Appendix C.— Manufacturers of NMR Imaging Devices

The following company descriptions of NMR-imaging-device manufacturers are based on interviews with representatives from each firm. The initial interviews took place in 1983 and information was updated in August 1984. Magnet field strength is stated in kilogauss (kG). Conversion of kilogauss to Tesla units is as follows: 10kG = 1.0T.

ADAC LABORATORIES
4747 Hellyer Avenue
San Jose, CA 95138

Background: ADAC Laboratories is an independent publicly owned company. The company decided to invest in R&D efforts for NMR in 1982. ADAC is in the early stages of NMR-imaging-system development. It expects to have an engineering model available in early 1986 and a commercial prototype system in the second half of 1986.

Current NMR-imaging models: None (permanent magnet prototype is in development)
Collaborative arrangements with universities or medical centers: Negotiated, yet to be announced.
Clinical placement sites: None
Number of employees engaged in NMR imaging: 40 (including magnet developers)
Other diagnostic imaging products: Nuclear medicine, digital radiography; conventional X-ray; and fluoroscope
Other medical products: Radiation-therapy planning; special procedures room; clinical information systems; medical linear accelerators
Non-health-care-related products: Instruments for nondestructive testing

BRUKER MEDICAL INSTRUMENTS, INC.
Manning Park
Billerica, MA 01821
(Head Office: West Germany)

Background: Bruker Instruments is a privately owned subsidiary of Bruker A.M. of West Germany. The company began work on NMR spectroscopy in 1961 and developed extensive magnet technology and experience with pulse and spectroscopy techniques. Bruker made its first commitment to NMR imaging in 1977, and by 1979, had completed its first experimental prototypes. In 1982, Bruker placed its first NMR-imaging unit in an outside clinical setting. In 1983, the company acquired Oxford Research Systems, which specializes in animal research systems, from Oxford Instruments and plans to build superconducting magnets with its new subsidiary. Bruker had its first marketing prototype available for placement in 1983.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Resistive	1.3 kG	Whole body	1979
Superconducting	47 kG	Animal	1979
Superconducting	19 kG	Animal or head only	1982
Resistive (self-shielded)	2.4 kG	Whole body	1984

Collaborative arrangements with universities or medical centers: 2
1. Baylor College of Medicine, Houston, TX
2. Yale University, New Haven, CT

Clinical placement sites:

Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1. Baylor College of Medicine, Houston, TX	Resistive, 1.3 kG, whole body	1982
2. Baylor College of Medicine, Houston, TX	Superconducting, 47 kG, animal	1982
3. Japan	Resistive, 1.3 kG, whole body	1982

4, Brigham & Women's Hospital, Boston	Resistive, 1.3 kG, whole body	1983
5. Brigham & Women's Hospital, Boston	Superconducting, 19 kG, animal	1983
6. D.K.D. Hospital, Wiesbaden, West Germany	Resistive, 1.3 kG, whole body	1983
7. Yale University, New Haven, CT	Superconducting, 15 kG, whole body	1985E

Number of employees engaged in NMR imaging: 50
Other diagnostic imaging products: None
Other medical products: Parent firm makes ECG monitors, mobile defibrillator, and patient monitoring systems
Non-health-care-related products: NMR spectrometers

CGR MEDICAL CORP.
2519 Wilkins Avenue
Baltimore, MD 21203
(Head office: Paris, France)

Background: CGR Medical Corp. is a private, wholly owned subsidiary of Thompson-Brandt of France. The company was created in 1971 by the acquisition of Westinghouse Medical X-Ray Division by CGR of France, which merged in 1979 with Thompson-CSF to form Thompson-Brandt. CGR Medical Corp. decided to invest in R&D efforts for NMR imaging in 1979. Its first engineering models were available in 1982. The company expects to place its first NMR imaging unit in a clinical setting and to have available for placement its first commercial system in 1984.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Resistive	1.5 kG	Whole body	1982
Superconducting	3,5 kG	Whole body	1983
Superconducting	5 kG	Whole body	1983

Collaborative arrangements with universities or medical centers: None in USA (number in Europe not available)
Clinical placement sites: None
Number of employees engaged in NMR imaging: approximately 150
Other diagnostic imaging products: Computed tomography; ultrasonography; nuclear medicine; digital radiography; conventional X-ray and fluoroscope
Other medical products: None
Non-health-care-related products: Parent firm makes assorted electrical appliances and equipment

