Appendixes

Glossary

Coil/rail gun: Uses a rapidly changing magnetic field in a spiral coil (coil gun) or a linear conductor (rail gun) to accelerate a projectile via magnetic forces. Much greater velocities can be reached than are possible with gas expansion (as in a conventional gun).

COMAT, Committee **on** Materials: An interagency group under the Federal Coordinating Council for Science, Engineering and Technology chaired by the White House science advisor. COMAT's Superconducting Materials Subcommittee, chartered in June 1987, is comprised of program directors and other representatives of Federal agencies involved in superconductivity R&D,

Critical current density: The maximum value of the electrical current per unit of cross-sectional area that a superconductor can carry without reverting to the normal (non-superconducting) state. The critical current density drops as the temperature rises toward the transition temperature, and as the magnetic field increases,

CTA, Civilian Technology Agency: Several legislative proposals over the years would establish a Federal CTA focused on commercial technology development.

DARPA, Defense Advanced Research Projects Agency: A Defense Department R&D funding agency that gives most of its support to long-term, high-risk projects, Examples include artificial intelligence, and, currently, processing of high-temperature superconductors.

DPR, Domestic Policy Review of Industrial Innovation: A Carter Administration study of alternative Federal policies for stimulating technological innovation.

Electromagnetic launcher: See coil/rail gun.

ERCs, Engineering Research Centers: Cross-disciplinary research centers funded by the National Science Foundation at universities.

ETL, Electrotechnical Laboratory: This Japanese laboratory, administered by the Ministry of International Trade and Industry, has been involved in superconductivity research since the mid-1960s

FCC, Fine Ceramics Center: A laboratory in Nagoya, Japan jointly funded by industry and the Ministry of International Trade and Industry. participating firms send researchers to work at the facility, which opened in the spring of 1987,

Fiber-optics: Use of glass fibers to transmit light (produced by lasers) for telecommunications and computer networking. Optical fibers can carry much more information than electrical wires.

FLC, Federal Laboratory Consortium on Technology Transfer: A network of technology transfer officers from 400 Federal laboratories and eleven agencies for facilitating transfers of technology from the laboratories to industry. First setup informally in 1974, the FLC was given a statutory basis in the Federal Technology Transfer Act of 1986 (Public law 99-502).

HTS, high-temperature superconductor: Refers to materials—four classes of which have been discovered since 1986—with much higher transition temperatures than previously known superconductors. (See LTS.)

Intermetallic compound: Chemical compounds of nominally fixed composition, one or more elements of which are metals. Most intermetallic compounds—e.g., the superconductor niobium-tin (Nb_3Sn)—are brittle and therefore hard to work with,

ISTEC, International Superconductivity Technology Center: An organization for superconductivity R&D set up by Japan's Ministry of International Trade and Industry.

IUCRs, Industry-University Cooperative Research Centers: National Science Foundation program that provides seed grants for cooperative R&D at universities,

JJ, Josephson junction: Superconducting electronic devices that can be used to sense electromagnetic radiation and also as digital switches (hence as logic devices in computers).

°K, degrees Kelvin: The absolute scale of temperatures, with O °K (-4940 F) equal to absolute zero (a temperature that can be approached but never reached,

Logic chips: Integrated circuits consisting of arrays of gates each of which implements a Boolean function such as AND, OR, NOR, NAND. Computer processors are built from logic chips, as are many specialized digital systems.

LTS, low-temperature superconductor: Materials that become superconducting only when cooled to a few degrees above absolute zero. All superconductors discovered before 1986 were low-temperature materials, with 230 K (-418 °F) the highest known transition temperature, (See HTS).

Magnetically-levitated train (maglev): Trains suspended and propelled by magnetic forces offer the prospects of much higher speeds than can be achieved by conventional wheel-on-rail technologies. A prototype superconducting maglev train in Japan (also called a linear motor car) has achieved speeds of over 300 miles per hour.

Magnetometers: Sensors which measure magnetic field strength. Because magnetic fields accompany so many physical phenomena, magnetometers—including ultrasensitive versions made from superconducting devices—have many uses. (See JJ, SQUID.)

Magnetic resonance imaging (MRI): Refers to equipment and techniques used in medical diagnosis for imaging the soft tissues of the body. MRI systems often use superconducting magnets.

