections are included.

Course	Enrollment	Success	Retention
Astro 20	3066	61%	78%
Astro 25	1327	52%	75%

Retention in Astronomy 25 is not much less than for Astronomy 20, but the Success Rate is about 10% lower. In part, this may be due to a difference between instructors, since some instructors teach more sections of Astro 25 than others.

The Astronomy Lab course, Astro 12 had a success rate of 67% and a retention rate of 78% over the same period. The telescope-making lab, Astro 13, although it has a small enrollment and is offered only once per year, stands out not only for its high success rate (95%) but for its high repetition rate.

Comparison of on-line with lecture (face-to-face) classes

Below we compare the on-line Astro 20 sections with the 16-week lecture sections over the same period as above.

Mode	Enrollment	Success	Retention
Lecture	3066	61%	78%
On-line	483	46%	63%

The on-line sections have significantly lower success and retention rates. We conclude that while the on-line classes provide a good opportunity for many students who might otherwise be unable to take astronomy, in terms of the Program's overall success, the number of on-line sections should be limited to two per year .

Scheduling

The astronomy lecture courses (Astro 20 and 25) are given in the Planetarium. Currently, classes are scheduled in the morning, afternoon, and evening. Students prefer classes that meet no more than twice a week, so the daytime classes meet on Monday & Wednesday

or on Tuesday & Thursday. The first class in the morning is scheduled for 7:45am; because of recent section reductions, this time slot is often unfilled. The mid-morning, late-morning, and afternoon time slots are nearly full. In the past, demand was greatest for morning classes; in recent years, however, nearly all sections, regardless of time, have been filled.

The lab class (Astro 12) meets in the Planetarium on Monday evenings. (On Tuesday, Wednesday, and Thursday evenings, the Planetarium is reserved for lecture classes.) At the present time, number of sections of Astro 12, normally two or three, has been reduced to one per semester because of the remodeling of the Observatory on top of the former Math Building. After the refurbishing of the Observatory, additional lab sections can be scheduled right in the Observatory.

On Friday the Planetarium is underutilized. A 3-hour class is usually scheduled for Friday morning. This long lecture class, coming at the end of the week, suffers from an unusually high withdrawal rate. There are no Friday afternoon classes.

Years ago, we scheduled a class on Saturday morning, but had to discontinue it when we could no longer find an instructor willing to teach on Saturday.

Were we ever to restore some of the sections that have been cut in recent years, two sections could be scheduled in the morning, one in the late afternoon on Friday, and one on Saturday morning. An extra evening section on Monday night could be accommodated by moving Astro 12 to another classroom. Adding all of these possible sections gives a total of 18 sections that could be scheduled in the Planetarium. Astronomy 12 can be scheduled in other classrooms or on the roof after the Observatory is re-opened up to a total of four sections.

Comparison of times

We decided to look at the effect of scheduling on success and retention. These data were not readily available on a department-wide basis, so the following data were compiled for the courses of one instructor in the fall semester over the years 2010 to 2012.

Time	Enrollment	Success	Retention
Mornings	334	69%	85%
Afternoons	182	61%	76%
Evenings	230	69%	80%
Friday mornings	94	48%	67%

These data indicate that class time has a large effect on success and retention. The highest rates are for morning and evening classes; the lowest for Friday sections.

Recommendations

1. Add more sections of lecture and, after renovations are complete, lab.
2. Limit the number of on-line sections to two per year.
3. Schedule morning sections in preference to afternoon sections.
4. Experiment with scheduling 8-week classes in the late afternoon. Retention tends to be higher in shorter classes.
5. For evening courses, schedule two 1.5-hour classes, meeting two days a week, instead of one 3-hour lecture.

Curriculum

The Astronomy curriculum is small, consisting of two lecture courses and two lab courses.

The lecture courses are Astronomy 20 (the Solar System) and Astronomy 25 (Stars and Galaxies). Both are introductory courses, with no math or science prerequisites, that are intended to meet general education requirements.

The lab courses are Astro 12 (Astronomy Laboratory) and Astro 13 (Astronomical Optics). Astro 12 fulfills the physical science lab requirement for the general education curriculum. Astro 13, the telescope-making course, is a specialty course intended for enrichment. Although it doesn't satisfy any general education requirements, it does transfer to CSU as an elective. Moreover, it is an exciting, rarely offered course which has invigorated the telescope-making community in the South Bay and has appeared often in the news. Currently, because of cutbacks, Astro 13 is offered only once every year.

