External Program Review
for the
Aerospace Engineering Program
at
San José State University

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Preamble

The following report is an evaluation of both the BSAE and MSAE programs at San José State University. The reviews were based on a careful reading of the Program Self-Study Report dated 18 December 2007, as well as a visit to the campus on 12-13 March 2007. The evaluation report will cover the following areas for both the BSAE and MSAE programs:

- Program Planning
- Students
- Faculty
- Administration
- Advising
- Facilities
- Institutional Support and Financial Resources

Certain comments that pertain to both programs will be made in this Preamble section. Specifically, San José State University (SJSU) is strategically placed to be an essential institution for engineering education in California. Being co-located within a region that contains such a large percentage of the high-technology industries of the country is truly an advantage for the university. The same is true for the Aerospace Engineering (AE) program, since the proximity to NASA, Lockheed-Martin, Loral, and other aerospace industry locations is excellent for the mutual benefit and support of the program.

The AE program enjoyed a strong and growing reputation when it was first accredited in 1991, which is evidence that the program is needed and can flourish. The potential for the future is great at both the BS and MS levels. In spite of this, the program had declining student enrollment in a period of a State budget crisis, leading to a merger of AE with the Mechanical Engineering Department. In addition, the retirement of Dr. Desautel and the loss of Dr. Pernicka further eroded the program, resulting in a less-than-full accreditation from ABET after their review in 2005.

I also believe, however, that the program is at a crucial crossroads with every potential for growing and improving. Specifically, while a number of important areas of opportunity exist within the program and department, I do not believe that many of these issues can be effectively resolved at the present time. For whatever reason, the lack of trust between Dr. Barez and Dr. Mourtos is jeopardizing the future viability of the program. The everyday problems a program experiences are blown out of proportion, elevating the most basic concerns into critical issues. This must be resolved before meaningful, long term solutions can be found for all other issues. One of the more disturbing aspects of this rift is that the undergraduate students in AE are acutely aware of the problem and see how it is adversely impacting their own education, which is a very unfortunate situation.

Based on the above, I have serious doubts that simply hiring a new faculty member at the Assistant Professor level will substantially improve the quality of the program in the long term. In addition, the current search, while creating a reasonably sized applicant pool, has not produced a reasonable number of qualified, viable candidates. While there may be a number of solutions to the situation (some more draconian than others), I believe a possible solution is this: cancel the current search for an Asst. Prof. And re-advertise for an Assoc. or Full Prof. who will also be the AE Program Director (in fact, if not in title), with appropriate levels of release time to achieve the many administrative duties of the program. The Director, while...
necessarily being under the leadership of the MAE Department Chair, would have authority and ability to make decisions for the program. The program faculty need to have ownership of the program, and I believe having a director would go a long way toward improving many of the problems that currently exist. If the new director is successful in stabilizing the situation, a period of growth and renewal in the program could start, eventually leading the program back to vitality and possibly allowing the program to once again attain department status (again, within the constraints of the College and SJSU).

While a recent memo from the Dean of Engineering’s office dealt with many of the issues described in the remainder of this report, I believe that a new director would allow most, if not all, of these issues to be resolved effectively. The issues requiring attention include:

