Nearly every engineer at some point in their career has pondered the idea of returning to school for additional education. Students whose four year degree is not in electrical engineering may even return to school and obtain a MS or PhD in electrical engineering, especially for those students with significant technical experience.

There are valid and erroneous motivations for returning to school. Valid motivations include:

1. Gaining more knowledge to satisfy intellectual curiosity
2. Gaining new skills to change to a new technical field. This is an especially important aspect for those engineers who are converting from a military oriented profession to a commercially oriented profession
3. Improving or expanding career opportunities to include teaching, consulting, or more research oriented work
4. Enjoying a culturally rich and diverse atmosphere

Erroneous motivations, or myths about the advantages of returning to school include:

1. Gaining a higher degree is a guaranteed way to earn more money
2. Returning to school is a solution to "job burn-out"
3. Obtaining a new or advanced degree is a "vacation" which requires little work

In this article, we explore the motivations for returning to school, examine educational alternatives, discuss some of the advantages and disadvantages of returning to school and provide advice on how to select the best school to fit your needs. Much of the perspective for this article has been furnished by students who left full-time jobs to return to school for advanced electrical engineering degrees at Virginia Tech's Mobile and Portable Radio Research Group (MPRG).

Mechanism for Further Education

There are four ways for an engineer to acquire further education:

1. Short courses
2. Part-time education while working full-time in industry
3. Full-time education while working part-time in industry
4. Full-time education while working at the university

Short courses are obviously the most convenient of these options in terms of minimizing impact on one's personal life. It is usually a cost effective way to learn since most employers will cover the expense of courses relevant to one's job. The drawback is that this type of learning can be very superficial. It is very difficult to retain information presented at the fast pace of a short course. The learning process requires time, concentration and a chance to wrestle with concepts so they become integrated into the problem solving thought process. Unfortunately, short courses offer little, if any, opportunity for the student to work problems or participate in design projects.

Part-time education offers a compromise between short courses and full-time education. Part-time education is less disruptive of personal life than returning to school full time and less financially draining. Drawbacks are that the quality of education is not as high as a full-time education since time is split between work and school. Coordinating time between education and a full-time job can be frustrating, particularly if the student is married and has a family. Part-time education is becoming increasingly important for keeping up in a technical field, but it requires patience and commitment to get a degree in a part-time program. Typically, a part-time MS student takes three to five times longer to obtain a degree as a full-time MS student.

Part-time PhD student status is not usually feasible, unless it is combined with an extended period of being a full-time PhD student. This combination can be an excellent strategy. Beginning school as a part-time student allows one to refresh math skills and complete a few classes while searching for an advisor, dissertation topic and preparing for any entrance exams. A financial advantage to part-time education is that many employers will reimburse the cost of work-related courses.

Full-time student status has many merits. Besides being a quicker mechanism for obtaining the degree than part-time status, the ability to focus exclusively on education allows for a better quality of education. Furthermore, one can enjoy the rich diversity of culture that college campus have to offer. New friends and associates made in school often times become important contacts for years to come.

Frustrations of Returning Engineers

For the engineer who returns to school as a full-time student, there are some potential surprises awaiting. The decision to return to school can often be met with skepticism from co-workers and management. Co-workers can often be discouraging, pointing out the loss of income and hard work in going back to school, as one returning MPRG student put it "my co-workers thought I was crazy." Management may not be supportive of this move as
well. For instance, returning back to the same company after earning a degree may not lead to improved salary, especially if one returns to the same job title. A company can easily take for granted the benefits of the enhanced education of their employee.

Rusty math, technical skills, test taking, and study skills are the bane of the returning engineer. Most find that these skills return quickly, and are quite pleased to know that this information is not lost. The returning engineer does have an advantage, the ability to better discern what the important material is and what the relevant applications are to industry. This is a tremendous asset in studying for exams and working design projects, which have become a pervasive part of most technical graduate courses. One older returning graduate student in the MPRG describes his ability to compete with non-returning students this way, "Old age and guile will beat youth any day."

There are psychological barriers for returning to school. One MPRG student expressed his concern on returning to school as being viewed as the "old man on campus." This myth was quickly dispelled. "Now the only time I feel like an old man is when I walk into a bar and find myself surrounded by people that are barely twenty one. I find that there are a lot of students who are like me, returning to school after working for some period of time. Quite a few of my friends are actually older than I am."

Another psychological barrier for returning students is in moving from an engineering position where one has control over resources and people to being powerless. A good electrical engineering department will respect the experience of returning engineers and the benefits they bring. As one MPRG student stated, "I've noticed that the professors treat someone who has experience with a bit more respect. I think professors do genuinely value the opinion of someone who has a bit of real-world and real-life experience. Maybe I've just grown more assertive from being 'out there' and demand more attention in class than I used to (compared to my undergrad days)."

