## Index

Advanced Civilian Technology Agency (ACTA), proposal for, 144 Advanced Technology Program, proposal for, 143 Altair. 31 American Superconductor Corp., 60 Ampex, 45 Antitrust, enforcement and U.S. industrial competitiveness, 5, 6, 22 Applications high-current, high field, 40-41, 65, 136, 159-160, 162-163 LTS, 154, 157 military, 162-163 prospective HTS, 40-41, 44-48, 134-136, 159-163 superconducting electronics, 41, 136, 161-162 Appropriations. See Budgets; Funding Atomic Energy Commission U.S. (AEC), 25, 131, 140 AT&T, R&D funding by, 7, 21, 55, 56, 57, 58, 59, 71, 72.102 Bardeen-Cooper-Schieffer (BCS) model, 158 Bednorz, J. C., 26 Bellcore, R&D by, 56, 59 Bloch, Eric, 141 Boeing, 98 BRITE (Basic Research on Industrial Technologies in Europe), 43 Budgets CTA R&D, 144, 147 Federal Government R&D, 5, 9, 17, 23, 83, 87 Japanese superconductivit, R&D, 10, 61, 65, 68, 69, 70, 71-72, 73, 75 see also Funding California, University of-Berkeley, 58, 60 Carter, Jimmy, 22 Central Electric Power Research Institute-Japan, 70 Ceramics commercializing R&D results pertaining to structural for use in heat engines, 27, 28, 44-45 Japanese expertise and leadership in, 19, 27, 61 superconductivity materials made of, 3, 6, 27, 44-45, 155, 156, 157, 158, 162 China, 3 Chu, Paul, 26, 129 Civilian Technology Agency (CTA) desirable features of, 144, 145-146, 147 mission of, 143-145 potential problems with, 146-147 project selection and review for, 145, 146 proposals for, 13, 126, 141-142, 143 Collaboration industrial R&D, 133-137 industry/Federal Government R&D, 5, 12-13, 23, 86, 113-114 industry /university/Government, 123, 124, 126

industry/university HTS, 59, 60, 130, 131

international HTS research, 11, 77-79, 86, 115-118 in Japanese R&D system, 9-10, 11, 62-63, 73-77 policy issues and options concerning strengthening university /industry/Government, 8, 9, 85-86, 104-115 Commercialization, 3-5, 17-20, 42-44 aggressive support strategy for, 132-138, 139 European HTS, 43 factors influencing U.S. HTS, 35-40 Federal Government's role in high-technology, 3-5, 9, 20-27 flagship approach to technology, 125, 139 overview of technology, 3-5, 17-20 strategies for HTS technology, 12-13, 123-142 summaries of specific examples of technology}' R&D, 27-28, 44-48 working group on, 137-138 see also Management; Marketing; Research and development [R&D) Committee on Materials (COMAT), 90 Conductus Inc., 60 Costs. See Budgets; Funding Current density, critical, 156, 157 Defense Advanced Research Projects Agency (DARPA)-DoD, 139 as precedent for CTA, 142-143 R&D support by, 9, 25, 44, 85, 93, 104, 139, 163 Defense. See Department of Defense, U.S. (DoD); Military Department of Commerce, U.S. (DOC), 138, 143, 145 Department of Defense, U.S. (DoD), 90, 91 high-technology development [postwar history), 96-98 HTS R&D funding by, 6, 12, 24, 41, 85, 93-99, 112, 162-163 R&D budget of, 23, 87 see also Defense Advanced Research Projects Agency (DARPA); Military Department of Energy, U.S. (DOE), 90, 91 collaboration with industry by, 5, 23 HTS R&D funding by, 6, 12, 24, 28, 44, 85, 99-101 see also National laboratories Development, See Commercialization; Research and development (R&D) Digital Equipment Corp., 31, 137 Domestic Policy Review of Industrial Innovation (DPR), 22 Du Pont, R&D by, 6, 7, 51, 57, 58 Eastman Kodak, 57 Economic Competitiveness, International Trade, and Technology Development Act—1987, 144 Economic Policy Council (EPC), 90 Education

