6 Making Contact and Communicating with Program Managers and Program Directors

An important question most young faculty members ask relates to how the proposal management process within government agencies is conducted, and who is responsible for the execution of the process. The mission agencies term the people who manage the research proposal process Program Managers, while the National Science Foundation (NSF) terms them Program Directors. Sometimes the general title of Program Officer is used. The duties of the program managers and program directors are similar, but fundamentally different in authority, and the manner by which the proposal management process is performed. Perhaps one of the first questions you might ask is: "Do I need to make personal contact with funding agency program managers and program directors?" The answer varies somewhat, depending upon the funding agency you wish to solicit for funding, but the general answer is an unqualified "Yes, you are well advised to make personal contact with the program managers!"

6.1 The Need to Personally Communicate with Program Managers and Program Directors

For the mission agencies, such as the offices within the Department of Defense (DOD), the Department of Energy (DOE), NASA, etc., personal contact can be paramount. Program managers in these agencies and offices generally have discretion and authority to provide funding to researchers for proposals they deem worthwhile, sometimes without the need to conduct in depth reviews or evaluations of the proposals. Although the mission agencies make use of external or internal proposal review panels staffed with technical experts, the final decision as to which proposals to select for funding rests with the program manager,

although they generally accept the review panel results. However, in their core program, the program manager selects the proposals to be funded, and any reviews solicited by the program manager are used as guidance, and the results of the review do not necessarily determine the program manager's decision as to whether to accept or reject the proposal for funding. The program manager will often personally read and evaluate proposals and form his or her own opinion of the quality and importance of the proposed research. They have the authority to disregard reviews that they feel don't accurately represent or value the proposed research. The program manager's evaluation of the proposed research, and exactly how it supports his or her research program objectives, will dominate the decision.

In order for the program manager to select your proposal for funding, he or she needs to have confidence both in you as a potential principal investigator and in your ability to perform quality research, as well as in the specific topic being proposed. The program manager will evaluate the prospects for success, and how the proposed research will support the overall goals they are pursuing. Therefore, they need to meet you and give you a chance to present your research pursuits. An unsolicited proposal submitted blindly, without prior contact with the program manager, has little chance of being selected for funding.

However, for non-mission agencies, like the NSF, personal contact is useful, but not absolutely necessary since your proposal will be evaluated by a panel of experts who come from institutions outside of the NSF. Program directors or other experts within the NSF do not personally evaluate proposals and do not generally enter into the evaluation and discussion of a proposal during review panel deliberations. The results of the panel review will determine which proposals are selected for funding. Therefore, the review panel ratings of all proposals are extremely important, and the NSF program directors can only recommend a proposal for funding if it has received high ratings. The NSF program directors do not actually have the authority to obligate the NSF to fund a particular proposal, and their role is to organize and manage the review process, usually by means of a proposal review panel, although they will sometimes send certain proposals to experts outside of the NSF for

review. They then rank/order the proposals according to the review panel or outside reviewer evaluations, and then they make recommendations to the division director regarding the proposals to be funded. The actual selection is the responsibility of each division director, although they normally approve proposals for funding by concurring with the program director's recommendation. If they do not concur with a proposal selection recommendation, that particular proposal will not be selected for funding. This occurs only for well-defined reasons that are entered into the official records.

Personal contact with mission agency program managers has always been important, and is becoming more so as research budgets become stressed. Simply stated, you need to demonstrate to the program manager that you are performing research that is contributing advances to an area in which they wish to invest. The program manager needs to have confidence both in you as a researcher, and in the technical area in which you work. I emphasize that the program manager working in a mission agency, as stated above, personally makes the decision of which researcher will be supported and provided a research grant. For a non-mission agency such as the NSF, the program director will make their recommendation decision from a ranked list of proposals evaluated by an expert panel. In either case, the program manager or program director is an important person in making, or recommending, the decision regarding grant acceptance and funding, so it's a very good idea to meet them and establish a personal relationship. If you survey faculty members who have been successful in obtaining research funding over a sustained period of time, the one common characteristic you'll discover is that they all have established personal relationships with program managers and program directors. Generally, these personal relationships form networks that endure over many years, and sometimes decades. The relationships are beneficial to both sides, and establishing a personal relationship with a program manager that may grow and extend to other program managers will be one of your main priorities. In order to understand why this is so, it is helpful to understand how program managers interact within their home agency and colleagues, and how the program managers are evaluated in their performance within their agency.

6.2 Program Managers and Program Directors

United States government program managers and program directors come from the research community. At the majority of the US government funding agencies, the people who are selected to serve as program managers will be PhD-level scientists and engineers. In some instances, the program managers may not hold a PhD, but they will have significant professional experience, which gives them expertise and practical knowledge essentially equivalent to their PhD colleagues. All program managers and program directors are highly trained and are experts in their fields. Their responsibility within their agency is to learn and understand research trends and developments within science and engineering, and particularly within their specialty field. They are expected to keep their knowledge up to date and to know and understand the state-of-the-art in their areas. In order to accomplish this, they have numerous approaches available to them. For example, program managers will study the technical literature, including professional publications and technical reports from a variety of sources, they will attend technical and professional conferences and meetings, they routinely visit research laboratories and discuss research trends and developments with leading researchers in academic, industrial, and government organizations, and they read and evaluate many research proposals, serve on research proposal evaluation panels where various approaches to research are discussed, and host meetings with researchers who will travel to meet them for the purpose of presenting their research approach and results.

Program managers will periodically travel to visit scientists and engineers, particularly those they are supporting, to review their progress and recent developments. The program managers also interact extensively with research scientists and engineers both within their own organization, and within other government organizations. It is not unusual, for example, to see research scientists and program directors from organizations such as the US Army Research Office, the Army Research Laboratory, the US Office of Naval Research, the Navy Research Laboratory, the Air Force Office of Scientific Research, the Air Force

Research Laboratory, DARPA, the Department of Energy, NASA, the NSF, and others, all attend, with outside scientists and engineers, meetings on research and development topics of mutual interest. Technical meetings are often organized and hosted by government program managers, with the financial support of their organizations, for the purpose of examining recent developments in a given area, and to explore approaches for future research directions. Strategic planning meetings occur on a routine basis, and many of these planning sessions result in research funding opportunities for the academic and industrial communities.

In this process, the program managers and program directors become aware of what scientific and engineering approaches are being followed, what results are being achieved, what future trends are developing and, most importantly, the identity of the major research performers that present the most novel and promising approaches and results. The majority of these meetings are open to attendance by academic and industrial scientists and engineers, and attendance at these meetings can help a researcher place their research approach in perspective, to be exposed to alternative approaches, and to help in future planning. Attendance at these meetings can also help make you aware of which program manager may be a potential source of support for your research, and your presence at the meeting gives you the opportunity to make contact with these program managers in an informal setting. While it will not be possible to attend all these meetings, you should make an attempt to attend those that are directly pertinent to your research topic. These meetings are generally widely and publicly announced and advertised. Again, agency websites are a good location to search for information.

6.2.1 The Program Manager Evaluation Process

Mission agency program managers and NSF program directors are evaluated in different ways, although both go through detailed annual performance reviews. In order to better understand the role of the program manager or program director, it's helpful to discuss how they are evaluated and rated by their organization. This, in turn, helps you to

understand what they are looking for in a new researcher, and how you can best approach them and introduce and explain your research ideas and goals to them. Also, understanding how the mission agency program managers are evaluated places in perspective the reason that they have authority to select certain proposals for funding, and why the proposal merit review process does not necessarily restrict them in the same manner as it does for program directors at NSF.

Program managers and program directors working for US government funding agencies go through robust evaluation procedures. They, along with their colleagues and managers, have the responsibility for determining the research areas in which their agencies will invest research funds. Program managers also determine which researchers actually receive research funds in response to their submitted proposals, while NSF program directors serve a similar purpose, and make recommendations for which proposals are selected for funding. Both have the responsibility of selecting the successful proposals from competing proposals, which can be a large number. In this regard they have significant control over the direction of national research, and play a very critical role in the direction that science and technology emerges and develops. For this reason, the program managers and program directors go through a very robust and detailed review and evaluation procedure, generally on an annual basis.

During these reviews the mission agency program managers are required to stand before their department and agency managers, directors, and colleagues, and sometimes outside experts, and explain and defend their program, detailing what they are attempting to accomplish, progress that has been achieved, how the research supports the agency mission, and whom they are supporting with research grants. Program managers have a technical area that they oversee that is usually quite well defined and specific, with well-stated research goals. They generally have a good idea of what research areas and technical subjects they want to support and have a well-developed and formulated strategic plan. They are generally trying to accomplish an end result that has been defined by their in-depth knowledge of a given area, and through meetings and discussions with their colleagues and managers. Often, the end

goal will consist of a larger overall view of a specific area and may include development of a new approach to a complex problem. They may be coordinating their research program with that of their colleagues from within their own agency, or those from other agencies. In order to accomplish their goal, they will need advances in a variety of scientific and technical subjects, all related to the end goal. In their program review the program managers will generally present and describe their view of what they're attempting to accomplish, along with a description of the work the researchers to whom they are providing research grant funding are pursuing, the progress that has been achieved, and the future directions for the research.