DIASONICS INC.
NMR Division
533 Cabot Road
South San Francisco, CA 94080

Background: Diasonics is an independent, publicly owned company. Initial R&D on NMR imaging began in 1975 as a University of California, San Francisco (UCSF) project with outside funding. In 1976 Pfizer Corp. began funding the work. In 1981, Diasonics purchased the rights to all patentable NMR technology developed under the UCSF-Pfizer agreement. Diasonics had its engineering model available in 1981, and the company made its first clinical placement of an NMR imaging unit the same year. Its first commercial prototype system became available for placement in 1983.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Superconducting	5 kG[a]	Whole body	1981

[a]System Operating at 3.5 kilogauss; probable commercial prototype system; commitment to upgrade to higher fields if Diasonics believes clinical relevance demonstrated.

Collaborative arrangements with universities or medical centers: 3

1. University of California, San Francisco
2. University of Texas, Dallas
3. University of Michigan, Ann Arbor

Clinical placement sites:

Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1. University of California, San Francisco	Superconducting, 5 kG, whole body	1981
2. Huntington Medical Research Institutes, Pasadena, CA	Superconducting, 5 kG, whole body	April 1983
3. University of Texas Health Science Center, Dallas	Superconducting, 5 kG, whole body	September 1983
4. Private radiology clinic, NJ	Superconducting, 5 kG, whole body	1983
5. University of Michigan, Ann Arbor	Superconducting, 5 kG, whole body	1983
6. St. Anthony's Professional Building St. Petersburg, FL	Superconducting, 5 kG, whole body	1984
7. UCSF-Radiation Instrumentation Laboratory, San Francisco, CA	Superconducting, 20 kG, whole body	1984
8. Montclair Radiological Association, PA, Montclair, NJ	Superconducting, 5 kG, whole body	1983
9. University of Texas Health Science Center, Dallas	Superconducting, 20 kG, whole body	1984
10. NMR Associates, Houston, TX	Superconducting, 5 kG, whole body	1984
11. Private clinic, Wuppertal, West Germany	Superconducting, 5 kG, whole body	1984
12. Institute of Radiology, Geneva, Switzerland	Superconducting, 5 kG, whole body	1984
13. Roentgen Institut, Dusseldorf, West Germany	Superconducting, 5 kG, whole body	1984
14. NMR Imaging, Torrance, CA	Superconducting, 5 kG, whole body	1984
15. Long Island MRI, New Hyde Park, NY	Superconducting, 5 kG, whole body	1984
16. Northeast Medical Center, Ft. Lauderdale, FL	Superconducting, 5 kG, whole body	1984
17. Magnetic Resonance Images, Inc., St. Petersburg, FL	Superconducting, 5 kG, whole body	1984
18. Diagnostic Imaging Center, Lausanne, Switzerland	Superconducting, 5 kG, whole body	1984
19. Heart to Heart, Phoenix, AZ	Superconducting, 5 kG, whole body	1984
20. San Jose MRI, San Jose, CA	Superconducting, 5 kG, whole body	1984

21. NMR Scan Center, Ft. Lauderdale, FL	Superconducting, 5 kG, whole body	1984
22. NMR Imaging, Santa Ana, CA	Superconducting, 5 kG, whole body	1984
23. Magnetic Resonance Center of San Diego, San Diego, CA	Superconducting, 5 kG, whole body	1984

Number **of employees engaged in NMR imaging:** 152
Other diagnostic imaging products: Ultrasonography and surgical C-arm imaging equipment
Other medical products: None
Non-health-care-related products: None

ELSCINT LTD.
Head Office: Haifa, Israel
U.S. Subsidiary: Elscint Inc.
930 Commonwealth Avenue
Boston, MA 02215

Background: Elscint is an independent, publicly owned company in Israel. The company decided to invest in R&D efforts for NMR imaging in 1981, and by 1982, had developed its first engineering model. Elscint produced its first prototype NMR imaging system in 1983 and expects to have a second prototype in late 1984. The company made its first clinical placement outside the company's plant in November 1983.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Superconducting	5 kG	Whole body	1982

Collaborative arrangements with universities or medical centers: 2
1. Hebrew University, Jerusalem, Israel
2. Weitzman Institute, Rehovoth, Israel

Clinical placement sites:

