

## The NSF Graduate Traineeship Program Background Information

For the past two years the National Science Board has strongly urged the National Science Foundation to develop and implement a graduate traineeship program, running parallel to the existing NSF fellowship program, that would start in FY 1992 at \$25 million (1,000 new starts) and build to \$125 million per year over a five-year period. Here the principal distinction between the *traineeships* and the current NSF *fellowships* is that the traineeship grants would be made to programs and departments within institutions and assigned by the institution to graduate students in contrast to the existing fellowship program which makes the awards directly to students who then choose their institution (so-called "portable" awards). The basic parameters would be that each traineeship would consist of a \$25,000 per year grant, with \$7,000 of this requiring a one-to-one institutional match. Hence, the fully-funded package would provide \$32,000 per year to cover both stipend and institutional costs (e.g., tuition and research equipment).

This particular program would be part of a broader initiative being considered by the FCCSET Committee on Education and Human Resources. Last year, the FCCSET CEHR originally recommended a graduate traineeship/fellowship program across all mission agencies. This would begin at \$150 million for FY 1992 and build to \$300 to \$400 million by the mid-1990s. The program would then decline in the latter part of this decade as the science and engineering doctorate pipeline began to fill. During the fall budget process, the particular priorities established by FCCSET and OMB deferred this effort to FY93, and hence it does not appear in the FY92 White House budget recommendations.

The background for the strong support of such a program by the National Science Board has to do with the pending crisis in the availability of graduate level scientists and engineers in this nation. Many of us are convinced that education and human resources will become the dominant issues of the 1990s, determining whether this nation has the capacity to sustain its prosperity, security, and quality of life in the decades ahead. As we see it, the pipeline problem, running from pre-school through lifetime education, can really be viewed from two different perspectives: In the *long term*, it is clear that we have to completely rebuild the pipeline to serve a different population in a changing nation in a changing world. The challenge will be a total overhaul of K-12 education, college education, graduate education, and lifelong learning in science, mathematics, and engineering. However, in the *short term* there are a separate set of urgencies that

will arise late in the 1990s and will first manifest themselves in a serious shortfall in the availability of engineering and science doctorates.

The projected shortfall in science and engineering doctorates is being driven simultaneously by both the supply and the demand sides. On the supply side, the shifting demographics of our society, coupled by the recent tendencies for fewer and fewer U.S. students to select science and engineering majors, will almost certainly lead to a decline in the number of doctorates over the course of the next several years. At the same time, the need for such doctorates will continue to increase due to the aging and retirement of both faculty and industrial/government personnel, the increasing needs of both industry and the government sector for doctorates, and the trend for foreign nationals who are currently compensating for the shortfall in domestic doctorates to be lured back to their home countries as their economies and technology begin to heat up.

Furthermore, there are increasing signs that the shortfalls developing at the doctorate level have created, in effect, an "air bubble" in the science and engineering pipeline that is blocking the flow of students into these critical areas at earlier stages. The shortage of U.S. nationals has led to a situation in which many graduate programs are now predominantly enrolling foreign national students--in excess of 70 to 80 percent in some engineering fields. Furthermore, the vast majority of all young engineering faculty under the age of thirty-five are now foreign. Hence, the absence of role models provided by U.S. nationals in graduate programs and on faculty have led to a situation in which undergraduates can no longer identify with science and engineering as career options. There is already some evidence suggesting that this is one of the major factors for the sharp decline in science and engineering majors in recent years.

Ironically enough, even as these crises in science and engineering doctorate production in the late 1990s become more apparent, federal policies seem to be moving in just the opposite direction. The new FCCSET process for determining budget strategies last year set priorities of pre-college over graduate education for the FY 1992 budget. This led to a series of recommendations which would see all-agency funding increase by 28.4 percent for precollege programs, 14.5 percent for undergraduate programs, and only 2.4 percent for graduate education. In fact, the only increase recommended for graduate student support is an adjustment in the NSF fellowship funding to bring it to the level necessary to meet current NSF fellowship commitments rather than expanding programs. Hence, the FCCSET priority setting process is actually threatening to undermine graduate education just at the time when the nation faces a looming crisis in this area.

To respond to this situation, last August in an unprecedented action, the National Science Board strongly recommended to the National Science Foundation that it

include in its budget request a new NSF graduate traineeship program with the parameters outlined in the first paragraph above. This was a highly unusual action by the Board, but this program was felt to be such overwhelming importance that the Board urged the Foundation to give such a program the highest priority, even if it required reallocation of existing Foundation resources "within the envelope" for Foundation-funding growth provided by OMB.

The strong support of the National Science Board reflected two years of work by its Education and Human Resources Committee which identified the traineeship program as the most effective way to deal the the shortfalls projected for the late 1990s. It was felt that traineeships would be far more effective than research assistantships since they would provide long-term security for financial support necessary to attract U.S. national undergraduates into graduate education. Furthermore, it was noted that research assistantships tend to be roughly twice the cost of traineeships or fellowships since they had associated indirect costs and fringes that had to be included in the research contracts.

Also, it was believed that traineeships were superior to fellowships for this purpose--particularly in engineering disciplines--because they would be granted directly to departments and programs, thereby providing maximum incentives for the faculty to become active in recruiting U.S. nationals. In effect, they would make the faculty themselves responsible for filling the slots allocated to the departments through the traineeship program. Furthermore, the traineeship program would spread the load of talented students throughout the full capacity of science programs across the country. In the present system of highly portable fellowships, most NSF fellows tend to focus on a small handful of institutions, which simply do not have the capacity to handle the existing load, and furthermore, draw students away from programs of comparable or even better quality at other institutions. Finally, it was our belief that the traineeship program would allow for better targeting of federal investments to correspond to science and engineering areas of particular national priority, while assisting in the building of strong programs across the country.

In summary, it was the belief of the National Science Board that the shortage in science and engineering doctorates projected for the late 1990s was a very real and serious possibility in areas of key importance to the country. Further, it was our belief that a highly targeted federal traineeship program, starting within the National Science Foundation and then broadening to other mission agencies during the early 1990s, was the most effective way to deal with this on the time scales necessary.