Probably the greatest barrier for returning students is the financial burden, especially for those with a family. It's difficult to live on a graduate student budget after acquiring a comfortable lifestyle. In the long term returning back to school usually offers a financial advantage. However, it takes several years to make up for the loss of income during the time spent in school. It would be unwise to return to school strictly with the expectation of financial gain.

Faculty advisors may give preferential funding to returning engineers because of the value of their experience. Student pay is generally quite low. Typically, research assistantship stipends (PhD level) run from $1300-$1600 per month and may or may not include tuition. Research assistantships are more likely to be given to returning engineers. Often universities will grant tuition waivers for fellowships to highly qualified students. For example, at Virginia Tech, the Bradley Fellowship program supports eight U.S. citizen PhD students in the electrical engineering department and provides a stipend of $1650 per month, full tuition, all book costs, and a small housing allowance.

Picking the Right University
Picking the right university for full-time study can be a very difficult task. Look especially hard at the strength of the particular department, emphasizes within the department and use these as the most important criterion, instead of the name recognition of the university. A strong department will have adequate resources including faculty, equipment, lab and office space and a wide selection of relevant classes. A strong research university will require a lower number of teaching hours from its faculty, strong ties to industry and the faculty will have a lengthy publication record in leading technical journals. Reviewing student theses and dissertations is also an excellent way to judge the quality of school and its research program.

Meeting with potential research advisors, instructors, and fellow students is an effective way to evaluate the quality of the faculty. Ask tough questions of the faculty and administrators, e.g., "What is the percentage of students being funded though research contracts and teaching assistantships?", "Are tuition waivers granted?", "What is the minimum and maximum class size?", "What is the per-

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**About the Mobile and Portable Radio Research Group (MPRG) at Virginia Tech**

The MPRG was founded in 1990 by Dr. Ted Rappaport to conduct research on emerging wireless communication technologies. The group has research, teaching and service missions which are national in scope and is a leading producer of professionals for the wireless communication industry. MPRG consists of three principal faculty members, seven support staff and approximately thirty five graduate students, many of whom are engineers returning to school for advanced degrees. Major MPRG research thrusts include:

- Simulation and analysis of wireless communications systems using real-world channel models.
- Development of signal processing algorithms for interference rejection, antenna steering, error correction, and fast synchronization.
- Advanced modem development.
- Site-specific prediction of propagation characteristics.
- Measurement and analysis of propagation characteristics for wireless channels.

Core funding is provided by the MPRG Industrial Affiliates Foundation, a coalition of major corporations in the wireless field who serve as academic "stockholders" of the research group. MPRG Industrial Affiliates include: AT&T, Bell Communications Research (Bellcore), Bellsouth, BNR, the Federal Bureau of Investigation (FBI), Grayson Laboratories, MCI, Motorola, National Semiconductor, Southwestern Bell, and Texas Instruments.

The MPRG prepares quarterly research reports for its industrial affiliate members and promotes aggressive technology transfer through frequent visitation. Most industrial affiliate members have hired one or more MPRG graduates. In return, affiliate members provide financial support and serve as unofficial "stockholders" of the group, providing technical and managerial advice. The MPRG also conducts funded research for individual government or industry sponsors.
percentage of students who pass the PhD entrance exam?”, “Are faculty evaluated on their teaching skills?”, and “What are the infrastructure resources (e.g., computers, office space, lab equipment) available to graduate students?”. These same questions should also be posed to students attending the university.

Examine the faculty’s attitude towards returning students. A quality engineering department will recognize the importance of returning engineer’s skills. Some universities, such as Virginia Tech, allow especially qualified students to serve as co-principle investigators on research contracts. A quality advisor will encourage close and continuing contact of the students with research sponsors. Some faculty provide business cards to MS and PhD students who are expected to eventually manage their own research projects.

It’s also advantageous to examine the relationship of the faculty with industry. If a faculty member has a good relationship with industry it is likely that their classes and research fosters skills that make graduate students attractive to employers. A university’s ties to industry is an excellent indicator of how easy it will be to get a job once a degree is obtained.

Should You Return to School?
Returning to school is a personal decision based on the expectations of the educational experience. Higher education is an investment which does not immediately lead to greater financial gains, but rather an investment in intellectual maturing and technical sophistication. We have seen few returning students who have regretted furthering their education, and believe that more engineers error in making the decision not to return to school.

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About the Authors
Jeffrey H. Reed, Theodore S. Rappaport, and Brian D. Woerner can be reached at: Mobile and Portable Radio Research Group, Bradley Dept. of Electrical Engineering, Virginia Tech, 840 University Blvd., Suite 1, Blacksburg, VA 24061-0350. Tel: (540) 231-2964; Fax: (540) 231-2968.