MCC, Microelectronics and Computer Technology Corp: A joint venture that conducts R&D. MCC's program to develop and evaluate electronic applications of HTS had 13 participants as of the spring of 1988.

MITI: Japan's Ministry of International Trade and Industry.

Monbusho: Japan's Ministry of Education, which supports university research.

MRLs, Materials Research Laboratories: Now supported by the National Science Foundation, several of the MRLs are conducting research on HTS.

Multicore Project: Established by Japan's Science and Technology Agency to link nine laboratories and government organizations working on HTS with one another and with industry.

NBS: National Bureau of Standards of the U.S. Department of Commerce.

New Superconductivity Materials Research Association: Generally called the "superconductivity forum, " this association was set up by Japan's Science and Technology Agency. It provides workshops, symposiums, and other opportunities for interaction among corporations, universities, and national laboratories.

NSA: U.S. National Security Agency.

NSF: U.S. National Science Foundation.

1-2-3 superconductor: One of a new class of high-temperature superconductors, typified by yttrium-barium-copper-oxide and called 1-2-3 because of their generic chemical formula: $RBa_2CO_3O_{7-x}$, with R almost any one of the rare-earth elements.. Much of the research on the new superconductors has focused on the 1-2-3 materials, which typically have transition temperatures above 90 ^0K.

OSTP, Office of Science and Technology Policy: Headed by the White House science advisor, OSTP is part of the Executive Office of the President.

Perovskite: Refers to the crystal structure shared by the 1-2-3 and other high-temperature superconductors.

Rail gun: See coil/rail gun.

RAM chips: Integrated circuits that provide random access memory for computers and other digital systems.

SBIR, Small Business Innovation Research: A Federal program, in operation since fiscal 1983, which requires Federal agencies to set aside a small percentage of extramural R&D budgets for contracts with small businesses.

SDI, SDIO: The Strategic Defense Initiative, and the Defense Department organization that runs it.

Sematech: An R&D consortium, financed by 14 member companies (as of the spring of 1988) and the U.S. Government, established to pursue improvements in semiconductor manufacturing technologies.

Signal-to-noise ratio: An important parameter for sensors, the signal-to-noise ratio compares the signal the sensor is intended to measure with background noise (one source of which is thermal, rising with temperature).

SMES, superconducting magnetic energy storage system: A coil or solenoid of superconducting wire in which an electric current can circulate, storing energy until needed for purposes such as feeding an electric utility grid or powering a free-electron laser.

SQUID, superconducting quantum interference device: A very sensitive instrument, built with Josephson junctions, used to detect magnetic signals.

STA, Science and Technology Agency: Under the Prime Minister's Office in Japan.

S&T centers, Science and Technology centers: Multidisciplinary centers proposed for funding by the National Science Foundation.

Stevenson-Wydler Act: The Stevenson-Wydler Technology Innovation Act of 1980 (Public law 96-480, as amended), placed increased emphasis on technology transfer from the Federal laboratories. The 1986 Federal Technology Transfer Act (Public law 99-502) amended the 1980 act to provide (among other things) more emphasis on cooperative research between federally operated laboratories and industry.

Superconductivity: Total loss of resistance to direct electrical currents.

Superconducting magnet: An electromagnet wound with superconducting wire. Essentially all the power consumed goes for refrigeration to keep the coil windings below their superconducting transition temperatures.

Three-terminal electronic device: One which, like a transistor, can amplify a signal substantially. (See two-terminal device.)

Transition temperature: The highest temperature

at which a material becomes a superconductor, also known as the critical temperature. The transition temperature drops as the magnetic field and current density increase.

Two-terminal electronic device: one which, like a Josephson junction, can serve only as a weak amplifier. (See three-terminal device.)

URI, University Research **Initiative:** A Department of Defense program, started in 1986, intended to support university capabilities in research, and training of scientists and engineers, in disciplines important for national defense.

VHSIC **program:** An R&D program begun by the Department of Defense in 1979 to develop advanced integrated circuits for military systems.

VLSI **program:** Joint government-industry R&D effort in Japan for developing very large-scale integrated circuits (VLSI), in existence from 1976 to 1980.

X-ray lithography: Creation of patterns for fabricating integrated circuits using X-rays, Because X-rays have shorter wave lengths than visible light, they can produce finer patterns, hence denser circuits.