In preparation for these reviews the program manager will generally solicit input and results from the researchers they sponsor. In their overview of their programs, the program managers will also address how their research program aligns with their agency mission and goals, and what future trends are developing. They will present and discuss the research areas that are developing and why their agency should be investing research funds in these areas. Also, in the program reviews, the program managers will often present a list of specific accomplishments, publications, technical or scientific performance awards received, etc. The technical or scientific performance awards, along with any they personally may have received, include those received by the researchers they have sponsored. In particular, all program managers enjoy announcing that a researcher, and particularly a young and new researcher that they are supporting with a research grant, has received a recognition award from a professional society, etc. This is considered an indication that the program manager is sponsoring high-quality, significant, and important research, and the recognition award is a positive factor in the program manager's review and evaluation. To be mentioned in these reviews is also a very significant recognition for the researcher, and helps to make their research known to other program managers in attendance at the review. Program managers are always on the lookout for a new, young researcher that appears to be a developing research talent. Your goal should be to become this new talent waiting to be discovered!

Annual performance reviews for NSF program directors are not as detailed or complex a process. The performance evaluation is conducted between the program director and the division director, and the program director will complete a standard evaluation form that requires that certain specific topics be addressed. The form is submitted to the division director and serves as the basis for the annual performance review.

6.3 Funding Agencies and Organizations

Another important question most, particularly new, faculty members just starting a research career, ask is: "What funding agency should I approach, and do they all function in the same manner?" There are a variety of funding agencies for you to investigate. The best places to start are the funding agencies with the largest research budgets for external grants. That is, although some agencies have relatively large research budgets, some keep most of their research funds for internal use and support of their agency research laboratories. As the data presented in Fig. 5.6 indicate, the federal agencies that provide the largest amount of financial support for university research and development are, in rank order, the National Institutes of Health (NIH), the National Science Foundation (NSF), the Department of Defense (DOD), the Department of Energy (DOE), and the National Aeronautics and Space Administration (NASA). All of these agencies have established research offices to manage their external research. These five main funding agencies are briefly described below.

6.3.1 The National Institutes of Health (NIH)

The National Institutes of Health (NIH) is a mission agency that supports science in the areas of biology and the behavior of living systems, with the goal to apply that knowledge to extend human life and reduce illness and disability. The various NIH Institutes and Centers (ICs) provide funding for a wide variety of programs, and the NIH uses activity codes to differentiate the research-related programs. For example, "Series" codes for research-related activities are: Research Grants (R

series); Career Development Awards (K series); Research and Training and Fellowships (T & F series); and Program Project/Center Grants (P series). A research grant to support a well-defined and specific research project is called an R01 grant. This is, in fact, the most common grant program offered by the NIH. There is no dollar limit to the grant, unless a specific limit is indicated in the Funding Opportunity Announcement (FOA), which is the NIH's version of a Call for Proposals. However, advance permission from the NIH is required for any budget request in excess of $500 000 in direct costs for any year. The NIH R01 grants are typically awarded for a performance period of three to five years. The NIH Institutes and Centers periodically publish FOAs, either as a Program Announcement (PA) or as a Request for Applications (RFA), and these are generally open for a period of time ranging from one to three years for proposal submissions. The NIH Institutes and Centers will also accept unsolicited proposals for research that is not appropriate for the research described in their published FOAs. Unsolicited proposals should be submitted through what NIH terms "parent announcements," which are funding opportunity announcements that cover the entire breadth of the NIH mission.

The NIH seeks to support high-quality research that is relevant to public health requirements and research that is consistent with NIH Institutes and Centers priorities. Proposals submitted to the NIH go through a dual peer review process, which is mandated by statute (Section 492 of the Public Health Service Act). Each proposal is first reviewed by a Scientific Review Group, which is mainly made up of non-federal scientists with expertise in the relevant scientific discipline of the proposals they are assigned to review. The second review is performed by NIH National Advisory Councils or Boards, which are made up of both scientific and public representatives chosen for their expertise, interests, or activities in appropriate areas related to the proposed research. Proposals must be recommended for approval by both levels of review before they can be recommended for funding. If you wish to pursue NIH funding opportunities, it is always best to contact the appropriate person within an NIH Institute or Center to discuss your research before submitting a proposal. Information concerning NIH interest areas

and funding opportunities at the NIH can be found at the NIH website (http://www.grants.nih.gov), and funding opportunities are listed on the Grants.gov website.

6.3.2 The National Science Foundation (NSF)

The National Science Foundation (NSF) is an independent federal agency established by an act of Congress in 1950 "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense. . . ." It is a non-mission agency dedicated to supporting basic research in fundamental science, engineering, and education, and is the only federal agency that provides support for research in all fields and areas of fundamental science and engineering, except medical sciences. The NSF's goal is to support research that is high-risk, but potentially high pay-off, as well as to support novel collaborations and approaches. While providing about a quarter of the total external research funding to US colleges and universities, the NSF provides the majority of the research funding in areas such as mathematics, computer science, and the social sciences. For example, about 80% of the external funding for computer science academic research is provided by the NSF, primarily through the CISE directorate. The NSF is composed of seven technical directorates (the Directorate for Biological Sciences (BIO), the Directorate for Computer & Information, Science & Engineering (CISE), the Directorate for Education and Human Resources (EHR), the Directorate for Engineering (ENG), the Directorate for Geosciences (GEO), the Directorate for Mathematical and Physical Sciences (MPS), and the Directorate for Social, Behavioral & Economic Sciences (SBE)), and each directorate is composed of a number of divisions, organized according to scientific and technical discipline within each area. The NSF program directors within each division have responsibility for managing a technical portfolio in each scientific and technical subject area.

The NSF will periodically offer funding opportunities for specific research topics, which are determined through a strategic planning process organized to identify new and emerging research topics and areas.

These specific opportunities are announced by means of either a research solicitation (called a Dear Colleague Letter) or a request for proposals. Each division generally publishes their own solicitations and requests for proposals. The divisions will also accept unsolicited proposals on any topic consistent with their overall disciplines and interests. However, unsolicited proposals are accepted only during the "open window" period for each particular division. There are, in general, two windows, one in the fall, generally in the September/October time frame, and one in the spring, usually in February. However, some divisions offer only one window each year, which is usually in the fall. You'll need to check the NSF website and the Grants.gov website to stay current on the opportunities for proposal submission. All proposals submitted to the NSF are evaluated by means of a merit review procedure, and are evaluated by a panel of scientists, engineers, and experts selected based upon their expertise in the subject area of the panel on which they serve. The panel members are primarily derived from university faculty and scientists, but also may include scientific and technical experts from US government agencies, industry, and independent research centers and laboratories. For more information concerning NSF opportunities, policies, and procedures, you can explore the NSF website (http://www.nsf.gov). Along with the NSF website, research program opportunities are published on the Grants.gov website.

6.3.3 The US Department of Defense (DOD)

The US Department of Defense (DOD) has historically provided research support to academic scientists and engineers dating back to the founding of the nation. However, significant support for academic research primarily dates back to the nation's experience in the Second World War and the benefits to the military that were demonstrated by advances in technology. The nation's military forces are heavily dependent upon technological advantage that requires significant advances that are derived from research in science and engineering. As science and engineering advance, technological advantage requires ever-increasing levels of research to provide seed ideas and concepts, thereby providing

the basis for the realization and development of systems that can provide the desired performance. The DOD is a mission agency and, as such, it provides support only for technical disciplines that are considered to be fundamental and supportive of the mission. In general, there are 12 technical areas that are appropriate for research support by DOD research offices. The 12 areas are tabulated here.

- *Physics*
- *Chemistry*
- *Mathematics*
- *Computer Sciences*
- *Electronics*
- *Materials Science*
- *Mechanics*
- *Terrestrial Science*
- *Ocean Science*
- *Atmospheric and Space Sciences*
- *Biological Science*
- *Cognitive and Neural Sciences*

These areas consist predominately of engineering disciplines, computer and information sciences, and physical sciences, including materials science and engineering. Mathematics research is also supported to a significant extent. The department also provides some, although in general limited, support in the social sciences, medical research, and life sciences. Research support in the latter disciplines is directed towards research consistent with the DOD mission, and this research does not significantly overlap or compete with research in these areas supported by the NIH or NSF. A significant strategic planning process is employed by the DOD, and agency priorities are continually being revised in accordance with emerging threats and scientific opportunities. Currently, seven priority areas for DOD-wide research and development have been identified. These seven priorities are Autonomy, Countering Weapons of Mass Destruction, Cyber Sciences, Data-to-data Decisions, Electronic Warfare, Engineered Resilient Systems, and Human Systems. These priority areas are subject to review and redefinition on a periodic basis. Each service and DOD agency also identifies their specific priorities and interest areas, and periodically they will identify specific focused research opportunities, sometimes identified as Grand Challenges (e.g., ONR's Basic Research Challenges, and AFOSR's Discovery Challenge Thrusts).