Hospital or clinic	NMR Imaging system	Date of installation (E = expected)
1. Skokie Valley Imaging, Skokie, IL	Superconducting, 5 kG, whole body	1983
2. Fondren Imaging, Houston, TX	Superconducting, 5 kG, whole body	1984
3. Private clinic, Freiburg, West Germany	Superconducting, 5 kG, whole body	1984
4, Herzlyia MRI Clinic, Herzlyia, Israel	Superconducting, 5 kG, whole body	1983

Number of employees engaged **in** NMR **imaging:** Not available
Other diagnostic imaging products: Computed tomography; ultrasonography; nuclear medicine; digital radiography; conventional X-ray; and fluoroscope
Other medical products: None
Non-health-care-related products: None

FONAR CORP.
110 Marcus Drive
Melville, NY 11747

Background: Fonar has been an independent, publicly owned corporation since 1981. Founded originally as the RAANEX Corp., it has invested in R&D efforts for NMR imaging since 1978. In 1980, Fonar completed its first experimental prototype and made its first clinical placement of a unit outside the plant. The firm's first commercial prototype system became available for placement in 1983.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Permanent	0.4 kG	Whole body	1980
Permanent	3 kG[a]	Whole body	1983
Permanent	3 kG[a]	Whole body (mobile)	1983

[a]Probable Commercial prototype system(s).

Collaborative arrangements with universities or medical centers: 1
1. University of California at Los Angeles (UCLA)

Clinical placement sites:

	Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1.	Diagnostic Imaging Associates, Cleveland, OH	Permanent, 0.4 kG, whole body	December 1980 (This unit is no longer in place)
2.	Hospital Universitario, Monterey, Nuevo Leon, Mexico	Permanent, 0.4 kG, whole body	April 1981
3.	San Raffaele Hospital, Milan, Italy	Permanent, 0.4 kG, whole body	March 1982
4.	Nakatsugawa Hospital, Nagoya, Japan	Permanent, 0.4 kG, whole body	July 1982
5.	Brunswick Memorial Hospital, Amityville, NY	Permanent, 3 kG, whole body	October 1983
6.	Universal NMR, Inc. (mobile scanner)	Permanent, 3 kG, whole body	October 1983
7.	UCLA	Permanent, 3 kG, whole body	1984
8.	Montvale Diagnostic Imaging Center, Montvale, NJ	Permanent, 3 kG, whole body	1984
9.	Neurodiagnostic Center, New York, NY	Permanent, 3 kG, whole body	1984E
10.	Chicago Medical School, Chicago, IL	Permanent, 3 kG, whole body	1984
11.	NMR Centers, Inc., Los Angeles, CA	Permanent, 3 kG, whole body	1984E
12.	Parkview Hospital, Nashville, TN (Hospital Corporation of America)	Permanent, 3 kG, whole body	1984E
13.	Loyola University, Chicago, IL	Not available	Not available
14.	Mercy Hospital, Altoona, PA	Permanent, 3 kG, whole body	1984E
15.	AMD (Advanced Medical Diagnostics), Melbourne, FL	Permanent, 3 kG, whole body	1984E
16.	NMR Investors, Inc., Santa Monica, CA	Permanent, 3 kG, whole body	1984E
17.	Odessa Diagnostic Imaging Center, Odessa, TX	Permanent, 3 kG, whole body	1984E

Number of employees engaged in NMR imaging: 100
Other diagnostic imaging products: None
Other medical products: None
Non-health-care-related products: None

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GENERAL ELECTRIC CO.
Medical Systems Business Group
P. O. Box 414
3000 Grandview Avenue
Milwaukee, WI 53201

Background: General Electric is a publicly owned, multiproduct company. The Medical Systems Business Group is responsible for NMR imaging R&D. Early R&D work in phosphorus spectroscopy began in 1978, but firm corporate commitment to NMR imaging was not made until 1980. In 1982, General Electric completed its first engineering model and made its first clinical placement of an NMR imaging unit outside the company's plant. General Electric expects to have its first commercial prototype available for placement in late 1984.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available (E = expected)
Superconducting	15 kG[a]	Whole body	1984E

[a]Probable commercial prototype.