HTS personnel, 130, 133

U.S. engineering, 4, 142

Electric power HTS applications involving, 160-161 shortage in Japan, 9, 40 Electric Power Research Institute, 90, 101 Electronics, superconducting, 41, 136, 161-162 Energy Research and Development Administration (ERDA], See Department of Energy (DOE) Engineering education, 4, 142 parallel, process for HTS, 34-35, 159, 163 raising priority of research on, 13, 141-142 Engineering Research Centers (ERCs)-NSF, 9, 103, 104, 106, 107, 108 ESPRIT (European Strategic Program of Research in Information Technology), 43 Eureka (program), 43 European Community (EC), 43, 78 Expenditures. See Budgets; Funding Exxon, 55 Fabrication. See Processing Federal Government. See Government, Federal Federal laboratories. See National laboratories Fine Ceramics Center (FCC)–Japan, 70, 76 Food and Drug Administration, U.S. (FDA), 47 France basic research support by, 26 government involvement in industry affairs by, 22 R&D support by, 43 Funding continuity in R&D, 8, 85, 91, 123, 124-125 Federal HTS R&D, 6, 9, 24, 84, 86-93 Federal objectives of R&D, 9, 23-27, 84 industrial R&D, 6-7, 21, 54, 57, 58, 60, 61, 84 R&D at U.S. universities, 6, 12, 85, 102, 103, 104, 132-133 see also Budgets Fujitsu, 71, 72 General Electric (GE), R&D support by, 46, 55, 57, 59 General Motors Corp. (GM), 21, 98 Germany, Federal Republic of. See West Germany Government, Federal (U.S.) HTS funding by, 6, 9, 24, 84, 86-93 industry support by, 3-5, 12, 20-23, 128, 131, 133-137 procedural rules for R&D cost sharing by, 136-137 R&D budget, 5, 9, 17, 23, 83, 87 R&D funding objectives of, 9, 23-27, 84 technology commercialization strategy options for, 12-13, 123-148 see also Military; individual agencies in Government, State, HTS support by, 11, 23, 114-115, 129 Heat engines, 44-45 History, of superconductivity development, 26, 154-158 Hitachi Co. business strategy of, 51 R&D support by, 7, 64, 71

Hoechst AG, 43 Honda, 32, 33 Houston, University of, 58, 129 Hypres Co., 41, 159 IBM, 41, 43, 51, 98 R&D funding by, 7, 21, 55, 56, 58, 59, 71, 72, 102 transition temperature breakthrough by, 3, 26, 155 Imsai, 31 Incentives indirect, for commercialization, 5, 6, 12, 20, 22 Japanese energy shortage as HTS R&D, 9, 40 Industry competitiveness of U.S. high-technology, 3-5, 8-9, 32 direct support from Federal Government to, 5, 12, 20-23, 128, 131, 133-137 HTS R&D consortia, 127, 133-137 HTS R&D strategies of U. S., 6-7, 57-59 R&D funding by, 6-7, 21, 54, 57, 58, 60, 61, 84 R&D strategies of Japanese, 9-11, 29, 33-35, 51-52, 60-67 R&D strategies of U. S., 4, 6-7, 10, 34, 35, 51-52, 53-59 "wait and see" attitude of U. S., 4, 6-7, 10, 52, 53, 55-56, 131-132 Industry/University Cooperative Research Centers (IUCRs)–NSF, 107 Intermagnetics General Corp. (IGC), 48 International Superconductivity Technology Center (ISTEC)-Japan, 65, 72, 77-79 Investment. See Budgets; Funding Japan basic research support by, 7, 9, 26, 61, 68, 75 ceramics technologies expertise of, 19, 27 corporate R&D strategies in, 9-11, 29, 33-35, 51-52, 60-67 HTS policy of, 9, 10-11, 67-79, 86 HTS R&D initiatives in, 3, 7, 9, 10-11, 67-80 industry support by government in, 9-10, 22, 62-63, 73-77 national laboratories of, 9, 69, 70, 76, 78 policy issues and options concerning technology interchange with, 9, 86, 116-117 U.S. technology interchange with, 11, 77-79, 86, 115-118 Josephson junctions (JJs) computer applications using, 41, 64, 71-72, 161-162 reproducible HTS, 30, 41 R&D for, 57, 70, 163 Keyworth, George, 91 Knowledge base Federal Government's contribution to, 3, 5, 11-12, 21,96 for superconductivity, 163 gaps in U.S. technology, 11, 83, 85, 91, 136 private sector's access to, 3, 5, 21 Korea, Republic of. See South Korea Legislation. See individual statutes