1. The program faculty must be allowed to retain ownership of the curriculum, within the budgetary and logistical constraints of the MAE Dept., the College of Engineering, SJSU, and the CSU.
2. The program faculty must have oversight and approval authority for advising all BS and MS students in AE (an Engineering Advising Center could be a College-wide solution to this issue).
3. The AE faculty need to control their independent study WTU credits, to be used in ways that make sense for their program.
4. The AE faculty need to have participation in the recruitment for, and hiring of, part-time faculty that teach AE courses.
5. The AE faculty’s concern for students has led them to offer multiple options and electives at both the BS and MS levels. This is only efficiently handled if the effective integration of other courses can be accomplished (fluids, thermodynamics, dynamics, controls, materials, structures, and propulsion are examples). ME faculty are unaware of the needs of the AE curriculum in these areas, so good communication could greatly improve the integration.
6. Effective integration can free up the program faculty to concentrate on other important issues, including outreach (and the improvement in the number of women in the program, which is currently at half the national average), improving retention of students, improving relations with industry, improving fund raising efforts, increasing funded research, etc.
7. The AE faculty need to prioritize their Five Year Plan Goals; some things make sense in the short term, others need to wait until the health of the program is stabilized. A Blended BS/MS program can have positive impacts (go to the SJSU Graduate Studies AVP for insights into lessons learned at Cal Poly, for example); this can be accomplished in the short term with minimal expenditure of time and energy. The addition of AE10 is an excellent idea—similar efforts at Cal Poly had significant impacts on retention of students and the size of the department. Online courses, Interdisciplinary programs, International programs, and increasing the electives available in aircraft systems are all good ideas, but often time consuming. I would recommend waiting on these issue until later. I have examples of all of these and am more than happy to share lessons learned with you.
8. The program faculty have defined goals and objectives which do not make the AE program truly unique. I believe you have a unique mission, but you need to make it part of your goals and everyday existence of the program.
9. The AE labs need attention: both equipment and space utilization can be improved, all to the benefit of the students and program.
10. The AE faculty can increase their funded research, which will support the development of dual-use labs by improving equipment, which benefits both the undergraduate and graduate students.
Review of B.S. in Aerospace Engineering Program

Program Planning

The Aerospace Engineering Program at SJSU offers an ABET-accredited curriculum with options in three areas: Aircraft Design, Space Systems, and Space Transportation & Exploration. The program is well thought out and has good Program Outcomes and a reasonable Assessment Plan, however the program does not seem to define itself in any unique way (something which the program faculty may want to address). While there seemed to be a great deal of assessment, I was not as impressed with the level of continuous improvement based on that assessment. The program faculty should consider improving the formal feedback of assessment results into their course improvement cycle (something which may be going on, but which was not easy to see from the Self Study Report). An advisory board reviews program plans and gives input, which is necessary, but the size of the board should be increased to give a broader view from across the aerospace industry.

The viability of the program is currently limited due to the small number of full-time faculty. This limits the amount of time that can be spent on planning and growth for the program. While the program faculty had an ambitious five-year plan, the ability of the faculty to actually achieve those plans (given their teaching loads and other duties) is somewhat dubious. I would strongly recommend that they consider tackling the “low hanging fruit” issues that can be addressed without significant expenditure of time and resources. Included in this list could be the Blended BS/MS program, which I believe to be the most productive for the program. Excluded from the list should be online courses, interdisciplinary programs, international programs, and increasing the electives available in aircraft systems; these goals should wait until the program is stronger and more independent.

Finally, the program cannot continue to exist without the addition of at least one more full-time faculty member. ABET has expressed concern at the low level of full-time faculty, and this issue must be addressed in the near term.

Students

The AE program at SJSU has a growing, vibrant group of undergraduate students, many of whom are in part-time status as they work to put themselves through school. In spite of the hardships on them, they are progressing through the program and taking advantage of the opportunities that are available for them. There are approximately 180 BSAE students enrolled in the program, which represents a growth over recent years. These students come from a combination of first-time freshman and transfer students from community colleges, as well as students who change majors into the program. The number of under-represented students is fairly normal for an urban university, but the number of women students is approximately one half of the national average in engineering. This issue is normally dealt with by participation in some type of outreach (either through MESA, SWE, AIAA, or other professional organizations), but the small number of faculty in the AE program makes this type of outreach very difficult.

