Executive Summary

The following is an evaluation of the undergraduate and graduate programs in Mechanical and Aerospace Engineering at San Jose State University. To provide continuity, this evaluation will focus upon elements similar to those addressed in the reviewer’s previous visit to the campus, in May 2003:

1.) Mission Statement and Goals
2.) Curriculum
3.) Faculty/Lecturers
4.) Facilities/Technical and Staff Support
5.) Students
6.) Industry Connectivity
7.) Planning and Assessment

The evaluation concludes with a summary of program strengths and recommendations for improvement. This evaluation is aided considerably by the Accreditation Board for Engineering and Technology (ABET) review that the program underwent in 2005.

1.) Mission Statement and Goals

MAE Department Mission

The Department mission statement remains unchanged from that stated in 2003, and is a valid now as then.

To serve society, the public sector, and private industry by:

- Providing undergraduate and graduate Mechanical and Aerospace engineering education that prepares students with the knowledge, modern applications and lifelong learning skills required to serve the engineering professions and industry.
- Contributing to the development and application of knowledge through faculty scholarship.
- Preparing students for the modern professional-practice environment.
Comment: One addition that might be considered, is that of preparing undergraduate students for graduate study. The reviewer notes that on p. 33 of the self-study report, the statement “The ME Program has given me a strong foundation for graduate work,” 52% of the respondents replied “not sure”.

MAE Department Goals

The program self-study report lists six goals for the ME program for the coming five years. This format is a departure from that used in the 2003 visit, and concentrates upon specific targets for growth and improvement. This is a commendable approach as it allows for a meaningful, quantitative assessment as to whether the goals were achieved.

Goal 1: To stimulate ME students’ interest in pursuing mechatronics as their focus area.

Comment: This goal builds upon an existing strength in the Department and fits nicely within the needs of surrounding industry. Mechatronics provides an important niche area for mechanical engineering. This is especially true since it has been the reviewer’s experience that many electrical engineering departments are moving away from the study of engineering mechanics (dynamics) as part of their curricula. The latter discipline is an important part of mechatronics.

Goal 2: To strengthen the mechatronics curricular at the Master’s level.

Comment: (see Comment for Goal 1). Strengthening the mechatronics curriculum at the graduate level also has the potential of improving the research environment for faculty working in this area.

Goal 3: To see one additional faculty member in the area of mechatronics, since Prof. Wang is planning to retire within two years.

Comment: The proposed faculty replacement is critical, and achievement of Goals 1 and 2 obviously hinge upon the achievement of Goal 3.

Goal 4: To improve engineering fundamentals of our undergraduates and graduate students in the thermal and fluids area.

Comment: This is a laudable goal. It was not clear whether this goal was created as the result of a weakness identified in an assessment, or whether it was included as a reminder not to ignore the “wet” side of the Department while emphasizing an aspect of the “dry” side, i.e., mechatronics. The Course Assessments for thermal/fluid systems (Appendix B of the self-study did not note any apparent problems).

Goal 5: To increase interaction with industry and government organizations in the thermal and fluids area.

Comment: (see Comment for Goal 4).
Goal 6: To establish a more comprehensive mechanical design curriculum for the ME undergraduate program.

Comment: This goal nicely parallels that of Goals 1 and 2, i.e., the heart of mechatronics is mechanical design.

Final Comment: While not stated as a separate “goal” the necessity of adding an additional technician was mentioned in the accompanying narrative. It is this reviewer’s position that such an addition is a program necessity.

2.) Curriculum

San Jose State University Curricular Priorities

a.) Centrality to Mission
The Mission Statement for the College of Engineering is one of providing an empowering educational opportunity to students for their technical, professional and social development in a competitive and dynamic global society.