All four courses have been reviewed within the last six years. The review schedule follows.

COURSE	LAST CURR. REVIEW	NEXT CURR. REVIEW
Astro 12	Spring 2012	2015-2016
Astro 13	Fall 2012	2016-2017
Astro 20	Spring 2010	2014-2015
Astro 25	Spring 2010	2014-2015

Astronomy 50 (Special Topics) hasn't been offered in many years and is being inactivated. Astronomy 99 (Independent Study) is offered occasionally.

The astronomy curriculum has been unchanged for many years. The Department feels that this is a good time to expand the program by offering new courses. Currently under consideration are an introductory course in Astrobiology (offered in many other community colleges) and a sophomore-level course in Astrophysics or Cosmology (offered at UC).

<u>Distance Education</u>

Only Astro 20 has been offered as an online course. For a few years, two online sections were scheduled every semester. However, the semi-retired instructor who taught these sections is retiring completely. At the moment there is no one trained in teaching the online course.

Transfer and Articulation

There has been no change since the last review. Astro 12, 20, and 25 continue to maintain articulation with CSU and the UC system and continue to satisfy the requirements for the transfer curriculum.

Astronomy 13 (Astronomical Optics) is not intended to be a transfer course. It does not articulate and transfers to CSU as an elective.

Certificates and major program

The Astronomy Program does not award any certificates; nor is there an astronomy major. As is customary at the undergraduate level, students interested in astronomy are advised to major in physics. We have had many excellent students who have gone on into advanced studies in astronomy and physics.

Recommendations

1. Develop new courses, such as an Astrophysics course and an Astrobiology course.
2. After developing the Astrophysics course, create an Astrophysics major tied to the Astrophysics major at UCLA.

Student and Program Learning Outcomes

Almost all SLO assessments (8 of 9 or 88%) have been completed at least once. The last one is scheduled for Spring 2014. Three of the four (75%) PLOs have been assessed; the other is scheduled for Fall 2016.

Alignment Grids
Program mapping to ILO:

INSTITUTIONAL SLO	*PROGRAM RATING*
I. Content knowledge	4
II. Critical, creative & analytical thinking	4
III. Communication & comprehension	2
IV. Professional & personal growth	1
V. Community & collaboration	1
VI. Information & technology literacy	1

PROGRAM SLOs (PLOs)	*I*	*II*	*III*	*IV*	*V*	*VI*
1. Students will be able to apply the Scientific Method to the solution of scientific problems.	3	4	2	1	1	2
2. Students will be able to identify and appreciate ways in which astronomy affects their daily lives.	3	3	2	3	1	1
3. Students will be able to identify the structure and contents of the Universe and major events in the history of the Universe that led to the formation of the Earth.	4	3	2	2	1	1
4. Students will explain how electromagnetic radiation, astronomical instruments, and the application of the laws of physics are used to reveal the properties of stars, planets, and galaxies.	4	3	1	2	1	1

Alignment of SLOs with PLOs:

SLOs	PLO1	PLO2	PLO3	PLO4
Astro 12 (Astronomy Laboratory) SLO#1: Students will be able to apply the Scientific Method to the solution of scientific problems.	X			
Astro 12 (Astronomy Laboratory) SLO#2: Using a Cassegrain reflecting telescope, students will be able to align the telescope and point it at several objects, including the Moon, planets, bright and faint stars, and diffuse objects.				X
Astro 13 (Astronomical Optics) SLO#1: Students will begin a description of an optical surface and Foucault test data measured from it. They will then construct a Foucault test diagram and assess the quality of the surface.				X
Astro 20 (Solar System) SLO#1: Students will be able to apply the Scientific Method to the solution of scientific problems.	X			
Astro 20 (Solar System) SLO#2: Students will be able to explain causes of seasonal variations in the length of the day, direction of sunrise and sunset, and the amount of solar heating on the Earth.		X		
Astro 20 (Solar System) SLO#3: Students will be able to describe the modern theory of the origin of the planets and discuss the evidence that supports the theory.			X	
Astro 25 (Stars and Galaxies) SLO#1: Students will be able to apply the Scientific Method to the solution of scientific problems.	X			
Astro 25 (Stars and Galaxies) SLO#2: Students will explain how electromagnetic radiation and astronomical				X

instruments are used to reveal the properties of stars.				
Astro 25 (Stars and Galaxies) SLO#3: Students will be able to describe the modern theory of the origin of the Universe (the Big Bang Theory) and discuss the evidence that supports the theory.			X	

