The following comments were submitted by Sandra McRae Duchesne '78, one of the alumnae who attended the science and engineering event in April 2006, in response to questions posed at a dinner forum.

What were the most important ways in which your Smith education contributed to your career as a scientist or engineer? Did Smith influence your decision to go into these fields?

My Smith education contributed greatly to the development of my critical thinking and communications skills. I learned how to research a topic effectively, express my thoughts articulately, and support my arguments with pertinent examples and references. My liberal arts background has been a huge asset in my career advancement as a civil engineer; in a very real sense, it gives me a competitive edge in the workplace. Many technically brilliant engineers are handicapped by poor speaking and writing skills, and it makes them far less effective at communicating their ideas to decision-makers. Reports, presentations, and interactive meetings are a major component of my work as a consulting engineer, and I can thank my Smith education for giving me great all-purpose building blocks that have helped me succeed in the engineering world.

Smith did <u>not</u> influence my decision to become an engineer. I had dabbled with the idea of an engineering career in high school, but when I found myself struggling to comprehend calculus, I decided to switch gears entirely and focus on the humanities (where I could pull straight-As without a lot of effort). I took exactly one math course and one science course in my entire 3.5 years at Smith, and only came back to engineering in my mid-30s. Fortunately the University of Maine transferred 44 credits from my Smith bachelor's degree, which completely covered my humanities requirement, so all I had to take was three years of straight math and science courses to get my bachelor of science degree. I later got a master's degree in civil engineering as well.

The more interesting question for me is whether I might have checked out one of the Picker engineering courses if they had been available to Smith students while I was there, and whether that would have nudged me back toward engineering as an undergraduate major. If that had happened, I might have started working as an engineer in my 20s instead of my 30s. Ultimately, I'm glad I took the more circuitous route. I got a great job right out of school as a Russian civilization and government major, and enjoyed a wonderful eight-year career in the Washington, DC area. Then my husband and I made a lifestyle choice to return to Maine, where I worked for several years as a self-employed technical translator and abstracter during the hours when I wasn't working/playing as a whitewater rafting guide. I returned to school full-time as a civil engineering student at age 34, and between full-tuition scholarships and graduate research grants, I only had to pay for one year of my five-year engineering education and I was able to pay off my student loans within one year of graduating. I even got to play on the University of Maine women's ice hockey team while I was a student there, and it was quite a challenge to be skating competitively with 20-year-olds! I don't think I would be the good engineer I am today without all of that life history coming into play, and quite frankly I was willing to work harder at calculus the second time around. I think that you may see more than a few

Ada Comstocks scholars gravitating toward engineering as the program develops.

What capacities are most important for a successful career in science and engineering? How can Smith most effectively develop those capacities in its students?

Most of the scientists I know are methodical, long-range thinkers who show a lot of determination and patience (or maybe it's just disciplined persistence?) in pursuing their goals. Engineers tend to be less patient and more pragmatic, and the nature of our work explains the difference in personality types. Scientists are motivated by the pursuit of the capital-T Truth in their research, whereas engineers just need to find a timely solution that works and fits the budget. Then it's time to move on to the next project. Anything more is overkill, and a waste of your client's money. Scientists need to adhere to strict, consistent research protocols and maintain careful records of current and past projects, and good, well-documented process is often just as important as useful research results. Engineers get the satisfaction of seeing the tangible results of their efforts, usually in a fairly short timespan after the initial problem is presented to them. I don't think I could handle all the delayed gratification and disciplined methodology of the scientific world, but I do just fine in engineering (with the help of a highly organized assistant to handle the administrivia). Scientists go equally crazy if they end up in engineering careers, because timely solutions are valued much more highly than solid research, and because many engineering techniques are empirically based: no one understands exactly why they work, but if they work, that's good enough for engineering purposes.

The point is that people who make excellent scientists are not well-suited to engineering careers, and vice versa. There is considerable overlap in our academic training and language, but we have radically different work cultures and radically different approaches to problem-solving. It is an epiSTEMological error (sorry for the pun) to paint us too broadly with the STEM brush, as if all STEM careers fit some monolithic technical "type." It's like asking about the capacities that are important for a successful career in English literature and dancing. I can tell you what I think about engineering success, but not much of it will translate into success in a scientific career.

Engineers need to have a solid grounding in mathematics and the hard sciences, but they also need to be flexible thinkers with a high tolerance for ambiguity. In life there are usually multiple solutions to a given problem, and it's important to keep an open mind and involve other stakeholders as necessary to find the best solution, at the best cost, within a reasonable length of time. This often involves accepting compromises - and taking risks. Engineers frequently have to rely on judgment and assumptions about unknown conditions, and they have to be able to react and revise their plans quickly if any of their assumptions turn out to be wrong. That is why getting your professional engineering certificate in the U.S. requires a four-year period of apprenticeship under a practicing engineer, after you have already demonstrated basic academic proficiency by passing the Fundamentals of Engineering examination. Most states also require you to practice lifelong learning by accumulating so-called "professional development hours" to keep your certification.