Comment: The MAE Department’s mission reflects the overarching mission of the College and University. The curriculum serves the Department’s mission well.

b.) Quality of Instructional Program

Comment: Viewed in the context of the self-study evaluation, the MAE instructional program is of high quality. This is in no small part due to the quality of the faculty. Quoting from the recent ABET review: The faculty members possess doctoral degrees from well-known institutions and five are professionally registered. The faculty members show great enthusiasm for the program and are readily available to students outside the classroom.

c.) Student Demand

Comment: There is little need for comment here. The educational requirements of employment in the technical sector of Silicon Valley ensure student demand for the programs offered by the College and the MAE Department.

d.) Societal Need

Comment: I was impressed by the comments of Dean Wei in stressing the importance of engineering in addressing societal needs. This emphasis carries over into the student body. Quoting from written remarks by a mechanical engineering scholarship winner: “I chose to study mechanical engineering not only because it is interesting and challenging, but because it is practical; instead of talking about the problems facing my community and the world, I am learning skills to solve them.”
e.) Financial Resource Effectiveness, Viability, and Efficiency

Comment: Engineering is, in general, a demanding educational enterprise in terms of resource requirements. The MAE Department appears to score high marks in the effective use of limited resources, in maintaining viable programs and in efficient operation. As an example, I would point to the ability of MAE faculty to equip engineering labs with state-of-the-art equipment obtained by gifts from industry.

f.) Interdependence of Programs

Comment: Traditionally, engineering programs do not provide service courses to the campus as a whole. This may be changing as accreditation agencies such as the Western Association of Schools and Colleges (WASC) encourage non-technical majors to expand their background by taking a limited number of broad-interest engineering courses.

g.) Capacity to Contribute to an Academic Field

Comment: MAE faculty are active in their individual fields of expertise, their technical societies, and contribute frequently to technical conferences and archival journals.

h.) Availability of Instructional Alternatives

Comment: With its emphasis on accommodating students who hold part time employment, and in the case of graduate study, full-time employment, San Jose State occupies a unique position in the academic Silicon Valley community.

Thesis/Project at the Master Degree Level

Graduate students currently have the choice of completing a project or thesis at the Masters degree level. The project is probably preferred by industry as it can often be tailored to a topic closely allied to the student’s current employment. The thesis is probably more advantageous to the faculty adviser in terms of research productivity and also to the student who may wish to pursue a PhD at a Research I institution. Perhaps the thesis should be encouraged for more students for both the reasons just outlined.

3.) Faculty/Lecturers

The reviewer is familiar with most of the MAE faculty, having interacted with them on the last visit in May, 2003. As in 2003, I was impressed by their enthusiasm and for their commitment to the Department and College. In my discussions with the undergraduate students, they commented very positively on the availability of faculty and the fact that the faculty are genuinely interested in the undergraduates.

I was given the opportunity to speak with five MAE lecturers. I found them dedicated and capable. They bring a great deal of industrial and academic experience to the Department,
to the obvious benefit of the students. They obviously enjoy the opportunity to contribute to the MAE Department in the area of instruction.

Although not directly pertinent to the review, I did note some concerns expressed by the faculty associated with the Aerospace Engineering program. They felt that ME faculty may be advising Aerospace Engineering students on projects/theses that would better be advised by the Aerospace faculty. Of course, the students make the final choice in these matters, but it is a concern that should be addressed. Continued support of the Aerospace Engineering program is of obvious importance to the overall health and vitality of the Department as a whole.

4.) Facilities/Technical and Staff Support

The laboratory facilities were well-maintained, and as mentioned above, the reviewer was impressed by the amount of experimental equipment that had been obtained by gifts from industry. The continued health and maintenance of the machine shops is an item that should be addressed. These shops are a vital part of any mechanical engineering program as they contribute directly to the quality of the capstone design experience of ME seniors. The shops (both College and Department) are especially critical to the Department as it moves to strengthen its mechatronics offerings.

In terms of staff support, the current complement of one office staff member and one technical staff member appears far too low. This same concern was voiced in this reviewer’s comments in 2003. Things have improved somewhat, as in 2003 there was no technical staff support. I note in the MAE self study, that one additional technician will be sought for hiring. I heartily endorse such action. The current technician must meet the needs of all three focus areas within the Department, i.e., mechanical design, mechatronics and thermal/fluids.