Collaborative arrangements with universities or medical centers: 4

1. University of Pennsylvania, Philadelphia, PA
2. Medical College of Wisconsin, Milwaukee, WI
3. Yale University, New Haven, CT
4. Duke University, Durham, NC

Clinical placement sites:

Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1. University of Pennsylvania Hospital, Philadelphia, PA	Resistive, 1.2 kG, whole body	October 1982
2. Yale University School of Medicine, New Haven, CT	Resistive, 1.5 kG, whole body	August 1983
3. Duke University, Durham, NC	Superconducting, 15 kG, whole body	February 1984
4. Memorial Sloan Kettering Cancer Center, New York, NY	Superconducting, 15 kG, whole body	August 1985E
5. Medical College of Wisconsin, Milwaukee, WI	Superconducting, 15 kG, whole body	October 1984E
6. Pittsburgh NMR Institute, Pittsburgh, PA	Superconducting, 15 kG, whole body	November 1984E
7. University of Illinois, Chicago, IL	Superconducting, 15 kG, whole body	February 1984E
8. University of Nebraska, Omaha, NE	Superconducting, 15 kG, whole body	April 1985E
9. Henry Ford Hospital, Detroit, MI	Superconducting, 15 kG, whole body	January 1985E
10. Ohio State University, Columbus, OH	Superconducting, 15 kG, whole body	November 1984E
11. Michigan State University, Ann Arbor, MI	Superconducting, 15 kG, whole body	February 1985E
12. New York Hospital—Cornell University, New York, NY	Superconducting, 15 kG, whole body	December 1984E
13. Rochester Consortium, Rochester, NY	Superconducting, 15 kG, whole body	November 1984E

14. State University of New York at Albany Medical School, Albany, NY	Superconducting, 15 kG, whole body	March 1985E
15. University of Texas Health Science Center, San Antonio, TX	Superconducting, 15 kG, whole body	March 1985E
16. University of Texas/Herman Hospital, Houston, TX	Superconducting, 15 kG, whole body	March 1985E
17. Driscoll Children's Hospital, Corpus Christi, TX	Superconducting, 15 kG, whole body	March 1985E
18. University of Washington, Seattle, WA	Superconducting, 15 kG, whole body	December 1984E
19. Stanford University, Palo Alto, CA	Superconducting, 15 kG, whole body	December 1984E
20. University of Western Ontario, London, Ontario, Canada	Superconducting, 15 kG, whole body	February 1985E

Number of employees engaged in NMR imaging: in excess of 500
Other diagnostic imaging products: Computed tomography, ultrasonography, nuclear medicine, digital radiography, conventional X-ray, and fluoroscope
Other medical products: Assorted electromedical equipment
Non-health-care-related products: Assorted electrical appliances and equipment

JEOL USA, INC.
235 **Birchwood Avenue**
Cranford, NJ 07016
(Head office: Japan)

Background: JEOL USA is a publicly owned subsidiary of JEOL of Japan. JEOL has been manufacturing NMR spectrometers since 1960. In 1973, the parent firm was acquired by Mitsubishi. In 1982, the firm began investing in NMR imaging and spectrometry R&D. JEOL has decided not to pursue the clinical NMR market, and will instead focus on the research and experimentation market. The firm expects to have its first engineering model available in 1984.

Current NMR-imaging models: None
Collaborative arrangements with universities or medical centers: None
Clinical placement sites: None
Number of employees engaged in NMR imaging: 5
Other diagnostic imaging products: None
Other medical products: Radioimmunoassay equipment, blood gas analyzers; fluid analyzers
Non-health-care-related products: NMR spectrometers, Parent firm also makes electron microscopes.

M&D TECHNOLOGY LTD. *
Unit 1, Whitemyres Avenue
Aberdeen, Scotland, U.S. AB2-6HQ

Background: M&D Technology is an independent, private company in Scotland. M&D was formed in 1982 to commercially develop the NMR imaging system that had evolved from the work of Professor Mallard at Aberdeen, Scotland since 1974. M&D's first engineering model became available in 1982. In 1983 the company made its first clinical placement of a NMR imaging unit. Also, for a short time during 1983, M&D had entered into a marketing agreement with Fischer Imaging corporation. M&D expected to have a marketing prototype system available in 1984.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Resistive	0.4 kG	Whole body	197?
Resistive	0.8 kG	Whole body	1982

Collaborative arrangements with universities or medical centers: 1
1. University of Aberdeen, Scotland, U.K.

Clinical placement sites:

Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1. Edinburgh Royal Infirmary, Edinburgh, U.K.	Resistive, 0.8 kG, whole body	1983
2. Private Clinic, Geneva	Resistive, 0.8 kG, whole body	1983
3. Two additional sites		End of 1983E

Number of employees engaged **in NMR imaging:** Not available
Other diagnostic imaging products: None
Other medical products: None
Non-health-care-related products: None
*Information on M&D Technology Ltd. is as of October 1983.