Low-temperature superconductivity (LTS), 5, 6, 25, 65 historical development of, 154, 156, 157-158 magnet technology, 29, 40, 41, 48, 64, 154 properties and behavior of, 156, 157 R&D funding for, 93, 95, 99 see also Josephson junctions (JJs); Magnets Maglev (magnetically levitated] trains, 73, 74, 159, 160Magnetic resonance imaging (MRI), commercializing R&D results involving, 27, 29, 31, 41, 47-48, 154, 160 Magnets HTS, 29, 160 LTS, 48, 157, 159-160 Maintenance, See Management Management Japanese industrial R&D, 63 U.S. industrial R&D, 54-57, 135 Marketing policy, 143, 144 R&D applications, 8-9, 29-31 research, 43 Market pull, policies encouraging, 123, 124, 125-126 Massachusetts Institute of Technology (MIT), 60, 96 Materials Research Laboratories (MRLs), 103-104, 106-107 Matsushita, 29, 45 Microelectronics consortium, 5, 35, 134, 136 as precedent for HTS commercialization, 35-40 Microelectronics & Computer Technology Corp. (MCC), 79, 135, 136, 137 Military commercial spin-offs from R&D spending by, 4, 5, 9, 84-85, 94-95 R&D directed toward, 25, 83, 84, 85 superconductivity applications, 162-163 see also Department of Defense, U.S. (DoD) Ministry of Education (Monbusho)-Japan, HTS support by, 68, 70-73 Ministry of International Trade and Industry (MITI)-Japan, 63, 71, 72 HTS support by, 68, 69-70, 75, 76 International Superconductivity Technology Center (ISTEC), 65, 73, 77-79 Ministry of Transport-Japan, HTS support by, 68, 73, 74 Mitsubishi Electric, R&D support by, 64, 74 Muller, K. A., 26 Multicore Project (STA)-Japan, 69, 76, 77 Muto, Yoshio, 73 National Academy of Sciences (NAS), 86, 87 National Aeronautics and Space Administration, U.S. (NASA], 91-92, 101-102 National Bureau of Standards, U.S. (NBS), 24, 77, 87, 90.101 National Cooperative Research Act-1984, 22, 24 National Critical Materials Council (NCMC), 89, 90-91

National defense. See Department of Defense, U.S. (DoD); Military National Institutes of Health, U.S. (NIH), 25, 138-140 National laboratories HTS R&D in, 85, 110-114, 131, 139 LTS magnet research at, 48 technology transfer to private sector from, 19, 22, 23, 83, 86, 110-114, 130 see also Department of Energy, U.S. (DOE) National Security Agency, U.S. (NSA), 71, 97 National Science Foundation, U.S. (NSF), 90, 91 Engineering Research Centers, 9, 103, 104, 106, 107, 108 HTS R&D funding by, 6, 12, 85, 102, 103, 104, 132-133 Industry/University Cooperative Research Centers (IUCRs), 107 Japanese industry superconductivity survey by, 64, 65-66 Japan Initiative of, 116 multidisciplinary R&D encouragement by, 9, 85, 102-103, 105, 106, 107 Research Applied to National Needs (RANN) program of, 107, 125 science and technology (S&T) centers (proposed), 104 National Technology Foundation (NTF), proposal for, 141-142 NEC Co., R&D support of, 7, 71, 72 Netherlands, The, 43 Nippon Steel, 51, 67 Nippon Telephone & Telegraph (NTT), 71 Nissan. 33 Office of Science and Technology Policy (OSTP), 89, 90, 93, 138 1-2-3 ceramics. See Ceramics Onnes, Heike, 156, 157 Oxide ceramics. See Ceramics Packard, David, 23 Packard Commission, 131 Patents, as indirect incentive to industrial investment, 6, 20, 22, 111 Personnel CTA, 145, 147 exchange program (industry/national laboratories), 86, 112-113, 116-117 Japanese superconductivity R&D, 64, 65 U.S. superconductivity R&D, 11, 64, 130, 133 Philips, 43 Planning. See Management Policy commercialization and U.S. technology, 3-5, 9, 11-12, 20-27, 83-86, 128-132 issues and options for Congress, 83-119 Japanese HTS, 9, 10-11, 67-79, 124-125 see also Strategies Polymorphic Systems, 31 Private sector. See Industry