In terms of office staff, I can only quote my comments in my 2003 review: “A single staff member serves the entire department. This has obvious repercussions in terms of workload for the staff member involved, the department faculty, and the department chair.” In the past (perhaps distant past), two staff members worked in the Department. I would argue that two would be an absolute minimum given the duties the position requires.

5.) Students

Undergraduates

I had the opportunity to speak to a number of undergraduate students in a group format. I found them engaging and, after a bit of prodding, eager to comment on the program. Almost all were looking forward to graduate school. This is a good sign, i.e., they have not been “burned out” or discouraged by their undergraduate experience. There was some concern voiced about there being too many “lock-outs” and scheduling conflicts in MAE courses. In certain cases, these can prolong time-to-degree by one year. Concern was also voiced about program approvals, especially for junior college transfers.
Graduates

I had the opportunity to speak to a number of graduate students in the same group format as the undergraduates. The students were unanimous in their appreciation of the industry ties that the program had developed. They commented on the quality of the lecturers, and were appreciative of the current and past industrial experience that these lecturers brought to the MAE program. There were a few comments expressing a concern that some graduate classes were too much like a review of undergraduate material. This may be a natural consequence of offering courses to students who may possess significantly different backgrounds and preparation.

6.) Industry Connectivity

This is a strong point, both in terms of the College and Department. A pertinent example at the College level is the Deans’ Speaker Series, this year celebrating its 150th anniversary. There is an impressive line up of speakers from Nobel Laureates to Silicon Valley CEOs. As has been mentioned above, the MAE Department also enjoys an excellent connectivity with industry.

7.) Planning and Assessment

In terms of program planning and assessment, the San Jose State Program Planning Guidelines define the role of the external reviewer by requesting answers to the following six questions:

1.) Does the plan respond to the assessment materials included in the report?

Comment: The Mechanical Engineering program was reviewed by ABET in 2005. ABET requires a detailed assessment procedure to be in place for each accredited program. The five year plan is a result of this detailed assessment and is described by a clear set of goals, objectives and actions.

2.) Does (the plan) flow reasonably out the current condition of the program?

Comment: Again, the thorough preparation for and conduct of the ABET review ensures that the answer to this question is ‘yes’.

3.) Does (the plan) respond to the university “Statement of Curricular Priorities?”

Comment: See the discussion in Item (2): Curriculum.

4.) Does (the plan) recognize important trends in the discipline, both nationally and as reflected in the regional metropolitan area served by San Jose State University?”
Comment: Cognizance of national trends is somewhat dependent upon the professional activities of the faculty, e.g., participation in research conferences. The MAE faculty are, in general, active in this area. It is important for the campus and College to provide a research infrastructure that will allow young faculty to maintain and develop their research skills. This is particularly important in an environment where there are no PhD programs/students. The trends of local industry are certainly reflected in the MAE program. A pertinent example would be the role that the Department Advisory Council (DAC) plays in program assessment. I note that the DAC has apparently been re-vitalized since my 2003 visit.

5.) Do the planned activities related to faculty, students, and community provide measurable guidelines for the program in the next five years?

Comment: Once again, the detailed outcomes assessment that is part of the ABET review criteria ensures that measurable guidelines are in place. Indeed, absence of measurable guidelines can have serious repercussions to continued accreditation of engineering programs.

6.) Do (the planned activities) address educational needs of the diverse community of which SJSU is a part?

Comment: I saw no indication that the needs of the diverse community were not being addressed.

Program Strengths

- Excellent Department leadership
- Energetic faculty and lecturers, dedicated to the program
- Undergraduate students appreciation of the efforts of the faculty
- Strong ties with industry, particularly at graduate level
- Well-established program assessment tools

Possible Areas for Improvement

- Increasing staff and technical support
- Establishing the importance of the machine shops in achieving Department educational goals
- Increasing research infrastructure for young faculty
- Resolving thesis/project advising issues with Aerospace Engineering faculty and increasing the support of the Aerospace Engineering program