In my interview with approximately twenty undergraduate students from the AE program, they could see the direct impact of the current department situation on their ability to progress through the program. Specifically, they believe that the
small number of AE faculty is hampering their throughput in the program, especially since not all courses can be offered in a timely fashion for each student. This situation is obviously further hampered by the part-time status of the students. They also believe that the in-fighting between the AE faculty and the MAE Department has at times led to “overnight” changes in their curriculum options, which further hampers their ability to get through the curriculum. One transfer student said he felt “like a ping pong ball” in the current environment, in spite of the fact that his community college credits transferred with no problems. Students transferring from other four-year universities, however, mentioned that it took months to find out which courses could transfer to SJSU, which delayed their ability to progress through the program. Some students also mentioned that some regulations and procedures within the department were not applied equally to all students, which leads to concern among the students. The students are provided club space within the engineering facilities, and appear to be active in several club activities, including the SAE heavy lift competition and the AIAA Design-Build-Fly competition.

In spite of the somewhat negative issues within the department, however, the students were quite positive and pleased with the education they were receiving. They believe they are receiving a firm foundation in the AE discipline and have high hopes for their careers. They seemed proud to be at SJSU and to be students in the AE program.

**Faculty**

As was mentioned previously, there are only two full-time faculty members within the AE program, which greatly restricts the future viability of the program in many ways. The two full-time faculty have good qualifications and are offering a reasonable AE program for their students. Their concern for students was admirable, possibly to a fault, since they seem to want to offer many options and electives for the students at the expense of their over-used time and energy. The full-time faculty are teaching approximately 3/4ths of the required courses within the curriculum, which requires that they have 3-4 course preparations per semester (something which I would find unmanageable). Couple that with the administrative overhead required in running the program, and the full-time faculty are stretched too thin, something which cannot continue into the long term.

The part-time faculty within the program seemed remarkably well connected to the MAE Department (a rarity these days), and had a number of positive comments about their experiences at SJSU. They believe they are well supported in all aspects of their efforts to educate the students. They obviously bring an important “real world” flavor to the AE program, which is especially important considering the small number of full-time faculty.

There are problems, however, with how the part-time faculty members are hired by the MAE Department, since the AE faculty do not know about available funding levels for hiring, nor do they seem to participate in the hiring process. I believe that it is crucial for the future viability of the program that the AE faculty be involved in the hiring of part-time faculty (both “who” is hired and “what” they can teach).

In spite of these limitations, as well as the funding limitations of the CSU, the program faculty offer a wide variety of courses and multiple options for the
undergraduate students. While this may seem laudable at first, the future of the program may require a critical look at what is “essential” and what is only “nice” so that the overall quality of the program is not degraded.

**Administration**

This is perhaps the biggest problem area within the AE program. Unless the issues related to the administration of the program can be resolved, I believe the future of the program is in jeopardy. Specifically, the chair of the MAE Department and the AE faculty cannot seem to work together on multiple issues which are critical to the program. The awkward nature of the relationship between the AE program and the MAE Department makes it difficult for the AE faculty to feel ownership of their program. For example, issues related to the AE program must be approved at MAE faculty meetings, where the AE faculty are often “out voted” because of the large number of ME faculty within the department. As much as possible, I believe that the AE faculty should have the ability to oversee their own program, without undue hindrance from the ME faculty, but within the necessary constraints of the MAE Department, the College of Engineering, and SJSU. As was mentioned in the Preamble, this issue is crucial to the future of the program. The program cannot grow and become stronger without someone having the time and energy to be a champion for its future. Making contacts with industry, outreach for new students, soliciting (and obtaining) financial support, and other administrative duties take a great deal of time, something which the current faculty cannot possibly accomplish while also teaching.

**Advising**

The university supplies some level of advising through their student services group, primarily related to advanced placement credits, transfer credits, and other issues concerning records and registration. The College of Engineering provides advising for engineering students, but only related to their general education coursework, probation, and administrative issues. The MAE Department provides a group of faculty advisors for students who meet with students every term. If students do not meet with their advisors they receive a hold on their records, which essentially forces every student to receive regular advising. Career advising is available from any faculty member within the department, at the discretion of the students.

