FEDERAL TECHNOLOGY TRANSFER

TRANSFERRING SUPERCONDUCTIVITY TECHNOLOGY AT A NATIONAL-LABORATORY USER CENTER

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Department of Energy national laboratories have long sought to expedite the transfer of commercially viable technologies to the private sector through publications and reports, workshops, the licensing of inventions, and personnel exchanges and other cooperative agreements between laboratories, industry, and universities. This article focuses on the transfer of patentable technologies through a case study of the Oak Ridge National Laboratory high temperature superconductivity Pilot Center (HTSC-PC). The Pilot Center was established in 1988 to encourage rapid incubation and commercialization of high temperature superconductivity technologies. The success of this venture will hinge upon assuring compatibility of objectives between the center and likely industrial participants and directing center efforts toward the aspirations of potential collaborators and the ultimate consumers of HTSC technologies. Lessons for general multi-program-laboratory technology transfer include the need for a model of collaboration that emphasizes openness and non-rigidity and facilitates the streamlining of information vital to the cross-fertilization of ideas, continuing reform of the licensing and royalty-sharing process, and simplifying the process of scientific exchange with external constituencies.

Activities at Department of Energy (DOE) national laboratories to expedite the transfer of commercially viable technologies to the private sector are motivated by several concerns. Recent efforts hinge upon the goal of increasing American competitiveness in an interdependent global economy.(1,2,3) One potentially commercial technology for achieving this goal is high-temperature superconductivity. This paper examines some preliminary lessons of a specially-chartered superconductivity pilot center for achieving national-laboratory technology-transfer goals.

The High Temperature Superconductivity Pilot Center (HTSC-PC) at Oak Ridge National Laboratory is one of 15 user centers at the Tennessee laboratory and one of three nationally-designated DOE superconductivity pilot centers established in 1988. (The work of ORNL's 15 user centers is focused on environmental research, roof research, particle physics, bioprocessing, high temperature materials, health physics, and other activities. Two other HTSC pilot centers are located at Argonne National Laboratory and Los Alamos National Laboratory.) HTSC-PC is designed to facilitate R&D collaboration among industrial and academic researchers and laboratory scientists. While high-temperature superconductivity is thought to be valuable to the attainment of several national policy objectives (including strategic defense through magnetic shielding, energy conservation, electric-power generation and transmission, and computational technologies such as high-speed signal processors), it probably will not produce short-term commercial benefits.

Barriers to the chemical stability, current-carrying-capacity, and brittleness of superconducting materials, as well as other engineering problems, remain to be overcome. While scientific confidence in high-temperature superconductivity is great, and while expectations of various "breakthroughs" in the field are infectious, there is an atmosphere of caution matched by a sense of challenge. Many believe that movement from the laboratory stage of R&D to up-scale commercialization is unlikely to come about quickly. Again, this is one reason to emphasize the benefits of user collaboration from the standpoint of...
process development rather than short-term commercialization prospects.\textsuperscript{(4,5)} The founding of the center was based on the belief that these barriers can be overcome most rapidly through cross-fertilization of ideas, establishment of a common research agenda, and an integrated, collaborative center that expedites invention, licensing, and the sharing of royalties.\textsuperscript{(6)} It is hoped that the HTSC-PC will hasten the waiver of patents from high-temperature superconductivity to operating contractors of national laboratories and, ultimately, to industrial users.

**TECHNOLOGY TRANSFER AT NATIONAL LABORATORIES: CONTENDING GOALS**

Technology transfer is not an intrinsic mechanical process that automatically follows scientific invention or discovery. Constantly changing market structures, business cycles, adoption costs, and user expectations require public and private sector cooperation in this effort.\textsuperscript{(7,8,9)} DOE is a mission-oriented agency whose constituent parts profess explicit goals and aspirations. The development of technologies by its national laboratories is viewed, in part, as means of achieving these goals and aspirations. A principal reason DOE has established technology-transfer programs at its national laboratories is to accelerate the commercialization of energy technologies. While DOE exercises audit and oversight control to evaluate the success of these efforts, the laboratories bear primary responsibility for technology transfer and have established licensing activities designed to achieve this objective.

A recurring challenge in the implementation of laboratory technology-transfer programs is striking a balance between hastening the commercialization of technologies on the one hand and preserving government access to tax-supported inventions on the other. The so-called "patent-waiver" process, which is at the center of this issue, is an attempt to reconcile these goals by allowing the government to retain certain rights "in use" of a technology while still permitting commercial licensing by the private sector.\textsuperscript{(10,11)} While we contend that this process is central to the reconciliation of these contending goals, it must be added that the process of technology transfer includes much more than licensing. As one recent Congressional report has noted, technology transfer is the process by which technology, knowledge, or information developed in one organization, in one area, or for one purpose is applied and utilized in others.\textsuperscript{(12)}

**PATENT POLICY AND LABORATORY TECHNOLOGY TRANSFER**

Patent-policy changes initiated at the behest of Congress, the Office of Management and Budget, and the General Accounting Office (GAO) to accelerate the transfer of technology from federal laboratories to the private sector have been occurring for quite some time. These changes, designed to hasten sharing of patent rights and royalties between government-owned, contractor-operated R&D installations (GOCOs), such as some DOE national laboratories, and collaborating inventors are depicted in the appendix.

One issue pertaining to this sharing process which is especially relevant for the pilot center is how this process should be evaluated. DOE and GAO differ in their assessments of the expected rate of commercialization from waived national-laboratory patents. GAO, an arm of Congress, wants to see commercialization success measured partly in terms of licenses granted for new inventions as a percentage of total patent applications. DOE, on the other hand, wants the number of licenses to be assessed in light of the number of patents obtained which would produce a proportionally higher figure.

The point here is that the effectiveness of the pilot centers will ultimately be gauged by the degree to which patentable technologies are transferred through the patent-waiver process, as well as other "extrinsic" criteria, such as how readily commercial devices are licensed and commercialized and how effectively users perceive the benefits of their interactions with the centers. Over time, the patent-application "GAO standard" is likely to be used by Congress in evaluating the effectiveness of technology-transfer efforts at federal laboratories.

**COST RECOVERY AND THE AUDITING OF PATENTS**

DOE has long expressed concern over recovering the costs of patent waivers. That is why the department requires GOCS to consistently and carefully track the costs of patents and the rate of royalty return when patents are waived to contractors. This approach has been applied to "class waivers" as well as "identified invention waivers" (specific waivers for a unique discovery).\textsuperscript{(15)} The significance of this issue for the HTSC-PC is that DOE's model agreements for pilot-center collaboration with industrial users are designed to promote a high ratio of licenses and royalties relative to DOE expenditures on patents. Because patenting and licensing are slow, tedious processes, which produce