Assessment Timeline

CALENDAR YEAR	SEMESTER	SLO	PLO
Year 1 (2014)	Spring	A12: Scientific Method A25: Scientific Method	Scientific Method
	Fall	A20: Planet Origin	
Year 2 (2015)	Spring	A12: Locating Objects A25: Universe Origin	Origins
	Fall	A20: the Seasons	
Year 3 (2016)	Spring	A13: Optical Surfaces A25: EM Radiation	
	Fall		Applications Physical Laws
Year 4 (2017)	Spring		*[Program review]*
	Fall	A20: Scientific Method	

Discussion of assessment results

Program PLOs

PLO#1 (the Scientific Method) was assessed in spring 2010. In the analysis of this assessment it was noted that in general, most students are learning that science is about the interplay between hypothesis and observation. However, students get easily confused about the technical details and often fail to see the big picture. Finally, many students never get over the idea that scientists "prove" theories once and for all, rather than understanding that all theories are subject to continual development, refinement, and testing. Methods we are utilizing to improve student learning included updating course content, role playing, essay writing, and clicker questions.

In our discussion of PLO#2 (Astronomy in Daily Life), we noted progress in understanding cause of the seasons and identified the need to learn what other affects of the Sun and sky has on students' lives.

Our assessment of the Origins PLO#3 taught us that this learning objective — to describe our ideas of the origin of the solar system and of the Universe and to articulate why these ideas have become accepted — is a challenging goal. Students who are used to simply

regurgitating facts are not expecting to be required to give arguments (with the exception of the Honors sections). Most students at this level need some instruction and practice in formulating scientific arguments. At the beginning, they will learn a list of observations without a deep understanding of their significance. Students need practice in writing and in arguing for and against scientific hypotheses. More time needs to be spent actively thinking about evidence and theory. At the least, the student should write a paper supporting a scientific theory. Alternatively, students could engage in a group activity in which different scientific arguments are evaluated or . Students need practice before they can tell good scientific argument from a bad one.

Our overview of the Physical Laws PLO#4 noted the progress that has been made in Astronomy 25.

Course SLOs

Astronomy 12

Assessment of SLO#1 (Scientific Method) is scheduled for Spring 2014.

SLO#2 measures the student's proficiency in using a telescope to find an object of astronomical interest. The conclusion from this assessment was that the students needed more experience with the telescope in clear nights and that cloudy nights should be used for instrument practice.

Astronomy 13

SLO#1 assesses students' proficiency in measuring the shape of optical surfaces. One conclusion from this assessment was the need to stress the importance of making a very precise graph to see and analyze small differences in the test data compared to the theoretical predictions. The instructor plans to introduce a class activity where students examine a practice graph with small differences that can easily be discerned.

Astronomy 20

SLO#1 (the Scientific Method) is the same as PLO#1, which was assessed in Spring 2010 (see PLO#1 above).

The seasons SLO#2 is designed to measure whether students understand 1) why it is warmer in summer than in winter and 2) why the days are longer. The latest assessment showed that students understand the first idea well, but that the hours of daylight are confusing to students. Although most are aware that the days are longer in the summer than in the winter, they do not seem to understand why. As a result, we professors are spending more time in this idea, using demonstrations and check questions.

SLO#3 deals with the formation of the Earth and the Solar System. The assessment indicated that the great majority of students get the basic idea that the planets formed from a solar nebula, but are fuzzy about the details. In sum, students did fairly well in Content Knowledge, but not so good in Critical Thinking. We need to structure the class so that students spend more time thinking about the details of planet formation and how the process gave rise to the patterns we see in the motions and compositions of the planets.

Astronomy 25:

SLO#1 (the Scientific Method) is the same as PLO#1, which was assessed in Spring 2010 (see PLO#1 above).

In SLO#2 (Electromagnetic Radiation) there was a 17% improvement in assessment scores. A major factor was the use of *Lecture-Tutorials for Introductory Astronomy* by Prather et al. This book consists of in-class activities that stimulate critical thinking and enhance comprehension. The higher scores probably is the result of increased experience using this tool and taking more time on the activity. This experience shows the value of active learning techniques.

SLO#3 concerns the Big Bang Theory. Our assessment of this SLO showed that most students came away with a good understanding of the events of the early Universe. Based on remarks made by several students, many misconceptions were cleared up. Where there is room for improvement is in the ability to articulate the evidence for the Big Bang Theory. Most students do no more than list some supporting observations, without being able to reason out how they support the theory. What is clear is that the whole idea of reasoning from premise to conclusion is a skill in which most students are weak; indeed, they do not even seem to realize that they are expected to be able to do so. If this is what we expect them to do at the college level, then it is clear that we have to teach them how to reason from observation to conclusion and to give them some practice in doing so. Left to themselves, they will not be able to do so on an exam.