Unfortunately, the students within the AE program have not always received advising from the faculty within the AE program, a situation which is not acceptable. While this situation has been marginally addressed, the solution seems to be to assign one of the AE faculty members 0.2 Release Time for advising. Prior to this, the AE faculty received 0.2 Release Time for program administration, which essentially means that the AE program now receives 0.2 Release Time for advising and administration, which is also unacceptable.

Several undergraduate AE students mentioned that advising was spotty at best (see above for details), and bemoaned the fact that they often did not receive advising from their own faculty. Given the part-time nature of many of the students at SJSU, advising is critical to throughput, and I strongly urge the Dean of Engineering to create an advising center that provides quality, consistent advising to all engineering students, overseen by the faculty of each program (and with their approval).
Facilities

The AE program has excellent space allocations for most laboratories and club activities. While some labs were under-sized (such as the Aircraft Design Lab), the average amount of space for the number of students in the program was enviable. In general, however, the lab space does not seem well utilized, with large lab areas being used for storage or other non-educational purposes. The small number of full-time faculty members obviously makes it difficult to maintain and improve the program laboratory facilities, especially since the part-time faculty members cannot reasonably be expected to perform these duties. The equipment in the labs, in general, seemed to be in need of repair and modernization. Many of these issues could be addressed with increased support from outside sources, including research funding, donations, and increased industry involvement with the program. These activities, however, require a great deal of time, something which is in short supply when only two full-time faculty members run the program. Space for club activities, which is essential, was excellent—the program is to be commended for providing their students with the space and facilities they need to further their education in this way. There is one full-time technician for the program, but his time and energy is stretched thin by having to handle everything from equipment maintenance and repair to computer issues.

Institutional Support and Financial Resources

The funding difficulties of the State of California and the CSU are well known, which has led to the AE program being run on a tight budget. The level of support for hiring part-time faculty is marginal, but seems to be filling in the teaching gaps to some extent. Where the AE program is really lacking is in providing the additional funds that are necessary for creating a quality program. These funds would normally come from donations (both cash and in-kind), research funding, and other forms of outside support. Obtaining this type of support, however, requires a great deal of time and effort, something which is not readily available to the AE faculty. The future viability of the program depends on this type of support being generated. A single administrative assistant serves the MAE Department and is also stretched thin (even with the aid of a student assistant): additional student assistants for both the technician and front office could greatly improve the functioning of the facilities and program.
Review of M.S. in Aerospace Engineering Program

Program Planning

The Aerospace Engineering Program at SJSU offers a graduate curriculum with options in three areas: Aircraft Design, Space Systems, and Space Transportation & Exploration. The program is well thought out and has good Program Outcomes and a reasonable Assessment plan, however the program does not seem to define itself in any unique way (something which the program faculty may want to address). While there seemed to be a great deal of assessment, I was not as impressed with the level of continuous improvement based on that assessment. The program faculty should consider improving the formal feedback of assessment results into their course improvement cycle (something which may be going on, but which was not easy to see from the Self Study Report). An advisory board reviews program plans and gives input, which is necessary, but the size of the board should be increased to give a broader view from across the aerospace industry.

The viability of the program is currently limited due to the small number of full-time faculty. This limits the amount of time that can be spent on planning and growth for the program. While the program faculty had an ambitious five-year plan, the primary issue relating to the MS program was in addition of courses and curriculum in aircraft design and planetary landing issues. The goal of increasing research funding in these areas is crucial, however the ability of the faculty to actually achieve those plans (given their teaching loads and other duties) is somewhat dubious. The AE faculty are encouraged to consider how these goals can be achieved by only two full-time faculty members.