Although the DOD's budget for academic research in science and technology is relatively small compared with the budgets for the NIH and NSF, as indicated in Fig. 5.6, the DOD is, in fact, the major source of research funding in the disciplines in which they have priority interests, and therefore invest significant funds. For example, while the DOD provides only about 6% of the total funding for academic research in all disciplines, the department provides slightly under 30% of the research funding in engineering disciplines, around 20% of the research funding in computer science, and slightly under 20% of the research funding in mathematics. The DOD also provides significant funding for academic research in physical sciences and environmental sciences, providing slightly over 10% of the total funding for both disciplines. In certain disciplines, the DOD is the major source of research funding, providing almost 90% of the academic research funding for mechanical engineering, over 60% of the research funding for electrical engineering, and about a third of the research funding in metallurgy and materials science. The DOD's support for academic research derives primarily from the basic research (i.e., the 6.1) account, and the DOD provides about a half of their basic research funds for support of academic research. The department also provides about 15% of the applied research (6.2) funds, and slightly under 10% of the advanced development (6.3) funds for academic research. However, the majority of the applied research and advanced development (6.2 and 6.3) funds are provided to University Affiliated Research Centers (UARCs) and other specialized university research organizations that are structured to directly address and accommodate DOD security and other requirements. In general, these funds are not available to the wider academic research community.

The DOD is organized to interact and work with college and university researchers, and it hosts a variety of research offices that work extensively with the academic research community. Each of the three military services sponsors a research office that supports research programs within the academic community. The three service research offices are the Army Research Office (ARO), the Office of Naval Research (ONR), and the Air Force Office of Scientific Research (AFOSR). Collectively,

the three offices are call the OXRs, where the X refers to the service and the O stands for Office and the R stands for Research. ARO is located in Durham, NC, and ONR and AFOSR are located in the Ballston area, in Arlington, VA, across the Potomac River from Washington, DC. In general, ARO and AFOSR manage basic research (6.1) funds, while ONR manages the science and technology and advanced development (6.1, 6.2, and 6.3) funds for the Navy. Academic research is also supported by the Defense Advanced Research Projects Agency (DARPA), the Defense Threat Reduction Agency (DTRA), and the Defense Medical Research and Development Program (DMRDP), and sometimes other DOD organizations. The main mechanism for DOD basic research funding to academic organizations is a grant, primarily through one of the OXRs, DARPA, or DTRA. However, the DOD also supports a significant number of applied research and advanced development (6.2 and 6.3) projects, primarily through the services in-house research laboratories (i.e., the Army Research Laboratory (ARL), the Naval Research Laboratory (NRL), and the Air Force Research Laboratory (AFRL)), but also through DARPA, DTRA, and the Missile Defense Agency (MDA). Sponsored research from these organizations will generally be provided in the form of a contract, and quite often will involve partnerships with industrial collaborators and colleagues.

The best places to begin your exploration of DOD agency and office research interests and priorities and the opportunities for research support are the various office websites. Since the DOD is large and complex, there are many locations to explore. The primary websites are as follows.

Army Research Office:	http://www.arl.army.mil/aro
Air Force Office of Scientific Research:	http://www.afosr.af.mil
Office of Naval Research:	http://www.onr.navy.mil
Defense Advanced Research Projects Agency:	http://www.darpa.mil
Defense Threat Reduction Agency:	http://www.dtra.mil
Missile Defense Agency:	http://www.mda.mil
Defense Medical R&D Program:	http://www.dmrdp.dhhq.health.mil

6.3.4 The Department of Energy (DOE)

The Department of Energy (DOE) supports basic research and provides research grants to academic institutions and industries, primarily through the DOE Office of Basic Energy Sciences (BES). About 40% of the BES budget provided to external organizations is allocated to academic researchers. As a mission agency, the DOE, through BES, is interested in sponsoring research directed towards building understanding, and establishing foundations associated with energy, the environment, and national security. The BES program is a major sponsor of basic research in the natural sciences, primarily condensed matter and materials physics, chemistry, geosciences, and aspects of physical biosciences. The DOE BES focuses research support into disciplines that are directed towards advancing discoveries in new materials, new chemical processes, research related to all areas that involve energy resources, including production, conversion, waste mitigation, transmission, storage, and efficiency. BES is interested in basic and fundamental research directed towards understanding, predicting, and ultimately controlling matter and energy at the electronic, atomic, and molecular levels in an effort to establish the foundations for new energy technologies. The BES program also provides support for large-scale, scientific user facilities at various locations. These facilities house instrumentation and experimental measurement equipment for the purposes of imaging, materials analyses and characterization, and understanding chemical transformation. Materials that can be characterized include a wide range of substances, extending from metals, metal alloys, and ceramics, to biological samples. Characterization instrumentation permits research on both the microscopic and macroscopic levels to be conducted. Nanoscience and nanotechnology research are also focus areas for BES research, and significant support is provided for projects in these areas. The overall goal of research sponsored and supported by BES is to provide a base of knowledge that will permit the understanding and establishment of the scientific basis necessary to design technologies that can adapt to the natural world and secure a sustainable energy future for the nation and the world.

In order to maintain an energy focus to the BES basic research program, BES establishes distinct Core Research Activities (CRAs), which define the scientific disciplines that address the scientific and engineering base for the various energy technologies. The CRAs are structured as scientific disciplines, rather than technology areas, and are designed to align with the BES organization.

The Advanced Research Projects Agency-Energy (ARPA-E) provides funding for applied research and development projects, but does not provide support for basic research projects. Nonetheless, many of the applied research projects are appropriate for academic research and their funding opportunity announcements should be monitored for possible response.

The primary websites for DOE sponsored research opportunities are as follows.

http://science.energy.gov/bes/
http://arpa-e.energy.gov

6.3.5 The National Aeronautical and Space Administration (NASA)

NASA provides support for a wide range of science and engineering basic and applied research topic areas associated with the NASA mission, which is: "To pioneer the future in space exploration, scientific discovery, and aeronautics research." NASA directs their external research support to projects that contribute to its space or airborne assets, which could include making use of the assets, or research that is directed towards making use of the data derived from the assets. The NASA research program is organized around four mission-oriented directorates, each with their own research interests. The four directorates are: (1) the Aeronautics Research Directorate (ARMD), (2) the Human Exploration and Operations Directorate (HEO), (3) the Science Mission Directorate (SMD), and (4) the Space Technology Mission Directorate (STMD). ARMD is interested in research directed towards determining solutions to challenges that exist in the nation's air transportation system, including air traffic congestion, safety, and environmental impacts. Research

interests include topics focused upon green aviation technologies that will enable fuel-efficient flight operations, along with reduced emissions and noise. Research directed towards new aircraft technologies, including systems-level research on the integration of new operations concepts, is supported under the ARMD program. The HEO program is focused upon research and development (R&D) activities directed towards advancing human and robotic space exploration. Directorate interests include human exploration in and beyond low-Earth orbit. Exploration activities beyond low-Earth orbit cover a range of technologies associated with commercial space transportation, exploration systems development, human space flight capabilities, advanced exploration systems, and space life sciences and applications. The HEO Directorate is also responsible for issues associated with launch services, space transportation, and space communications in support of both human and robotic exploration. The Science Mission Directorate (SMD) has interests in research programs directed towards providing the science basis for a mission, defining technologies and techniques necessary to actually execute a mission, establishing technologies and techniques for gathering, calibrating, validating, and analyzing data during a mission, and analyzing and archiving data gathered during missions for later analysis. The overall goal of the SMD programs is to make use of the vantage point of space and provide the science community with the platform and tools to investigate and increase understanding of our planet, other planets, solar system bodies, the interplanetary environment, the sun and its effects upon the solar system, and the greater universe. The STMD programs are directed towards crosscutting, pioneering, and new technologies and capabilities needed to achieve current and future missions. A wide variety of disciplines are involved in this effort, with the goal of maturing and advancing technology required for space exploration missions. Many of the technology advances find use in other government agencies and commercial space activities.

NASA research opportunities for university-based research are announced periodically by means of NASA Research Announcements (NRAs). The NRAs are published on the NASA website, NSPIRES,

which lists the NRAs, as well as other information associated with proposal submission. The NRAs are, of course, also listed on the Grants.gov website.

The primary websites for NASA sponsored research are as follows.

http://nspires.nasaprs.com/external/
http://science.nasa.gov/researchers/sara/how-to-guide/

The NSPIRES website contains links to each of the mission directorate's websites, where more information concerning each directorate can be found. The NASA Science for Researchers website (the second website listed) contains useful information concerning proposal submission requirements and procedures.

6.4 How Do I Identify and Make Contact with a Program Manager or Program Director Appropriate for my Research Interests?

In this section we'll address some common questions often expressed by young and new faculty members recently recruited to an academic faculty position.

