

2006-105: ASSISTANT PROFESSORHOOD: YOUR VERY OWN STARTUP COMPANY

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Abstract

“Congratulations! Our departmental search received over one hundred applicants; we interviewed a handful of excellent candidates; and we have decided to offer the position to you.” The typical response is “Great! Now what?”

Even at historically regional institutions, there has been a growing emphasis on funded projects and (often) graduate education. In other words: research, research, research. Developing your own identity in the engineering research community is akin to being CEO of your own startup company. Instead of focusing on profits and losses you need to write successful proposals, manage undergraduate and graduate research students, and publish papers. You have (typically) six years to succeed to satisfy your “stockholders” (university administration). Oh, and you have to be an excellent teacher and do service, too.

As such, this paper will discuss some of the aspects involved in developing a “nationally recognized” research program. Additional discussion will focus on integration of research, teaching, and service activities.

Introduction: Your University Is Counting On You

The challenge that faces almost every new faculty member is the same: get tenure. However, aside from stating that you are expected to teach, do research (also called scholarship), and perform service, colleges and universities rarely tell the new faculty member what is required to achieve this goal. This is because levels of scholarly productivity vary greatly depending upon discipline, culture of the department, history of the institution, and personal goals of the faculty member (this part is also known as “academic freedom”).

Within engineering, the means to success is relatively straightforward. The Assistant Professor is expected to perform research at levels concomitant with the “development of a national (sometimes international) reputation.” If you were to look at the strategic plans for many smaller institutions it often is to “increase in the U.S. News and World Report Rankings.” However, not every institution can be successful in doing this. If your institution moves up, someone else has to move down.

As a faculty member you have the potential to make a significant impact on the national reputation of your institution. This is especially true of Assistant Professors. When you are hired, the school is making an investment in you to help grow their reputation. Consider joining the faculty in 2006 at Average State U. with the offer shown in Table 1 below:

Item	Amount	Total
Salary (close to national average)	\$65,000	x 6 years = \$390,000
Fringe benefits	\$20,000	x 6 years = \$120,000
Startup Package ~ 1 year of salary	\$65,000	\$65,000
Totals		\$575,000

Table 1. Total financial investment of Average State U. for a new engineering faculty hire.

For a higher tier institution, the startup package can be above \$200,000. Once you are promoted and tenured, the institution is making an even bigger commitment: at least thirty years of salary and fringe benefits! As you can see, the investment is significant, and it makes sense that you are expected to do more than teach your three to six courses per year and serve on two or three committees whether you are tenured or are tenure-track.

It is noted that none of the material in this paper can really be considered “new” or “unique.” These are things that the author has encountered while a professor that he feels can be used to get off to a good start towards tenure. Although the main focus of the present paper will be on research, many suggestions for teaching and service will also be provided throughout the narrative.

For additional advice on starting up your faculty career, consult the textbooks of Reis¹ or Wankat², the website of Rich Felder³, or the ASEE conference proceedings / engineering education literature⁴⁻¹⁰.

Glossary of “Research Topics”

There are several terms used throughout this paper for your possible research topics. They are defined here for the convenience of the reader.

- Topic X* Your PhD Dissertation Topic
- Topic Y* A new research topic for you that is closely related to *Topic X*
- Topic A* A “hot research topic” that is not related to *Topic X* or *Topic Y*
- Topic B* A “hot research topic” that is not related to *Topic X* or *Topic Y* (but is closely related to *Topic A*)

Starting Up Your Research Program

Since the number one expectation of a faculty member is to perform research or some other form of scholarly activity, this is where the untenured faculty member should (and likely will) spend most of their time.

Tip #1: “Invest In Yourself” – When you successfully defend your doctoral dissertation, you are one of the best in the world in your field of *Topic X*. Thus, you have the best chance to make an immediate scholarly impact by:

- writing one or two more papers in *Topic X*. This keeps your publishing record intact and shows you can publish papers on your own (usually a key “deliverable” of a national research grant)
- making a “lateral move” into a new, but parallel field of research. When you submit a proposal for review, the reviewers of your proposal will see you did your PhD on *Topic X*, and are now proposing *Topic Y*. If you can show how these topics are related, and that you are well qualified to do this work, you will get good reviews and have a good chance at funding.
 - If your proposal focuses only on *Topic X*, you may not get funded because the money could go to your advisor who already has a proven track record of success
 - If you propose to do *Topic Y* with no explanation of how you can solve the problem or how you are qualified to work on this topic, you will not be seen as an “expert in the field of *Topic Y*” and will not get funded either.
 - If you propose the unrelated “hot topic” called *Topic A* with absolutely no relation to your background, again you will face difficulties obtaining funding.

Thus, the pitfall that most young faculty members face is realizing that you need to identify an area of research (in the author’s opinion this is most likely to be *Topic Y*) that you can be nationally competitive in. Closely associated with this pitfall is in making the transition from their dissertation area *Topic X* into the new area *Topic Y*.