Level of Implementation

We believe that we are at the Proficiency level and are approaching Sustainability. We have established what we feel is a complete set of assessments, are assessing them on a regular schedule, and have used them to fine-tune our courses. All department faculty have been involved in the process. There is one SLO and one PLO that have yet to be completed, but they have been scheduled for assessment.

Process Improvement

We now have a complete set of assessments, all courses have had at least one assessment done, and all faculty members are participating. Some assessments have been performed more than once and we have been able to see improvement in student learning. The SLO

process has stimulated our thinking about what are the most important learning goals. We have discovered in some areas that students aren't learning as much as we had thought and have modified our courses accordingly. In other instances, we have been surprised at how much students are learning. SLOs have become a tool in the improvement of student learning.

One area where improvement could be made is more regular dialog about SLO results; we would like to meet more often to discuss learning problems and teaching strategies.

Facilities and Equipment

Existing program facilities and equipment

Astronomy facilities include the Planetarium, the Observatory, and the Telescope-making room.

The Planetarium is equipped with:

- Chronos star projector made by Goto of Japan
- full-dome LCD projector with computer
- 4 LCD 32-inch high-definition monitors each with its own computer (used as digital posters to supplement lectures)
- master computer at the podium that controls all 4 HD monitors
- 7-speaker surround audio system with amplifier
- DVD/VHS player
- Transparency overhead projector
- Slide projector
- Tables and chairs for approximately 55 students
- About 12 additional chairs on the sides of the room.

The Planetarium building also contains an office, two restrooms, a preparation room with sink, a small closet, and a work area on the second floor.

The Observatory contains:

- Observing dome with a 16-inch permanently mounted Schmidt-Cassegrain telescope
- Telescope room with about ten student 8-inch telescopes
- Storage room
- Observing deck with six tables with benches

The Observatory is being remodeled this year. The telescope room will be turned into a small classroom with internet access.

The Telescope-making room is located in Physics 102. It is a small workshop with tables and stools designed for grinding mirrors.

Immediate needs (1–2 years)

The air conditioning in the Planetarium is also an on-going problem. The temperature swings wildly from one extreme to the other, dropping below 65°F and then a half hour later rising above 80°F. The thermostat does not seem to know what the temperature is in the Planetarium and will continue piping in hot air when it is already too warm or cold air when it is too cold. Students complain frequently. The fluctuating temperatures put people at risk for colds and flu. For students, it means lost days and poorer performance on exams. For the instructors, it leads to cancelled classes or last-minute substitutes. If an instructor got the flu in the middle of the semester, it could cost the District thousands of dollars to hire a substitute.
The room needs a better temperature control. It is possible that moving the thermostat into the classroom will solve the problem. If that doesn't work, then a new temperature control system is needed. Alternatively, faculty can be given permission to reset the thermstat. *Estimated cost: $50,000.*

Another ongoing problem is the bad odor in the hot water in the restrooms. It seems the only way to fix the problem is to replace the hot water heater and associated plumbing. *Estimated cost: $30,000.*

Long-range needs (2–4+ years)

Many of the student telescopes are nearly twenty years old and badly in need of replacement. They have been subjected to so much use that parts get loose and fall off, making them frustrating for students to use. Unless they are replaced soon, it will be impossible for students to properly learn how to use them (Astronomy 12 SLO#2). We would like to replace them with 10 11-inch telescopes with wedges, eyepieces, dew shields, and planetary cameras. *Estimated cost: $50,000*

The carpet in the Planetarium is about fifteen years old and is getting worn and frayed. It has reached the end of its lifetime. *Estimated cost to replace: $30,000.*

Recommendations

1. Install a new thermostat in the Planetarium, or if not that, give staff and instructors the ability to re-set the thermostat. *Estimated cost: $50,000.*

2. Replace the water heater and associated plumbing in the Planetarium. *Estimated cost: $30,000.*

3. Buy ten new student 11-inch telescopes with wedges, eyepieces, dew shields, and planetary cameras. *Estimated cost: $50,000*

4. Replace the carpet in the Planetarium. *Estimated cost: $10,000.*

Technology and Software

Existing technology and software

There are eight computers in the Planetarium. Two of them are dedicated to the Chronos star projector. One controls the full-dome projection system. Four of them power the four HD monitors, while the last controls those four and connects to the video projector. All of these will need to be replaced eventually, although we have a spare computer for Chronos.