Question 1: I'm a new PhD graduate in electrical engineering, and I've just accepted a faculty position as an Assistant Professor. My department head has informed me that he expects me to write proposals to obtain research funding to support my research and my students (that I need to recruit). He's assigned me a light teaching load for the first year and provided me with some start-up funds. However, the amount of the start-up funds is limited and not sufficient to fully fund my research activities. I really need to get a research grant in place as soon as possible. Where do I start?

Answer 1: Your question is very appropriate, and you are in a position similar to that of a large number of new faculty members in the initial stages of their academic careers. Success in your new career depends very much upon how you approach this process. The answer has several dimensions. First, you need to determine your research topic.

This may appear simple, and your first impulse is, most likely, to continue your thesis research since this is the area in which you have the most experience and the most complete knowledge base. You've most likely published some of your work in peer-reviewed technical publications, and may have given papers on your research at professional meetings and conferences. You may have even received significant professional recognition for your research, either from your university, or from professional societies, funding agencies, etc. It may be very tempting to continue on the same work. However, upon reflection, your thesis research may not be the best work upon which you wish to build your career. For example, your research thesis topic may have been simply assigned to you by your mentor, and you may actually not have a major interest in continuing to pursue the topic and would prefer to work in an area you find more interesting. Also, you may sense or be aware that your thesis research topic, which was once a very good and intriguing idea, has not experienced significant and positive progress, and the topic is losing interest within the professional scientific and engineering community. Over the course of my career I have witnessed numerous scientific and engineering ideas and approaches emerge, usually accompanied with much fanfare, enthusiasm, and significant research effort and financial support, only to find that the early optimism and enthusiasm were significantly overestimated and overstated, and, after several years of intense research, positive research progress was limited, and interest subsequently waned.

Many of these less-than-successful research topics were, for a while, the dominant topic within certain disciplines, complete with "special sessions" at technical conferences, research panel discussions, meetings, journal articles, technical books published, etc., and, of course, supported with significant financial support from funding agencies. However, without positive progress being achieved, interests shift to other topics. When this occurs, funding agencies shift their support to other topics and alternative approaches. Also, when significant progress is not achieved and interest wanes, the researchers who had focused much of their effort

on these research topics do not simply go away with the topic, but rather they refocus their research interests to alternative approaches, or to entirely new research areas. Researchers almost always will follow the money, and shift their research activities to areas that are experiencing a growth in research funding. In one respect, these researchers are in a better position for their next research challenge since all research is a learning experience, and the knowledge gained in the process of researching a topic almost always proves of value in subsequent research efforts.

Another potential reason that your thesis research may not be the best place to concentrate your research activities relates to the level of development of your thesis research topic. Research is a very dynamic process, with topics continually emerging, undergoing intense research effort and, if the research is successful, the topic may mature and transition to advanced development and practical applications. If your thesis research is in this category, and undergoing a transition from basic to applied research, you should consider your position in the field. That is, you need to assess the status of your research and seriously consider what you can contribute to future advances in the field. The correct decision for you may be difficult to determine, but will be related to how you assess your status in the field and how you view the future. For example, in your new position as an Assistant Professor, will you have the research facilities necessary to continue to make advances in the area? If the research area has demonstrated significant progress and has developed to the point where practical applications are beginning to emerge, it is likely that industrial or commercial interests have developed. There may even be new start-up companies appearing with interests and products based upon the topic related to your thesis research.

This situation, which is actually fairly common, can be a two-edged sword with both positive and negative aspects. A negative aspect is that you may find yourself in an area with a growing number of contributors and locations performing related work. A good idea tends to spread rapidly, with many other scientists and engineers quickly shifting their efforts to related work. You may find yourself in competition with scientists and engineers working in much better equipped industrial

laboratories. In this case you may find your knowledge base quickly aging as the research in the field rapidly progresses and expands. A positive aspect of the process is that your thesis research has, most likely, provided you with state-of-the-art and detailed knowledge that positions you as an expert in the field. You may have been one of the first researchers to make contributions in the field. Your knowledge of the subject could make you a very attractive collaborator with the industrial scientists and engineers working on the subject. Such collaboration often serves as an excellent source of funding for your continued research efforts, as well as providing exposure and access to well-equipped industrial laboratories and facilities that may not be readily available to you at your university location. You may find that your ability to advance the field is greatly enhanced by the industrial augmentation. I have worked extensively with industrial researchers throughout my career, and I have found that my research was significantly enhanced by the collaboration. Not only have I received significant financial support from this type of collaboration but, more importantly, I was exposed to many real-world problems encountered in the field that served as the focus of my research and kept the work at the state-of-the-art. The industrial collaboration provided me with research data that would have been either difficult to gather or not available from the university laboratory resources at my disposal. In my experience, industrial scientists and engineers value collaborating with academic researchers, both for the research advances, and also for access to students that often result in future employees for their organization.

Recognition of the status of your research can be very difficult to determine and requires maturity on your part, a maturity that will improve as you continue in your career advancement. Nonetheless, you need to question the status of your research topic and determine if you wish to continue on your current research course, or if you need to build upon what you have already achieved, but move in new directions. Most faculty members find that their research performed as a graduate student prepared them for a career in research, but that the subject of their subsequent research differed from their thesis research, and often by significant deviations. How you assess your situation is very important since it will

dictate the topic of your research proposal, as well as focus your efforts upon the organization you wish to pursue for financial support.

Question 2: OK, I've evaluated the area in which I perform research, I've spent a fair amount of time assessing my research and the results I obtained, as well as my status in the field, and I've determined the research topic I would like to pursue. After reviewing my own research, as well as that reported by others, I have identified a very promising topic, which is related to, but takes a new direction from my thesis research. I have a great idea for what I think is a very good research proposal, and I even have some results and data that are supportive of my idea. I've started to survey potential funding agencies, and I've searched the agency websites, found one with research grant programs that are in my interest area, and even identified a program manager who supports research similar to my own. I've even tried to contact him, both by email and by phone, with no success, and I haven't been able to get a response. What am I doing wrong? And where do I go from here?

Answer 2: You aren't doing anything wrong. In fact, you're doing exactly what you should be doing, and you are following a good approach. Quite often the program manager or program director will immediately respond to your attempts to contact them, but other times you may have delays in getting them to respond, and sometimes they won't respond at all. You need to keep in mind that program managers and program directors are very popular people with those wishing to acquire research support, as well as very busy people with their jobs and professional commitments and, at times, can be difficult to contact and get to respond. Basically, you need to develop stamina and perseverance, and keep trying. Generally, their failure to immediately respond to you, when this occurs, is more based upon their work commitments than any desire to not communicate with you. For the mission agencies in particular, personal contact with program managers is extremely important for success in obtaining grant funding. Keep in mind that their job requires them to stay at the forefront of the state-of-the-art in their technical discipline, and if you have interesting

results and a new approach to a specific problem, and particularly when your approach is supported with experimental data and/or other supporting evidence, they most definitely want to learn what you are doing. Also, it is useful to recognize that program managers are always on the lookout for new and promising scientific and technical talent who can bring a new and fresh perspective and approach to challenging problems. Also, funding agencies have a variety of special awards for new and young investigators. These awards are separate from their regular core program and they receive credit in their performance evaluations when one of their researchers is recognized with one of these awards. Since you are potentially a candidate for one of these awards, they have a natural desire and willingness to meet you and learn your ideas and approaches to challenging problems.

However, the impetus for establishing the first contact with a program manager is your responsibility, and until you actually make contact with them and establish a dialogue with them, they won't know what you have to offer. For this reason, you need to be very persistent in your efforts to communicate with them. If sending them an email doesn't result in a reply within a reasonable length of time, which could be on the order of a few days or a week, you should try to contact them directly by telephone. You can either get their phone number from the agency website, or call the office in which they work. The agency telephone operator or division secretary will either connect you with them, if they happen to be in their office, or will take a message and make sure it is delivered to them. When you make contact on the telephone with them, you should keep your discussion very brief and for the purpose of establishing personal contact. It is highly unlikely that a phone call alone, especially an initial phone call, will prove sufficient to gain their interest to the degree that they will welcome a proposal. Rather, your efforts should be directed towards providing a very brief overview of the research you wish to pursue and to determine their interests. Your main objective is to find a basis of common interests and to learn how you can fit into their program. This will not be possible on a first, brief telephone call, but you should be able to confirm that you have identified the correct person for your interests.

If not, you should question the program manager concerning which program manager is a better match for your research interests.