I think Smith already has all the tools it needs to develop these career-building capacities in engineering students. I loved the interactive learning and hands-on projects that I observed in the engineering and science classes, and the Smith culture has always encouraged independent, flexible thinkers and doers. Smith graduates will embrace lifetime learning to satisfy their own intellectual curiosity, not just to meet the requirements for a professional license. I do think it's worthwhile to explore the differences between scientific and engineering careers with everyone who takes the introductory class. This was done in my first engineering class at UMaine, and several students in that class realized they were really scientists at heart. They changed majors that same semester.

How can Smith assure that its students are competitive for professional and graduate school admission?

As long as the engineering program meets accreditation standards, I don't think you need to worry about post-baccalaureate admissions. The professional and graduate schools will continue to come looking for Smith graduates, especially since they are working to increase the ratio of women students in their technical graduate programs. Smith has a great track record in this regard, and I didn't see or hear anything during our time on campus that would make me think this crop of graduates is any less competitive than we were back in the late 1970s.

Perhaps a larger concern is whether Smith engineering graduates can be competitive right out of school with the baccalaureate graduates of traditional engineering schools, since the Smith graduates receive a general engineering degree without much specialization in any one discipline. It's true that the trend in the civil engineering community is to require a master's degree as the minimum professional standard, but many students are still going to want to work for a while before returning to graduate school, either because of economic necessity or because they want to broaden their life experience. In engineering, it may be a liability to start your career as a Jill of all trades and a mistress of none. I hope you are tracking this type of data over time, as the numbers at this point are probably too small to identify any real trends.

What do you think are the most important priorities for Smith in building the strength of its programs in the sciences and engineering?

1. Maintain the high quality of the faculty, which in turn means that you must ensure a high quality of life for the faculty. We heard from many professors that they are dedicated to the Smith College mission and they love having so much interaction with their students, but they also worry about burnout from the combined pressures of classroom teaching, intensive laboratory research, and the need to publish and stay abreast of changes in their field. Whatever you can do to ease their stresses will be worth the investment, as you will keep quality people on board and attract more people like them.
2. Solicit additional feedback from employers, particularly the employers of graduates with bachelor's degrees. They will not be shy about telling you what assets Smith graduates bring to their companies, and what skills they lack.
3. Continue to foster formal and informal interactions between students, recent graduates, and older Smith alums in the technical disciplines. The old girls' network lives!

Smith obviously is not a research university, but a liberal arts college with research opportunities. What are the strategic advantages and disadvantages of the kind of institution Smith is? Are there ways of compensating for any disadvantages?

Advantages:

smaller class sizes
direct interaction with professors both in and out of the classroom
more opportunities for average students (not just superstars) to participate in research projects
technically capable graduates who know more about the world and who can communicate their ideas more effectively than their university-educated peers.

Disadvantages:

fewer classes to choose from
no graduate-level classes available for motivated undergraduates
the focus on general engineering as opposed to specific engineering majors
much less support for professors in terms of graduate student assistance, grantwriting assistance, general support staff, and discretionary funding that they can use to attend conferences or purchase specialized equipment.

Compensation:

The Five-College System permits students to enrich their course selections with the more diverse curriculum and graduate-level engineering classes available at UMass, although I heard from students that the traffic congestion on Route 9 has made it very difficult and time-consuming for them to shuttle to and from remote classes. The University of Maine uses televised interactive distance learning for many of its graduate-level classes, and you might be able to enter into a collaborative agreement with UMass or another research university to provide

additional upper-level courses each semester via interactive TV.

As I stated above, there isn't enough of a track record yet to know if the general engineering degree is going to be a hindrance to employment and advancement for those not going directly into a graduate program, but I do think the college needs to follow up and evaluate this issue annually. If the general engineering major does create employment problems for new graduates, it may make sense for the Picker program to consolidate around even one or two specialized engineering majors that it can do well, really beef up the faculty and laboratory resources in those areas to attract good students, and accept the loss to other schools of potential engineering students seeking different disciplines. I think that maintaining overall program quality and ensuring that graduates have good employment opportunities will be more important to the long-term success of the Picker engineering curriculum than its overall breadth.

The professorial support disadvantage is huge, and yet I can't think of any compensatory solutions that wouldn't detract from the equally huge advantages of direct student-professor interaction and student research opportunities. I think that the professors themselves would have the best insight about what they would like to see for compensatory strategies, since they are living with the problem every day.

Celebrate your strengths, rather than compensating for weaknesses! No, Smith is not a major research university, but the Picker program can tap into a niche market of potential students that is not well served by traditional engineering schools. Smith's program is perfect for the student who is potentially interested in an engineering career, but who also wants a broad-based education and a holistic, personalized small-school experience. Smith offers students more time to explore their options in science and engineering before settling on a specialty field for concentration at the graduate level - presumably at one of those large research universities, so they will get the best of both worlds. If a high school student already knows what she wants to do in life and thinks that she should attend a major research university for all the supplementary resources it can provide, Smith College is not even going to make her list of desirable schools, so you shouldn't bother chasing after her. If she is less sure of what she wants to do (as I was, and as I think most young people are), you can make an attractive pitch for the educational combination punch of an intimate, self-tailored, highly exploratory baccalaureate experience at Smith followed by graduate specialization at a major university of her choice. (This is where you pull out the statistics about the admissions rates to top-rated graduate schools for Smith alumnae.)