A computer and video projector will be installed in the Observatory classroom.

The full-dome projection system was installed early this year. It requires special videos designed to be displayed in 360°, only one of which came with the system (a second has been purchased through the STEM grant.) These videos will be used both in astronomy classes and during public presentations.

Immediate needs (1–2 years)

1. Videos for the full-dome projector. These will put the recently-installed projector to full use, excite students, and educate the public. *Estimated cost: $5000.*

Long-range needs (2–4+ years)

1. Planetarium shows, consisting of images, software, and videos, to run an ongoing series of Planetarium shows on a monthly basis. We currently envision dozens of short learning modules for use in our lecture and lab courses, in addition to about ten different public shows. *Estimated cost: $50,000.*

Recommendations

1. Purchase five full-dome videos. *Estimated cost: $5,000.*

2. Purchase images, software, and videos for Planetarium shows. *Estimated cost: $50,000*

Staffing

Current staffing

The number of full-time faculty in the Astronomy Department has dropped from three to two since the last report. Ten years ago there were four. There are two part-time instructors.

There are no staff persons in the Department. There is a lab assistant for Astronomy 12. For the last two semesters, we have had the assistance of an S.I. coach.

Staffing needs

Immediate (1-2 years)

The Astronomy has lost three full-time faculty in recent years: David Vakil, David Pierce, and Bruce Fitzpatrick. The addition of another faculty member will recover half of our full-time faculty cuts. Demand for astronomy courses is high and all sections fill along with their waiting lists. Because it is difficult to find qualified part-time instructors in astronomy, we will need a full-timer if we are going to expand the program. In addition, full-time faculty members share department tasks and add continuity to the courses and students taking the courses. *Estimated cost: $80,000.*

We need a casual worker to assist the faculty member during Planetarium and Observatory shows for schoolchildren and for the public. The casual worker is needed to set up and monitor the observatory telescopes while the instructor or Planetarium Manager is presenting a planetarium show. This worker would require approximately $12/hour, with time needed for set-up and take-down, for approximately 4 hours per show.
Estimated cost: $6000.

Long-term (2–4+ years)

Our top priority is to hire a Planetarium Manager. This is a supervisory position that develops and presents astronomy shows in the college Planetarium for the general public, local K–12 schools and the college community. The Manager will also host open houses at the El Camino Observatory. The Manager works with the Astronomy Department faculty under the general direction of the Dean of Natural Sciences.

The Planetarium is a natural way to attract students to ECC and boost short- and long-term recruitment. Elementary students that attend Planetarium shows become familiar and comfortable with El Camino, and see that we offer quality programs. Offering shows to the general public provides the same benefits. We need a Planetarium Manager to provide these shows on a regular basis.

The Planetarium does for science what Marsee Auditorium does for the arts: it draws people to El Camino and makes a real contribution to the community. The district has supported an amazing modernization of the Planetarium at the cost of over a half-million dollars, and yet it sits idle on Friday and Saturday evenings. In the past, when there was a

Planetarium Manager, multiple shows were given to accommodate the crowds waiting outside, while hundreds of schoolchildren were thrilled every semester by their first contact with the wonders of the universe. For years, new students told us that their first exposure to El Camino was a field trip as a child to our Planetarium that they will always remember.

In addition, the Planetarium, with its Chronos Projector, dome and sound system, requires a fair amount of maintenance, which could be more efficiently managed by a Planetarium Manager. The two full-time faculty persons haven't the time for equipment maintenance, much less for outreach programs.
Estimated cost: $75,000.

The Program would also benefit from institutionalizing the Supplemental Instruction coaches, which currently are funded by the STEM grant. Each coach works about 8 hours per week attending class, holding workshops, and preparing materials. We would like to provide funds for 4 S.I. sections each year. *Estimated cost: $8,000*
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Recommendations

1. Hire a Planetarium Manager. *Estimated cost: $75,000.*

2. Replace the full-time faculty position that has gone vacant. *Estimated cost: $80,000.*

3. Fund a casual worker to help with Planetarium shows. *Estimated cost: $6,000.*

4. Hire more S.I. coaches. *Estimated cost: $8,000.*

Direction and Vision

Changes in the field

The United States remains a world leader in astronomical research. While the future of manned space exploration by the U.S. is up in the air, so to speak, NASA remains committed to the launch of the next big space telescope, the Webb Telescope, and to a sustained program of Mars exploration. At this very moment, NASA has spacecraft in orbit around Mars, Mercury, and Saturn, as well as two rovers on the surface of Mars. Already underway are two missions to the outer solar system: New Horizons, which will pass by Pluto in 2015, and Juno, which will go into orbit around Jupiter in 2016. This is an exciting time for planetary exploration. On the Earth, a number of next-generation land-based telescopes are in various stages of construction. They promise to help answer some of the biggest questions in astronomy today: when did the first stars appear, how did galaxies form, and what happened during the Big Bang?