Many of the more successful new faculty make a smooth transition because they have had one or two years of post-doctoral research experience. With or without this experience, it takes an extreme level of focus, literature research, preliminary data, and a well thought-out plan to write a successful proposal at the national level. The NSF program solicitations often have a 10-20% funding rate, and it is the “cream-of-the-crop” investigators that have put in tremendous effort that get funded.

Many universities often give their young faculty a “honeymoon period” with a lighter teaching load for one or two semesters (or years). If you have this opportunity, use it to create your identity within your new area of research *Topic Y*. Once the “honeymoon is over,” you may not be able to devote the time required during the academic year (you will likely need one or two months) to write a competitive national proposal.

Tip #2: “Diversify Your Portfolio” – Eventually you may wish to do research on one of the “hot topics” *Topic A* or *Topic B*, but how do you get there? Here are several options:

- Find a collaborator at your (or another nearby) institution in *Topic A* who you can work with and learn from. You can either form a great team or eventually, on

- your own, take the expertise you developed on *Topic X* and on *Topic A*, and spin off *Topic B*.
- Learn something new. You can do this while satisfying the teaching mission of your institution.
 - If you are an experimental person in *Topic X*, get caught up on the modeling techniques common to this field. Volunteer to teach a mathematical based course to essentially “get paid” to teach yourself. Publish some of your work on modeling of *Topic X*. Find a seed grant to do some research on modeling of *Topic A*. Now you have the tools to obtain national funding to develop an experimental program in *Topic A*.
 - Alternatively, volunteer to teach in the core area that encompasses *Topic A* and devote part of the semester to that topic. This will at least get you up to speed on the topic and will help you develop the “boilerplate” that goes into certain proposals.

Tip #3: “Seek Investors In Your Company” – It is now time to seek funding for your research group. Being able to do this is one of the most difficult jumps from grad student to successful professor. In the opinion of the author, a good starting point is to find young faculty awards and seed grants. Some of these are offered within your own institution or the state your university is located in.

The seed grant is part of a program which provides funding for research in an area that someone has not worked in before and/or to allow the investigator to obtain preliminary data by which the investigator may be competitive for federal funding. One advantage of the seed grant is that many of them have low page limits (three to six pages). This sort of proposal can be written relatively quickly (perhaps a couple days to a week). With relatively low risk, you can try out some ideas that you may wish to include in a proposal to a federal funding agency. Many of these seed grant programs also provide you with the reviews so you can improve your ideas (and your chance of getting a larger grant).

Although the dollar amounts are low, if you can show on the “Current and Pending Support” some funding within *Topic Y*, and reference your funded project (with associated website) in your new proposal, you now have a better chance of getting funding at a much higher level.

Many national program solicitations (such as the NSF CAREER award program) receive proposals from many faculty at your university. The people that work in the office that formally submits these proposals on behalf of the university usually work very hard. Let them know well ahead of time that you are writing a proposal and when it is due. Send them the link to the request for proposals. Turn in your budget worksheets and other university boilerplate forms early so they can process your proposal ahead of time and not have to wait until the last minute.

Combined Tips #4 / #5: Hire Your “Temporary” Employees / Publish, Publish, Publish – One of the most rewarding (and often frustrating) parts of being a faculty member is supervising your research group. At the beginning, you recruit and hire students who

usually have little knowledge in your field of research (of course at this stage it is in *Topic Y*). After as little as one semester (undergraduate researchers) or as much as four or five years (doctoral student) of your time, money, and nurturing, the student leaves your group.

Akin to your university getting “credit” for hiring Assistant Professors, you need to get “credit” for your investment as well. For a masters or doctorate student you will often need to put in significant effort to help them graduate. Since you have limited resources and time, you might want to try to graduate your students one semester early. When your students defend, you need to submit research papers for journal publication. It is the author’s experience that this is usually easier with doctoral students, because they are in your group for a much longer time and can actually work with you to write the manuscript. With masters students (and often with your doctoral students as well) you will have to write one or more of the papers yourself, after the student has defended their work. Make sure that you get electronic copies of their thesis and all computer codes, laboratory notebooks, etc. so you can write the paper. Your grad students tend to answer email more rapidly before they have graduated!

If you have an excellent undergraduate student in your classes, recruit them for summer research in your group. Once you see that they can do just as good of a job in the lab as in your course, recruit them for graduate school at your institution.

Tip #6: Learn To Network – One of the best ways to develop a national reputation is to get to know as many people in your discipline and field of research as possible. Attending conferences is one of the best opportunities to do this. However, many engineering faculty are classified as “introverts” (author included) and would rather keep socializing with strangers to a minimum.

A good way to counter this effect is to present your research work during the poster session of the conference. When people walk by and look at your poster, introduce yourself. Tell them who you are and what you are doing. Ask them who they are, where they are from, and what they are doing. Exchange business cards. When you see them at future meetings you will now have someone to talk with.

Once you return to the office you can follow up the meeting with an email. Look at their webpages and see what papers they have written. They may have done something that you might be able to use for your research. Consider inviting the more successful of them for a seminar at your institution (there will be more about this later).