Processing as central element in HTS commercialization, 139 HTS applications marketing and methods of, 8-9, 30 R&D funding of, 95, 98 techniques for HTS materials, 157-159 RACE (R&D in Advanced Communication-technology for Europe), 43 RCA R&D support by, 55 VCR commercialization and, 29, 46-47 Reagan, Ronald HTS initiative of, 6, 34, 128-129 R&D support by, 12, 23, 83, 85, 90, 91 Young Commission and, 22 Regulation, as indirect incentive for industrial investment, 5, 20, 22 Research Federal support for directed, 25-27, 83 Japanese support for basic, 7, 9, 26, 61 U.S. support for basic, 12, 23, 24, 56, 83, 130, 133, 139 marketing, 34 multidisciplinary, 9, 85, 102-103, 105-107, 133 Research and development (R&D), 3-5, 7-11, 17-20 collaborative HTS, 133-137 continuity in funding, 123, 124-125 coordinating Federal, 89, 90, 128, 140-141 corporate strategies for, 4, 6-7, 9-11, 29, 32-35, 51-59 CTA intramural, 145-146, 147 diversity in support for, 123, 124 Federal budget for, 5, 9, 17, 23, 83, 87 Federal funding of HTS, 6, 9, 23-27, 84, 86-93, 128, 133-137, 140-141 industrial funding of, 6-7, 21, 54, 57, 58, 60, 61, 84, 163, 164 marketing of, 8-9, 29-31 parallel, 34-35, 66, 67, 163 policy issues and options concerning funding levels and priorities for Federal, 8, 9, 85-86, 87-93 science and technology (S&T) agency for coordinating, 128, 140-141 U.S. industry view of long-term, 4, 6-7, 10, 52, 53, 55-56, 131-132 Research Applied to National Needs (RANN) program—NSF, 107, 125 Saito, Shinroku, 76 Science. See Research Science and Technology Agency (STA)-Japan, HTS support by, 68, 69, 76 Science base. See Knowledge base Sematech, 5, 35, 134, 136 Siemens, 43 Sloan, Alfred, 33 Small Business Innovation Development Act-1982, 22, 115

Small Business Innovation Research, Federal (SBIR), 115

Sony, VCR development by, 31, 46 South Korea export policy effectiveness of, 5, 61 VCR development by, 46 Sperry Univac, 71, 72 SQUIDS, 161, 162 Stanford University, 58, 60 Stevenson-Wydler Technology Innovation Act-1980, 22, 143 Strategic Defense Initiative (SDI) HTS use in, 24, 85 LTS research for, 40, 162 Strategic Defense Initiative Organization (SDIO), 93 Strategies Japanese R&D, 9, 10-11, 29, 33-35, 51-52, 60-67 key ingredients of Federal HTS development, 123, 124 options for Federal Government HTS commercialization, 12-13 product/process, 33-34 U.S. industrial R&D, 4, 6-7, 10, 34, 35, 51-52, 53-59

see also Policy

Tanaka, Shoji, 72-73, 76
Taxes, as indirect incentive to industrial investment, 5, 20, 22, 92-93
Technologies commercialization of (overview), 3-5, 17-20
DoD's postwar development of, 96-98
industrial competitiveness and development level of, 4, 21
strategies for commercializing HTS, 12-13, 123-142
Technology base. See Knowledge base

- Technology push, 123, 124, 125-126 Technology transfer from Federal laboratories, 9, 22, 23, 83, 86, 110-114, 130
  - policy issues and options concerning U.S./Japanese, 9, 86, 115-117

Technology Transfer Act-1986, 111, 118

Toshiba

R&D support by, 64, 74, 76

- VCR development by, 29, 31, 45
- Training. See Education
- Transition temperatures
- current flow and, 154 discovery of ceramics' higher, 26, 155, 163

United States. See Government, Federal US. Universities funding for HTS R&D at U. S., 6, 12, 85, 102, 103, 104, 132-133 HTS R&D in Japanese, 72-73 multidisciplinary R&D within, 9, 85, 102-103, 105-107, 131 University Research Initiative (URI)–DoD, 107

U.S. Steel, 55

Video-cassette recorders (VCRs), commercialization of R&D results involving, 29, 31, 45-47 Visibility, level of R&D programs, 123, 125, 137, 139

West Germany export policy effectiveness of, 5 R&D support by, 43 Westinghouse, 59

Young, John, 22 Young Commission, 22, 128, 140

Zenith, 46