Public interest in astronomy and space exploration remains very high. There are cable channels almost exclusively devoted to astronomy and space. Students continue to regard astronomy as a top choice for a general education science course, and demand for our courses remains high. Increasing science literacy is a government priority, and astronomy is an excellent introduction into what science is about. Astronomy includes all the other physical sciences and some biology as well. This is a time expand the astronomy program.

Direction of the Astronomy Program

The Astronomy Department would like to restore the sections and staffing that have been cut over the last few years. We would also like to expand our public outreach program and expand our curriculum.

We need a full-time faculty member to replace the position that was recently vacated.

Our primary goal is to hire a Planetarium Manager. Filling this position will restore our public programs and will help short- and long-term recruitment. (El Camino will not have over-enrollment forever.) The manager would also be able to maintain all equipment and do the general upkeep of facilities. This is essential with all the improvements to the Planetarium. The would help students in all instructional sections. This has been a high priority for this department for 20 years. A Planetarium Manager would be responsible for offering Planetarium shows to elementary and middle school students during the day and would also be responsible for evening shows to the community as a whole.

A secondary goal is to utilize the approved funding for part-time support to develop a large variety of planetarium shows for the public and small demonstrations videos for our astronomy classes that utilize the capabilities of our all-dome digital projector. We are happy to report that this secondary goal is on the verge of becoming a reality.

In the curriculum area, students have expressed interest in a sophomore-level, mathematically-oriented astronomy course aimed primarily at science majors. We would need to document student interest and establish the viability of such a course. This will be difficult to implement until the College is able to restore some of the sections lost to budget cuts. If such is course is activated, we will be in a position to offer an Astronomy major program that aligns with UCLA.

Prioritized Recommendations

Our top priority is to hire a Planetarium Manager to increase our planetarium shows and do equipment maintenance and upgrades. Thus far, we have been able to take care of our planetarium maintenance and equipment needs from a variety of sources: iGrants, some funds from the Natural Sciences Division, funds from the ScienceFEST program's grant, and funds from the STEM grant. However, these were largely one-time sources of funds

that mostly came from private organizations. This is not a long-term solution to our needs. While private donors have been willing to donate money for equipment upgrades, they have not been willing to fund a permanent position for the Planetarium. While we have looked for external funding, we now feel this funding must come from ECC.

RECOMMENDATION	COST	Strategic Initiative
1. Hire a Planetarium Manager.	*$75,000/yr*	B
2. Replace the full-time faculty position that has gone vacant.	*$80,000/yr*	A
3. Fund a casual worker to help with Planetarium shows.	*$6,000/yr*	B
4. Hire two S.I. coaches per semester.	*$8,000/yr*	B
5. Purchase five full-dome videos.	*$5,000*	A
6. Purchase images, software, and videos for Planetarium shows.	*$50,000*	B
7. Move the Planetarium thermostat into the classroom, or if that is not possible, give staff and instructors the ability to re-set the thermostat. If that doesn't work, replace the temperature controls.	*$50,000 or less.*	F
8. Replace the water heater and associated plumbing in the Planetarium.	*$30,000*	F
9. Buy ten new student 11-inch telescopes, with wedges, eyepieces, dew shields, and planetary cameras.	*$50,000*	A
10. Replace the carpet in the Planetarium.	*$10,000*	F
11. Add two sections of Astro 20 per year.	*$8,000*	A
12. Limit the number of on-line sections to 4 per year.	*None*	A
13. Add two sections of Astro 25 per year.	*$8,000*	A
14. Schedule morning sections in preference to afternoon sections.	*None*	A
15. Offer 8-week classes in the late afternoon. Retention tends to be higher in shorter classes.	*None*	A
16. Offer two 1.5-hour classes, meeting two days a week, instead of two 3-hour lectures, in the evening.	*None*	A
17. Purchase ten large-format digital cameras for the student telescopes.	*$20,000*	