NALORAC CRYOGENICS CORP.
1717 Solano Way, Suite #37
Concord, CA 94520

Background: Nalorac Cryogenics is an **independent, privately** owned company, which was founded in 1975 by Dr. James Carolan to develop and manufacture superconducting magnets, cryogenic devices, and NMR systems. In 1977, the company was acquired by Nicolet Instrument Corp. In 1981, Dr. Carolan purchased the company back from Nicolet and reaffirmed its commitment to developing NMR-imaging magnets and systems. The company currently manufactures superconducting high resolution NMR magnet systems with bore diameters from 50 to 320 mm. and field strengths from 20 kG to 70 kG. The company is presently developing a complete imaging spectrometer system which is scheduled for introduction in early 1985,

Projected NMR-imaging models (spectrometer systems):

Magnet type	Field strength	Bore size	Year first available
Superconducting	20-40 kG	Animal (330 mm)	1985E
Superconducting	20 kG	Pediatric (450 mm)	1986E
Superconducting	10 kG	Head/appendage (600 mm)	1987E

Collaborative arrangements with universities or medical centers: No formal arrangements will be announced prior to late 1984.

Clinical placement sites:

Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1. University of California, San Francisco	Superconducting, 60 kG, 100 mm bore	January 1984
2. University of Texas Health Science Center, Houston, TX	Superconducting, 20 kG, 320 mm bore	June 1984

Number of employees engaged in NMR imaging: 10
Other diagnostic imaging products: None
Other medical products: None
Non-health-care-related products: Superconducting high resolution analytical NMR magnets, gradient coils, power supplies, dewars, NMR probeheads

PHILIPS MEDICAL SYSTEMS, INC.
710 Bridgeport Avenue
Shelton, CT 06484
(Head Office: The Netherlands)

Background: Philips Medical Systems is a subsidiary of North American Philips. Approximately 61 percent of the common stock of North American Philips is owned by Connecticut National Bank as trustee of the United States Philips Trust. Through the trust, North American Philips has strong relationships with N.V. Philips and their Medical Systems Division in Eindhoven, the Netherlands. In 1977, the company made a firm commitment to invest in NMR-imaging research. In 1981, their first engineering model was completed and used to image patients in the Netherlands. In 1983, Philips installed a 15 kG whole-body system in a U.S. medical center; the system is being used to image hydrogen and sodium. Philips is presently manufacturing three NMR models for worldwide distribution. Philips has been working with both Oxford and IGC (Intermagnetics General Corp.) to obtain superconducting magnets. The company had commercial prototype systems available for placement in 1983.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Resistive	1.5 kG[a]	Whole body	1982
Superconducting	30 kG	Animal	1982
Superconducting	15 kG[a b]	Whole body	1983
Superconducting	5 kG[a b]	Whole body	1983

[a]For sale as a product in the rest of the world.
[b]Investigational status in the United States only.

Collaborative arrangements with universities or medical centers: 2

1. **Neurological** Institute, Columbia-Presbyterian Hospital, New York, NY
2. University of Leiden, Leiden, The Netherlands

Clinical placement sites:

	Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1.	Neurological Institute Columbia-Presbyterian Hospital, New York, NY	Superconducting, 30 kG, animal	1982
2.	Neurological Institute Columbia-Presbyterian Hospital, New York, NY	Superconducting, 15 kG, whole body	1983
3.	University of Leiden, The Netherlands	Resistive, 1.5 kG, whole body	1983
4.	Columbia-Presbyterian Hospital, New York, NY	Superconducting, 5 kG, whole body	1985E
5.	Emory University, Atlanta, GA	Superconducting, 15 kG, whole body	1984E
6.	New York University/Bellevue Hospital, New York, NY	Superconducting, 5 kG, whole body	1984E
7.	Northwestern University Hospital, Chicago, IL	Superconducting, 15 kG, whole body	1984E
8.	Akademisch Ziekenhuis Leiden, Leiden, The Netherlands	Resistive, 1.5 kG, whole body	August 1983
9.	Casa di cura “Pio X,” Milano, Italy	Resistive, 1.5 kG, whole body	September 1983
10.	Instituto Neurotraumatologico Italiano, Rome, Italy	Resistive, 1.5 kG, whole body	April 1984
11.	Universitá di Firenze, Florence, Italy	Superconducting, 5 kG, whole body	September 1984E