The funds that any program manager has available for new grants are very limited and they will only provide financial support for research that is directed towards problems in which they have interests. The good news for you is that the program managers are always receptive to new approaches that show potential for making advances in the areas that support their goals and objectives. Your job is to learn what goals and objectives are being pursued by the program manager. Therefore, the initial telephone call should be directed towards briefly introducing yourself and giving a brief (short) overview of your research, with emphasis upon your new and novel approach, and starting a discussion with them on their program and the research that is currently being supported. You want to learn the scientific and technical interests of the program manager, and attempt to learn the overall goals of their research interests and support. If your initial telephone call is productive, there may be opportunity for follow-up calls, or preferably, a personal visit. In fact, as a priority, the next step for you is to attempt to make an appointment with them for a personal visit. This step is extremely important as a means to establishing communication with program managers in mission agencies. This will require some travel on your part, along with the associated travel expenses. Hopefully, your department will provide the necessary travel support, or include travel support for funding agency visits in your start-up package, as discussed in Chapter 3.

Once you schedule a personal visit with the program manager you will, most likely, be limited to a half hour, or so. This meeting will be very important so you'll need to be very organized and effective with the limited time you'll most likely have. You should prepare a very brief overview of your research, preferably using a very limited number of viewgraphs or slides. In my experience, faculty members generally have slides prepared using PowerPoint on a laptop computer. The presentation does not need to be formal or rehearsed. In fact, it's better not to be too formal, since a main objective is to get the program manager engaged in your work and to pique their interest. You want them to ask questions. Since time is limited you should focus upon the main topic of your

research, what approach you are following, what results you have obtained to date, and the direction you wish to pursue. All of this should be presented in no more than four or five slides. This generally will take some planning effort on your part since it's more difficult to give a short presentation than it is to give a longer and more detailed presentation. New and young faculty members, in particular, often have difficulty in giving short presentations since they want to present details. However, for the purpose of building communication with program managers, the focus should be on general approach and trends, and overall goals. Details will detract from what you are presenting, since it opens the discussion to issues that require more time, generally more than you will have at the meeting. Scientific and technical details are better left to future discussions, hopefully in the process of securing a research grant. Of course, if the program manager requests detailed information, you should be prepared to offer explanations, details, published results, etc. If you have published papers on the subject or closely related subjects, you should bring copies of the publication that you can leave with the program manager. Also, during the meeting and after the technical discussion, you should inquire about funding opportunities. You'll generally receive a general and noncommittal response, but you'll have broken the ice and planted some ideas for future discussion. Following the meeting, you should wait a few days and then follow up with the program manager and seek to determine the interest in your research, whether it is consistent with the program manager's overall goals, and how you might modify what you are pursuing so that it is more consistent with the program manager's objectives. This process may take some time, but if done properly, can lead to good success.

Question 3: Are there other techniques or methods for making contact with a program manager or program director besides telephone calls and email? What do I do if I can't reach them by telephone and if they don't answer my email messages to them? They don't yet know me, so how can I meet them?

Answer 3: This is another very good question, and this situation does occur, sometimes (and unfortunately) much more often than it should.

The answer is that it is very possible to make contact with the program manager to whom you would like to communicate. However, the process may require some time, and much more effort than a simple telephone call or email.

You've already determined that the program manager has research interests similar to your own. You can use this as an advantage. First, you'll need to travel, which, as previously discussed, will require support from your home institution. Of course, you can schedule visits to the program manager's office. But often it's more effective and convenient to meet program managers at technical conferences, meetings, and reviews. You're going to want to attend many of these meetings since it's one of the best methods to stay current in your technical specialty. It's at these meetings where the most current state-of-the-art results and developments are presented and discussed. Program managers will also attend these meetings, and for the same reason. Therefore, there is a good chance that you'll have the opportunity to meet an appropriate program manager by introducing yourself during a coffee break or other pause in the presentations. You'll often find small groups of meeting attendees talking in the halls, including researchers and program managers. Meeting attendees always wear name badges with their name and organization clearly displayed, making identification an easy process. In fact, meeting organizers always schedule breaks in the formal presentations explicitly for the purpose of attendees having an opportunity to meet each other and discuss mutual interests. In my own experience I've met many people, both researchers and program managers, by exactly this process. Over time you'll find your circle of contacts increases, and you'll meet many people that will become colleagues with whom you'll maintain communication, sometimes extending over many years. Networking of this type is common and widespread and is a primary method both of making new contacts, as well as maintaining previous contacts. Attendance at appropriate technical and professional meetings will be an important part of your professional development.

Participation in appropriate professional and technical conferences, meetings, and reviews as an attendee is the first step, but you'll also

want to attend these meetings to present the results of your work. As your research progresses, you should make every attempt to submit your work for review and inclusion in the meeting proceedings. This permits you the opportunity to stand before an audience of your technical peers, including program managers, and present the results of your work. If your work is closely related to the interests of the program manager, it is likely that they'll be in the audience. After the meeting you can also take the opportunity to send a copy of your paper directly to the program manager. As a program manager I've received many copies of papers and research reports from numerous researchers, sometimes on a fairly regular basis. There is a fairly large group of researchers who regularly send their papers and research reports to a distribution list of program managers. This process can be effective because even if the program manager doesn't read everything sent to him or her, he will at least read the title and names on the work, and if the title is of interest, he will read the abstract, and if that is interesting, he'll read the entire work. Also, simply receiving the paper and reading the title and author will get the author's name in the program manager's mind. Your subsequent attempts to communicate with the program manager will, likely, be more effective.

While participation in professional conferences, meetings, and program reviews, both as a participant and presenter, is extremely important, you should also volunteer to participate in the planning and organization of these meetings. Becoming involved in these activities is actually quite easy since the planning, organization, and management of these meetings requires a fair amount of effort, and the majority of the effort is performed by volunteers. The organizers are always looking for new volunteers. The conference organizers and their positions are always listed on the meeting announcement and schedule, both the print version and the electronic website version. You should contact them, identify yourself and your credentials, and volunteer your services.

Question 4: I've had a personal meeting with a program manager, I gave them a short presentation on my research, and had a very interesting discussion on future directions. The program manager seemed very

interested in my work, which I consider to be very encouraging. However, he then gave me the bad news, and indicated that his core research budget is very limited and he is currently over-extended. He stated that it would be very difficult to fund me at the present time. But then he asked me to submit a "white paper," and mentioned that there was a possibility for "year-end money." What's a "white paper" and what is "year-end money"?

Answer 4: Congratulations! You've made excellent progress. You appear to have made a good impression and presented ideas of interest to the program manager. You are on your way to establishing a good basis for future discussions and communication with the program manager. The program manager's response to you is very encouraging, and you need to focus upon responding with the requested information as a high-priority action on your part. First, let me explain the concept of a "white paper," and then I'll address "year-end money."

6.4.1 White Papers

The program manager has expressed interest in your research and has asked for you to prepare and send him a "white paper." The white paper is a document that gives you an opportunity to provide the program manager more detailed information on your research in a concise and simple way. The white paper does not have a formal format and is fairly easy to prepare. However, since it is a written document, it serves as an excellent follow-up to discussions, and it provides an effective means to keep your name and ideas readily available to the program manager. White paper submissions are becoming more popular and common for funding agencies since they offer enhanced flexibility in research program planning. It is also becoming more common for white paper submission to be requested in the funding agency BAAs and research program opportunity announcements, solicitations, etc. Use of white papers saves much work by both the proposer and the program manager since they are generally brief and don't require significant time to either write or to evaluate. In addition, the white paper is not an official proposal and does not require formal action by your home institution or the government agency.

It's simply a document that outlines, in a brief manner, usually five pages or less, your thoughts, ideas, and proposed research. The white paper does not require any official action by the government agency, and after submission you may or may not receive a response from the program manager, sometimes for extended periods of time, and sometimes not at all. However, the white paper may provide information that is of significant interest to the program manager, and this information may permit the program manager to plan his research program, with the positive result that he contacts you with a request for a formal proposal. You should carefully prepare the white paper and send it, as requested, to the program manager. I emphasize that the white paper should be brief, and certainly fewer than five pages. One- or two-page white papers are generally adequate.

There is a more formal white paper procedure often employed by funding agencies. When white papers are requested in published BAAs or research opportunity announcements, particularly for specific topics with defined funding, the white paper is often used to determine agency interest in your research and if it is appropriate for the announced research opportunity. Under these conditions your white paper will be evaluated and you will receive a response from the agency, generally by a defined date. The response will either encourage or discourage a formal proposal submission. If the response discourages a formal proposal submission, you may receive or you may request a debriefing explaining the reasons for the agency response. The white paper procedure is intended to discourage the time and effort required to prepare the submission of proposals that have little chance for success, and to limit the grant competition to the proposals that best address the research program objectives. This type of formal white paper process is often used for larger research opportunity programs, such as research centers, where significant time and effort is required to both prepare and evaluate long and detailed proposals, or for specific research opportunities addressing specific topics.