Ways that the author has been active in university and external networking are presented in a previous ASEE conference paper⁷.

Teaching and Service Tips for the “Research-Focused” Assistant Professor

If you are reading this paper, you have likely attended ASEE meetings or know someone who has. However, you know that your institution has rather lofty research expectations.

This section will give some suggestions to combine your research and scholarly efforts together with teaching and service. This will make it easier for you to do your job and be successful.

Tip #1: Consider Educational Scholarship – In addition to the annual conference proceedings, ASEE publishes several peer-reviewed journals in engineering education, such as the Journal of Engineering Education, Chemical Engineering Education, Computers in Education, and the Engineering Design Graphics Journal. One way to increase your publication record is to take the ideas you have about teaching, present them at the ASEE conference, get comments from others who attend your talk, and submit it to one of these journals. Be sure to spend most of your time in traditional research (in *Topic Y*) as well.

There are other advantages of being involved in “educational scholarship.” Proposals submitted to the National Science Foundation usually need to have a sound educational plan to receive ratings of “excellent” and be recommended for funding. In fact, a plan to “promote teaching, training, and learning” will help satisfy the “broad impacts” criterion¹¹. By being involved in “educational scholarship,” you will be better prepared to write this into your proposal and perhaps obtain this highly sought after funding. By showing attendance and presentations at ASEE, the reviewers will know that you are serious about the educational plan you have presented.

There are also education specific funding opportunities within NSF. These include “Research Experience for Undergraduates,” “Research on Learning and Education,” “Course Curriculum, and Laboratory Innovation¹²⁻¹³.” This is “educational scholarship” at its core. It is just as rigorous as traditional research in *Topic X, Y, A, or B*, although it may be a good idea to talk with your Department Chair or Dean before submitting one of these proposals.

Tip #2: Teach to Your Strengths, then to Your Goals – When you start your faculty career, you are an expert in *Topic X* and have a broad view of your discipline as a whole. However, as research continues to add increasing depth, it may be very difficult for a new faculty member to teach certain courses. Go through your department curriculum and plan out what courses you would like to teach and which you would like to avoid.

The author was fortunate to teach a core undergraduate class that encompassed his general research area. The author was “prepared” right away because of his coursework and research training in this area. Thus, the “warm up” time to prepare a good set of notes, homework problems, and exams was reasonable. This gave the author additional time to supervise graduate students and to write papers and proposals. As an added bonus, it made sense to integrate the author’s research interests into the course. This was done by illustrating the practical applications of the theoretical course material. The author also was a co-PI on a grant that required some of his graduate students to teach. They could come right into this class and talk about their research without having to modify their conference and/or thesis presentations.

It is advised to teach the same course at least four times. There is a significant time investment in preparing course notes. You will not get much research done while putting together a new course. However, the second time you teach it you are “prepared” and can spend more time on research. If you keep getting assigned to new courses, you will not be able to spend much time doing research.

Along the same vein, you should try to recycle most (or all) of the homework problems from one year to the next. This limits your preparation time. The author usually assigned three or four homework problems per set (about ten sets were assigned per semester). Only one (sometimes two) problem was new.

Finally, try to get a teaching assistant to help you with grading. If you do not get one, hire a grader for \$7 per hour from your startup funds. Your time is worth almost ten times more.

After a few years, you should consider expanding your teaching interests to coincide with your new research areas. You can start by either teaching a class to train yourself, or propose to develop a new course if your project is funded. Of course, you can also do both.

After four years, the author wanted to diversify his teaching background. He volunteered to teach a core graduate level course that was also related to his research area. Again, the author was able to easily integrate his research into the course. He also was able to study in more depth some research of famous people in his field, talk about them in his class notes, and add more tools to his “research toolbox.”

The author recently developed a collaboration with several people at his institution in “*Topic A*.” After getting a smaller-level seed contract to study the research area¹⁴, he then developed a course for the students working on the project. Then, he was able to successfully propose to integrate research results into this course¹⁵.

Tip #3: Integrate Research with Service – Although you should request a light service load as an untenured faculty member, there are ways to use service to the benefit of your research program. They are listed here:

- Try to get on an NSF review panel – contact your program manager and offer your services.
- If your department has a seminar series, offer to chair it. This will give you the chance to invite some experts (that you met at national meetings) in your field to visit your institution. By seeing your laboratory and facilities, they are more qualified to review your proposals and papers. They are also great people to ask to write a letter for your tenure package.
- Consider trying to turn your service work into an ASEE paper on assessment, curriculum improvements, etc.
- Offer to chair technical sessions at ASEE and professional society. The best way to do this is to go to planning meetings and lunches.

- Review journal articles that are sent to you, even if not directly in your area. Once you get two or three on your resume, be more selective in saying no.

Conclusion

This paper has suggested ways to get off to a good start as a professor with respect to teaching, research, and service. Remember that there are no set guidelines or criteria to reach tenure. Your best bet is to find help within your department or college. Ask your chair for help, but realize they are busy managing a department. You should seek out a mentor to give you more specific advice.

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