Students

The MSAE program at SJSU has a growing, vibrant group of graduate students, many of whom are in part-time status as they work in the local industry while obtaining an advanced degree. There are approximately 24 MSAE students enrolled in the program, which represents a growth over recent years. In my interview with three graduate students from the AE program, they seemed unaware of the current department situation, other than the fact that they receive conflicting information about courses and policies from the AE and ME faculty. Specifically, they are frustrated about the current seminar course and aren’t sure if it is a requirement or not. While this particular example may seem trivial, it points to a larger issue that can be resolved with consistent and uniform policies that are made known to students in advance. They also believe that the small number of AE faculty is hampering their throughput in the program, especially in the area of orbital mechanics, satellite design, and aircraft electives. The part-time faculty quality was seen as inconsistent (a common problem with part-time faculty), but they appreciated the real-world viewpoint that the part-time faculty bring to the classroom. The students were quite positive and pleased with the education they were receiving. They believe they are receiving a firm foundation in the AE discipline and have high hopes for their careers. They seemed proud to be at SJSU and to be students in the AE program.
Faculty

As was mentioned previously, there are only two full-time faculty members within the AE program, which greatly restricts the future viability of the program in many ways. The two full-time faculty have good qualifications and are offering a reasonable MSAE program for their students. Their concern for students was admirable, possibly to a fault, since they seem to want to offer many options and electives for the students at the expense of their over-used time and energy. The full-time faculty are teaching approximately 3/4ths of the required courses within the MS curriculum, however, the AE faculty are not fully involved in teaching the Lockheed-Martin MSAE program, which may lead to quality issues in the future. The Lockheed-Martin AE program is disconnected from the full-time AE faculty, which is not positive for the program or the students pursuing the degree. The faculty need to be active participants in the program for its future growth and viability.

In spite of these limitations, as well as the funding limitations of the CSU, the program faculty offer a wide variety of courses and multiple options for the graduate students. While this may seem laudable at first, the future of the program may require a critical look at what is "essential" and what is only "nice" so that the overall quality of the program is not degraded.

Administration

This is perhaps the biggest problem area within the AE program. Unless the issues related to the administration of the program can be resolved, I believe the future of the program is in jeopardy. Specifically, the chair of the MAE Department and the AE faculty cannot seem to work together on multiple issues which are critical to the program. The awkward nature of the relationship between the AE program and the MAE Department makes it difficult for the AE faculty to feel ownership of their program. For example, issues related to the AE program must be approved at MAE faculty meetings, where the AE faculty are often “out voted” because of the large number of ME faculty within the department. As much as possible, I believe that the AE faculty should have the ability to oversee their own program, without undue hindrance from the ME faculty, but within the necessary constraints of the MAE Department, the College of Engineering, and SJSU. As was mentioned in the Preamble, this issue is crucial to the future of the program. The program cannot grow and become stronger without someone having the time and energy to be a champion for its future. Making contacts with industry, outreach for new students, soliciting (and obtaining) financial support, and other administrative duties take a great deal of time, something which the current faculty cannot possibly accomplish while also teaching.

Advising

All graduate student advising is handled within the MSAE Department, an appropriate and normal situation. Career advising is available from any faculty member within the department, at the discretion of the students. Unfortunately, the students within the MSAE program have not always received advising from the faculty within the AE program, a situation which is not acceptable. The MSAE program at Lockheed-Martin, however, seems to be advised by non-AE faculty, a situation which is not advisable. When graduate students choose courses and project/thesis advisors, they should receive advising from faculty within their program.
Facilities

The AE program has excellent space allocations for most laboratories. It was not apparent, however, how much of these facilities were available for the graduate students, especially those working on a project/thesis. One possible solution to this situation is to have dual-use lab facilities which are supported by funded research: the labs are continuously improved for both undergraduate and graduate education, while still being appropriate and usable for the graduate students. The equipment in the labs, in general, seemed to be in need of repair and modernization. Many of these issues could also be addressed with increased support from outside sources, including research funding, donations, and increased industry involvement with the program. These activities, however, require a great deal of time, something which is in short supply when only two full-time faculty members run the program. There is one full-time technician for the program, but his time and energy is stretched thin by having to handle everything from equipment maintenance and repair to computer issues.

Institutional Support and Financial Resources

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