The BAA or research opportunity announcement may request that a white paper have a defined format, and request specific information be addressed that is generally explained in the BAA or research opportunity

announcement. When specific information is requested, care should be taken to address all questions and issues discussed in the BAA and include the appropriate responses to all information requested. The responses and the details of how this information is addressed by the principal investigator is considered by the evaluators, and the responses included in the white paper are primary factors in making the decision regarding whether a full proposal will be encouraged or discouraged. Typically, the BAA or solicitation will define the length of the white paper, and will request a white paper on the order of 10 to 15 pages in length, and sometimes no longer than two to five pages. No matter the length of the white paper, it should be carefully prepared with attention to the details requested in the BAA or announcement. When white papers are specifically requested in the BAA or announcement, they may need to be submitted through the official university sponsored research office, depending upon the grant proposal submission policies of your university. However, the white paper is still not an official legal document. If you receive a discouragement, the discouragement is not legally binding, and a proposal can still be submitted and will be considered and evaluated by the funding agency. However, a proposal submitted after receiving a discouragement should be significantly modified from the white paper and should address the weaknesses and inadequacies that resulted in the white paper receiving a discouragement decision.

6.4.2 Year-End Money

The concept of "year-end money" refers to a mechanism that program managers, particularly those in DOD agencies and offices, often use to initiate new grants in which they have interest, but don't have sufficient funds available in their core program. The term "core" refers to the funds that they are allocated to support their main research interests, which are determined in the office or agency budget by means of the agency strategic planning process. The "year-end money" mechanism provides them an opportunity to provide "seed" type funding for new and novel approaches that they feel aren't sufficiently defined or developed for

a regular grant award. The concept of "year-end money" refers to the internal budget process for the funding agency and how they provide for incremental funding requirements. United States government agencies have funding only as a result of Congress passing an appropriations bill for each agency, and the President signing the bill to turn it into a law. Once the appropriations law is passed, the agency is then authorized to execute their budgeted funds. The budgeting process is performed on an annual basis, and the appropriations law provides funds to each agency on a fiscal year basis, which for the US government extends from October 1 of each year, to the end of September of the following year. The typical duration for a standard research grant is generally three years, although the time period will vary somewhat from agency to agency. However, due to the annual US government budgeting process, the funding agency program managers will have funds available only for the fiscal year in which an appropriations law exists, and a new law is required to provide the funds to support subsequent years in the multi-year grant period. This, of course, means that additional year funding for the grant will be available only if a new appropriations law is passed. Program managers must, therefore, be good financial managers and provide the increments to the various research grants they support on a timely basis.

Since most new awards will initiate on a date that does not correspond to the start of the fiscal year, and since some awards that are terminating will end on a date during the fiscal year, the amount of funds available does not necessarily match the amount of grant funds commitments that exist. Program managers will provide the funding increments to the grants supported in their program, according to the budget schedule defined in the proposal. These increments are provided on a priority basis, and any remaining funds are used to provide the funds for new grants that are being initiated. This process proceeds throughout the fiscal year, in response to the available funding. It is not uncommon as the end of a fiscal year approaches for a program manager to have a limited amount of funding available that has not been committed. Since the remaining funds need to be spent before the end of the fiscal year, the

opportunity exists to provide funds to start a new grant. This is the source of the "year-end funds."

Generally, when a program manager decides to provide some of the remaining funds to a new principal investigator using the remaining year-end funds, the amount of funding that will be provided will be limited, and a grant for only a year or less in length will be awarded. The restriction to the one-year or less grant duration does not increase the program manager's commitment to providing future funds, and does not result in an over-extension of their budget. However, the one-year period permits the program manager to provide some "seed" funds in order for the new principal investigator to work on the research idea and further develop the concept or idea. The additional information can, if successful results are obtained, be used to support the preparation of a more complete proposal that can be submitted for consideration as a regular grant. The use of year-end funds is particularly attractive for program managers to provide seed funds to new principal investigators or to those who are changing research directions. Program managers make use of this mechanism only at the end of the fiscal year and, of course, only if remaining funds are available. Nonetheless, the mechanism is an attractive option to initiate new projects, and particularly those that are considered high risk, but potentially high payoff, in terms of the approach. Many program managers will use the year-end funds mechanism to support young and new principal investigators for short periods for the purpose of giving them an opportunity to demonstrate their research potential, and in fact, many of these year-end funds grants develop into regular grants in subsequent years.

Question 5: I submitted a white paper to the program manager. He read it and contacted me with a very encouraging response, and asked me to submit a formal proposal. However, before preparing and submitting the proposal, I'd like to know a little concerning how my proposal will be reviewed. I think this information will help me prepare the proposal. Can you provide a little background concerning proposal review procedures and considerations? Also, is there a difference

between agencies relative to what they want to see in a proposal? I'd appreciate any comments you can offer.

Answer 5: I'll address, in detail, the information program managers expect to see included in your proposal in Chapter 7. The information will vary somewhat, depending upon the funding agency, and there are requirements that need to be addressed. However, before addressing the specific issues associated with preparing a proposal, it's useful to understand some general issues regarding how your proposal will be evaluated and reviewed. The process does differ by funding agency and it's useful to understand the differences before preparing your proposal. Also, the differences in the mechanisms used by various government funding agencies to provide grant funding are useful to understand. These two issues are discussed in the following sections.

6.5 Proposal Evaluation Considerations

United States government agencies, in general, base their proposal evaluations upon "peer review," which means that each research proposal they receive will be evaluated and reviewed by PhD-level scientists or engineers, or those with equivalent experience, with expertise in the technical area of the proposal. The peer reviewers will have expertise in the subject of your proposal, although they may not necessarily be active researchers. However, they will know the subject and be familiar with current research trends and developments in the area. Essentially all US government agencies manage and operate their research offices under the peer review principle, although for certain mission agencies, the actual peer reviewer may be the program manager who receives the proposal. Three to five experts, normally, evaluate each proposal. The experts will consist of scientists and engineers from within US government organizations, universities, and industrial organizations. Generally, for mission agencies the proposals are sent to the reviewers for evaluation, and the reviewers will perform the review at their home institutions. They will submit the reviews to the program manager who is

managing the process. Many funding agencies have web-based systems for proposal review and evaluation. The program manager in the mission agencies, who as a PhD-level scientist is considered a peer, may be one of the reviewers, and will almost certainly read your proposal whether or not they actually perform a formal review. The reviewers do not normally meet as a group. The program manager will read the evaluators' comments, consider all reviews, and then make the decision regarding the acceptance or declination of the proposal. In this regard, the program manager has a very significant role.

For certain research program opportunities that are published as a specific Call for Proposals, the process is slightly different. In this case the proposals are received in response to the published solicitation. The proposals will be collected and organized according to the program definition, and organized by topics. The proposals will be evaluated by panels of experts that can consist of experts from US government organizations, universities, and industry. The US government program managers associated with the particular solicitation will then meet and decide which proposals are selected for acceptance.

The point here is that the program managers in mission agencies are all trying to accomplish a well-defined scientific or engineering advance. In order to accomplish their goal, they need a variety of scientific and engineering "building blocks" that all fit together into a complex web of interrelated scientific and engineering disciplines. The program managers know what areas and subjects they want to acquire for their programs. They also know who is doing what and at which institutions, both academic and industrial, and who is performing the best work in which they have interest. They generally have already provided, and are currently providing, funding support for various research topics and subjects to a variety of researchers, and consider these researchers to be fundamental to their interests. Each of the researchers in their program are essentially serving as "building blocks" for their overall goals and are helping to realize what the program managers are attempting to accomplish. The overall program strategy can consist of a wide variety of end goals, ranging from a scientific advance in a given theory, material, device or component, to realization of an advanced system. The overall

goal can be narrow in scope or very large, involving multiple program managers in multiple offices and even across agencies.

The important point for you to recognize is, if you wish to obtain funding from any of the mission agencies, you are going to need to learn the specific interests of the program managers, what they need to accomplish their overall goal, and how you can "fit" into their program. You'll need to identify the program manager most appropriate for your research. Your research area may be an excellent fit to the program manager you are contacting. However, after communicating with the program manager you may find that you need to "tune" and modify your research objectives slightly and refocus your research to areas of interest to the program manager. Basically, you want to become one of the "building blocks" in the program manager's research program. Once this is accomplished, you'll find that the program manager will, most likely, become a strong supporter of your research, particularly if it's successful, and you'll be well on your way to establishing an effective and productive enduring collaboration. Once you become an integral part of a program manager's program you'll find that they may become a supporter of your research work and will make every attempt to keep you funded to work on topics that are important to his or her objectives. Program managers have a variety of options to obtain funding from within various offices both within and outside their home agency. It's common practice for program managers to seek research funds from other internal government sources to support and augment their core activities. Most program managers actually manage a portfolio much larger than their core program, supported with funds they solicit and receive from their colleagues in other US government offices, laboratories, and field operations.

The program directors at the NSF have similar objectives, but function in a slightly different manner. The divisions in the various directorates at the NSF are organized according to technical area, with a program director in charge of each specific area. The technical areas are often fairly diverse and can include certain topics that only generally relate to each other. The reason for this is that the NSF accepts proposals from the entire academic community on virtually any scientific, technical, or

educational research subject, as long as it can be related to the interest areas associated with each division. This opens the proposal topics to a wide range of scientific and technical subjects. Once the proposals are received, the program directors will organize them into groups of similar and, hopefully, related topics. If a program director is assigned a proposal that doesn't fit well into the group of proposals they are managing, they will trade or transfer the proposal to another program director who will accept the proposal for review if the topic is appropriate for the subjects in their technical portfolio. Proposals that are not accepted by a program director will, most likely, have a low probability for success and generally will be declined. For this reason, it is important to make sure your proposal is submitted to a program with interests and goals consistent with that program.

At the NSF proposals are organized into groups based upon similar topic and subject matter, and then assigned to a panel for review and evaluation. The review panels consist of experts from organizations outside the NSF, generally universities, but also from industry, and other government organizations. The expert review panel members are selected by the program director from a database of qualified reviewers, and sometimes from their professional colleagues and contacts. The review process is a true "peer review," since the reviewers are all research level scientists and engineers. The role of the program director is primarily administrative, and focused upon the management of the review panel, and to ensure that each proposal is fairly and equitably reviewed and evaluated. However, the program director generally does not review and evaluate the proposal personally. Nor do they generally enter, in any significant detail, into the proposal evaluation discussions within the panel. This, of course, varies with the program directors, and some will actively participate in the discussions, although their main function is to lead the review and evaluation discussions. The panel members will discuss the details of the research and the research performance plan contained in the proposal, and will rank the proposals according to metrics such as overall quality, importance of the research topic, outreach plans, adequacy of budget, etc., and place the proposals into categories of: (1) recommend for acceptance and funding; (2) recommend

for acceptance if funding is available; and (3) decline and do not fund. The program director will then determine the number of proposals and which ones will be recommended for acceptance and funding. The actual decision on which proposals are funded is the responsibility of the division director, who is responsible for managing the division budget. The division director will either concur with the recommendation of the program director, or return the proposal to the program director for modification of the recommendation, or declination.

The main difference between the goals of the mission agency program managers and the NSF program directors is that the NSF program directors are simply looking for the best quality proposals to support. They are not necessarily looking to construct a well-defined and coordinated program focused upon a specific end result goal. They do not necessarily consider individual research programs as "building blocks" that relate and coordinate in an orchestrated manner. Rather, they attempt to find and support the most novel approaches to basic research in areas of science, engineering, and education research in their discipline. The mission agency program managers are focused upon achieving advances in a specific topic or area and are interested in constructing an overall research program that involves research advances from multiple performers. For this reason, they are not necessarily interested in funding the highest-quality proposal, particularly if the proposal subject is not in an area that is important to their overall goals and objectives. All program managers and program directors, of course, seek to identify and support the highest-quality research work and to accept the highest-quality proposals within their specialty areas.

6.6 Research Grants Basics: Standard Grants, Follow-Up Grants, and Incremental Funding

The basic research grant is termed a "Standard Grant," and is funded for a specific performance period of time, generally three years, although the actual performance period can vary. Once you receive your first funded grant from a program manager and perform successfully and produce meaningful results, you'll be in a good position to receive a renewal for

your grant, or a follow-on grant for additional research. Mission agency grants, in contrast to those from the NSF, can be renewed for an additional period of time, and multiple extensions are also possible. Once successful relationships with program managers have been established, you may work with the same program manager over a sustained period of time that can extend over many grants and many years. For example, I've known researchers who have been supported by the same program manager with grant funding over a period extending over a decade, or more. Once the program manager gains confidence in you as a researcher, and has learned to value your results and how your work fits into their overall program objectives, they have many means at their disposal to secure funding for your research. These follow-on grants, by the way, do not necessarily need to go through the intense competition process required for responses to specific calls for proposals, etc. That is, research grants provided from the program manager's "core" program go through a proposal review and evaluation procedure, but the proposal is not necessarily in extensive competition with other proposals. The program manager can fund your proposal based upon the subject matter, which will be covered under the general BAA issued for their agency. In their proposal evaluation they will indicate that your proposal was selected from the number of proposals that were received under the BAA, but in actuality there may be a very small and limited number of proposals that were in competition for the award due to inappropriate subject matter or other reasons. There are also no time limitations on when the proposal is submitted, and you can submit at any time during the year. However, you need to be aware that most program managers have a limited amount of funding available to allocate to their core program. The actual amount of core funding varies from agency to agency, but is always limited and defined by agency budget details.

Also, most mission agencies will fund research grants on what is called an "incremental" funding basis. That is, grant funds are always provided for a determined time period, which is generally three years for standard grants, with an increment of the total amount provided on a yearly basis, determined by the research performance requirements. These requirements are clearly defined in the grant proposal budget.

The "incremental" status indicates that the grant funding will be provided on a yearly basis, based upon the US government fiscal year, which runs from October 1, each year, through the end of September in the following year. In order to understand the incremental funding process and how it can affect your research program, it is useful for me to briefly digress and review the US government budgeting procedure for the various agencies and discuss how the research budgets are determined. The intent here is not to explain the government budgeting process in detail, but rather to give you a brief overview of the process and how it relates to your efforts to obtain research funding in your effort to build your research program.

6.6.1 The US Government Research Budget Process

United States government research agency budgets are determined through a complex budgeting process that involves their agency management, the national Administration, and Congress. The entire budget process is managed by the White House Office of Management and Budget (OMB), which works with the various government agencies, as well as Congress, throughout the year to define the agency budget requests that will be submitted to Congress. Basically, the Administration defines and requests budget funding, but only Congress can appropriate funds. The Administration establishes agency budget priorities depending upon a variety of issues, and works with the agencies to determine budget requests. Input from all agencies are gathered and evaluated by OMB staff, and a final budget request is prepared. Agency budget requests may be modified by OMB, in accordance with Administration priorities and overall budget limitations. The final budget is called the President's Budget Request (PBR) and is submitted for consideration to Congress, generally in the first week of February, although the actual submission date can vary. Submission of the PBR to Congress commences the entire process for the following year, and OMB continues to work with the various offices and agencies to plan and prepare the following year's budget request. Once Congress receives the President's Budget Request, it is divided up by agency and distributed to

the various committees in the House of Representatives and the Senate with responsibility over the various agencies and offices. These committees will evaluate the budget requests and generally make modifications. The various House and Senate committees also conduct their own separate and parallel budget process. At the completion of the budget process by the House and the Senate, separate budgets that do not agree generally result. A joint committee made up of members from both the House of Representatives and the Senate, called the Conference Committee, is established and will meet to reconcile the differences in the two budgets. Once they agree on a budget compromise, both chambers must vote to approve the new budget. The process will repeat until a final budget is approved. This budget will then be submitted to the President for his approval and signature. The President has the option to either accept or reject the budget he receives from Congress. If the President does not agree with the new budget, which may have little resemblance to the budget request he submitted, he can veto it, which will result in the budget being returned to Congress for reconsideration and modification. Under these circumstances the entire process is repeated by Congress and a new and/or modified budget is submitted to the President. The budget, once approved and signed by the President, becomes public law and provides the funds for the operation of the government for the fiscal year.

Ideally, the budget will become law before the start of the fiscal year. However, it often happens that agreement on the budget does not occur until well into the fiscal year. When this occurs, the government has no funds on which to operate and may be closed down for normal business. Congress, in this case, will often pass a bill called a Continuing Resolution (CR), which permits the government agencies to operate, based upon the previous year's budget. Once the President signs the CR bill, it becomes public law, and the government is authorized to expend funds to continue to operate. Generally, a CR is passed for only a short time period, which may be a week or two, and for the purpose of permitting Congress and the Administration time to work to negotiate and compromise, and pass the fiscal year budget. Further extensions are possible with the passage of additional CRs.

6.6.2 University Policy Regarding Research Grants and Continuing Resolutions

Although the fiscal year begins on October 1, it sometimes happens that the fiscal year budget is not finalized into law until the end of the calendar year, and sometimes into the next year. When these delays occur, agency research budgets are placed under significant stress. Grant funding increments, in particular, are often delayed and researchers are faced with a disruption in their research programs. Delays in receiving expected funding increments are treated in various ways by universities. Some universities will permit research work to continue and will permit funding expenditures as if there were no funding increment delay, subject to overall funding limitations. That is, they will permit expenditures as long as the overall approved budget limits are not exceeded. In effect, the university permits the research to continue without disruption, supported with university funds, which is managed as deficit funding on the grant. Once the expected increment is received, the negative balance on the grant budget will be cancelled by the newly received grant funds. This approach has some risk, since the university has no guarantee that the expected incremental funds will actually be received. The Terms and Conditions that are included with the grant always include the statement "... subject to the availability of funds." This is a downside of the incremental funding procedure, and the statement means that the government agrees to provide the requested funds, if they have funds available in their current fiscal year budget. If the funds have not been provided to the agency, they are not obligated to provide the increment to the university. Although this situation rarely, in fact, occurs, it is possible, and the funding agency will have the option to cancel the grant. For research that is satisfactorily progressing, cancellation of the grant is not common, and program managers tend to fund existing grants and provide the budgeted increments for existing grants before making commitments for new grant initiations. Nonetheless, the potential cancellation of a grant for budget reasons poses a threat and, for this reason, some universities will not permit expenditures of grant funds if an increment has not been received. When this occurs, faculty

researchers are placed in a difficult situation since they will need to devise methods to maintain their research and meet obligations until the new grant increment is received.

6.7 Research Funds Management by Program Managers and Program Directors

Once a program manager has decided to support your proposal with a research grant, they will generally determine how much funding is required to perform the research from the initiation date of the grant and through the end of the current fiscal year. This amount will generally only be a fraction of the total first-year funding requested since the first-year performance period generally does not coincide with the fiscal year budget period. The program manager may contact you and request that the budget sheet in your proposal be modified to satisfy the fiscal year funding issue. Since the general performance period for a research grant is normally three years, the actual performance period most likely will extend over four years due to the partial year funding, and the funds not provided in the first year, due to the grant initiation date, will be provided in the fourth year. In this way, the entire three-year performance period will be funded, but it will be spread over four calendar years in order to match the three-year funding to the fiscal year. An advantage of the incremental funding process for the program manager is that it permits them to fund more proposals than would be allowed if they provided the full proposal requests immediately. However, since the next increment is due the following year, the amount of funding for the initiation of new grants the following year is reduced. In fact, the majority of a program manager's core funds are generally committed to research grants that have been initiated in previous years, and most program managers will have a limited amount of funding to provide for new grants. This is one of the main reasons that the competition for the initiation of new grants is so intense. The problem becomes even more difficult in years when agency budgets are constant from the previous year, or even worse, reduced from the previous year's amount of funding. For the latter situation, very little to no funds may be

available for new grant initiation. In fact, the program manager may need to let an existing grant terminate in order to have funds to initiate a new grant. This is one of the major reasons the academic community routinely supports increases in US government research agency budgets. In fact, in times of increasing research budgets, the academic community profits in a significant way since there is enhanced opportunity for new grant initiation.

The possibility of a follow-up grant from NSF is more complex than for the mission agencies. First, the NSF does not provide for follow-up grants, and continuation of the research supported on one grant with award of a follow-up grant for continuation of the same work is not possible. The only way to secure a follow-up grant is to submit a new proposal for a new project that is based upon research performed under the previous grant. In the new proposal the previous work will be described and the results obtained presented. However, the new proposal must focus upon the new work that is being proposed, and the new work must be clearly distinguished from the previous research effort. The new proposal will be submitted and will go through exactly the same review and evaluation process as all proposals submitted to the NSF. In this regard, the new proposal is in competition with all proposals submitted. The only advantage associated with the new grant proposal is that the previous work that was performed and reported permits a stronger proposal to be submitted since the new work is supported by the results of the previous work. Reviewers will consider the results of the previous work to be evidence of the likely potential success for the new proposed research, and are likely to consider this a positive factor in their evaluation. In fact, many researchers successfully receive subsequent grant funding, sometimes extending over many years.

The funding mechanism at the NSF is slightly different from that employed by the mission agencies. In the standard grant procedure at the NSF (called a Standard Grant), a three-year budget is normally approved. The entire three-year grant budget will be applied to the current-year budget allocated to the particular division providing the funds. The funds will be placed in an account that your university can use to support your research grant budget requirements. Since the entire

three-year budget is available, there is essentially no risk to your grant funding for the duration of the grant performance period, assuming the work is proceeding satisfactorily. Delays due to Congress and the President arriving at an agreement on the Federal budget, which may include the passage of a Continuing Resolution, etc., will not cause any disruptions in your research funding since the grant funds have been secured for the duration of the grant performance period from the fiscal year budget in which they were committed. United States government agencies always have the option to cancel research grants, but only for specific purposes related to non-performance issues, and other extreme circumstances.

The NSF does fund a certain fraction of their awarded grants on an incremental basis, similar to mission agencies, using a process called a Continuing Grant (CG). This process functions in essentially the same manner described for the mission agencies. However, most divisions keep the number of their CGs to a minimum and attempt to minimize the total monetary value of the CGs, which is generally a relatively small fraction of their overall budget. The CG mechanism is useful to the divisions for management of their budget, particularly at the end of the fiscal year, when it is necessary for them to zero the budget. That is, all agency research funds are required to be committed by the end of the fiscal year, and the CG process is a valuable tool to accomplish this, since the amount of funding provided for grants funded by this mechanism is variable. The CG process also permits an increase in the number of grants that can be funded. An advantage of the NSF providing the majority of their grants by means of the standard grant procedure is that each fiscal year they will have most of their allocated budget available to initiate new grants. This is one of the reasons that the NSF has become a very popular funding source, particularly for new faculty researchers.

6.8 Professional Networking

Professional networking is an extremely important factor in building an academic research career. Actually, this is an understatement since

networking is important for success in essentially any career, not only an academic research career, and particularly, in any scientific or technical profession. What does "networking" mean? Networking is actually nothing more than interacting and communicating with your professional colleagues on a regular or periodic basis. In this process you'll make many friendships that will last for long periods of time, some for your entire professional life. You've already started this process by graduating from your university with an advanced degree. Some of your fellow classmates and colleagues, particularly those with whom you developed friendships, can be a good start on building your network. You should make an attempt to stay in touch with these people, particularly those with technical interests similar to your own. As time progresses, you are likely to meet these people at technical conferences and meetings, and they can be a good resource to meet other people. Also, over time you're likely to meet the same people in many different forums as both their and your careers advance. You'll find the positions, locations, and titles change, but the people remain the same.

Building a professional network requires making contact with many people. The best opportunity to do this will stem from your place of employment and related organizations, and your professional activities. These two activities are related, but distinctly different. In your employment you will interact with many people on various levels of the professional organization, and you will have many colleagues with whom you will interact on a daily or periodic basis. As time progresses, you and your colleagues are likely to move from one company or organization to another, and sometimes relocation to organizations across the country, or even relocation to other countries, may result. However, these people, particularly those with whom you have similar technical interests, are likely to attend technical and professional conferences and meetings in your specialty interest areas and you will have the opportunity to maintain contact with them. You are very likely to meet these people at these conferences and meetings and have a chance to stay in touch and continue your relationship. These networking opportunities, which should be pursued and maintained, can have many benefits, extending from personal to professional activities. These

relationships can even result in future employment opportunities. Also, continuing your relationships will likely result in significant growth in your network as you meet and develop relationships with people you meet through your colleagues.

Professional organizations, particularly through their conference and meeting activities, also offer a very significant opportunity for building your network. Virtually all professions are supported by professional societies made up of people who work in the profession. For example, people working in electrical engineering areas are supported by the IEEE, professionals working in materials science and engineering are supported by the Materials Research Society (MRS), physicists are supported by the Applied Physics Society (APS), and chemists are supported by the American Chemical Society (ACS). These professional societies and organizations sponsor numerous conferences and meetings throughout the year. Some of these conferences are large and include many technical areas, and some of the conferences and meetings are relatively small and dedicated to a single subject. Attendance at these meetings can be large, with hundreds or thousands of participants for the general conferences, or limited to a relatively few participants for the specialty topic meetings. You will need to determine what conferences and meetings are most appropriate for you, based upon your technical interests, and then make every attempt to attend and participate in these meetings. Attendance at these meetings presents an extremely fertile opportunity for you to meet new people working on topics of mutual interest and with whom you can discuss problems and research approaches. Many of these people will become your colleagues and some will become collaborators.

You'll also find that many funding agency program managers and program directors are likely to attend these meetings. This offers an excellent opportunity for you to meet and build relationships with them. Meeting and talking to them during coffee breaks, etc., presents a good opportunity for initial contact. However, you'll probably find that many of these people also serve on program committees and meeting organization and planning committees. Your participation in these activities presents an excellent opportunity to get to know these people

on a deeper level, and to further develop relationships. You should volunteer your time and effort and get involved in as many of these activities as your schedule permits as these activities present an excellent opportunity to continue to build your network of professional colleagues.

6.9 What We've Learned

In this chapter we've discussed the very important issue of how one goes about identifying and making contact with the program manager or program director most appropriate for his or her research area. We explained the qualifications of the program managers and program directors, and how they are selected to serve in the respective positions. The role of the program manager or program director was described, including their involvement in program development, and how they are evaluated by their organizations. We also described several US government grant funding agencies, and described the various methods they have to advertise their research opportunities. We then presented various techniques that could be used to communicate with appropriate program managers and program directors within the funding agencies. It is emphasized that personal contact and communication with the program managers or program directors is fundamentally important in order to build their confidence in you and your research. We also discussed the concepts of white papers and year-end money, followed by some considerations regarding how the agencies evaluate proposals. We also addressed both the funding agency, and university research grant, management processes. The chapter concluded with a discussion of the need to build professional networks, and mechanisms that can be successfully employed for this purpose.