12. Casa di cura "Pio X," Milano, Italy	Superconducting, 5 kG, whole body	September 1984E
13. Erasmus Ziekenhuis/Free University, Brussels, Belgium	Superconducting, 15 kG, whole body	October 1984E
14. Universitaetsklinik Koeln Cologne, West Germany	Superconducting, 5 kG, whole body	October 1984E
15. Akademisch Ziekenhuis Leiden, Leiden, The Netherlands	Superconducting, 5 kG, whole body	November 1984E
16. Neuro Besta, Milano, Italy	Resistive, 1.5 kG, whole body	November 1984E
17. Montreal Neurological Institute, Montreal, Canada	Superconducting, 15 kG, whole body	December 1984E
18. Centro Diagnostic Immagini Computerizzate, Catania, Italy	Superconducting, 5 kG, whole body	December 1984E

Number of employees engaged in NMR imaging: 30–North American Philips (U.S.); 80—N.V. Philips (The Netherlands)

Other diagnostic imaging products: Computed tomography; ultrasonography; digital radiography; conventional X-ray and fluoroscope; nuclear medicine[c]

Other medical products: Assorted electromedical equipment. Parent firm also produces surgical supplies and dental equipment

Non-health-care-related products: NMR spectrometers. Parent company produces assorted electrical appliances and equipment

[c]**Nuclear medicine imaging** products distributed by ADAC in the United States and by N.V. Philips in the rest of the world.

PICKER INTERNATIONAL, INC.
595 Miner Road
Highland Heights, OH 44143
(Head office: United Kingdom)
(Corporate headquarters: Ohio)

Background: Picker International is a U.S. corporation operating as an 80-percent-owned subsidiary of the General Electric Company (P. L.C.) of England (GEC). The company was formed in April 1981 through the acquisition of Picker from RCA in combination with GEC Medical and Cambridge Medical Instruments. GEC had earlier acquired the NMR technology of EMI of England and, by the end of 1981, the first Picker International NMR unit was clinically operating. In 1983, the first commercial units were shipped.

Current NMR-imaging **models:**

Magnet type	Field Strength	Bore size	Year first available
Resistive	1.5 k G[a]	Whole body	1978
Superconducting	3 k G	Whole body	1981
Superconducting	5 k G[a]	Whole body	1983

[a]Probable commercial prototype.

Collaborative arrangements with universities or medical centers: 11

1. University of Nottingham, Nottingham, U.K.
2. Royal Postgraduate Medical School and Hammersmith Hospital, London, U.K.
3. Mount Sinai Hospital, Cleveland, OH
4. Mayo Clinic, Rochester, MN
5. Bowman Gray Medical School, Winston-Salem, NC
6. University of British Columbia, Vancouver, Canada
7. City of Faith Medical and Research Center, Tulsa, OK
8. National Institutes of Health, Bethesda, MD
9. University of Iowa, Iowa City, IA
10. Queens Square Hospital, London, U.K.
11. National Heart Institute, London, U.K.

Clinical placement sites:

Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1. University of Nottingham Hospital, Nottingham, U.K.	Resistive, 1.5 kG, whole body	1978
2. HIRST Research Center, London, U.K.	Resistive, 1.5 kG, whole body	November 1978
3. Queens Medical Center, Nottingham, U.K.	Resistive, 1.5 kG, whole body	February 1981
4. Hammersmith Hospital, London, U.K.	Superconducting, 3.5 kG, whole body (operating at 1.5 kG)	March 1981
5. Mount Sinai Hospital, Cleveland, OH	Resistive, 1.5 kG, whole body	October 1982
6. Mayo Clinic, Rochester, MN	Resistive, 1.5 kG, whole body	December 1982
7. University of British Columbia, Vancouver, British Columbia, Canada	Superconducting, 3 kG, whole body	March 1983
8. University of Manchester, Manchester, U.K.	Superconducting, 3 kG, whole body	March 1983
9. Bowman Gray Medical School, Winston-Salem, NC	Resistive, 1.5 kG, whole body	June 1983
10. Dr. Wallnhofer, Private Clinic, 6500 Mainz 1, Munich, West Germany	Superconducting, 3 kG, whole body	July 1983
11. Dr. Assheuer, Private Clinic, 500 Koln 80, Cologne, West Germany	Superconducting, 3 kG, whole body	October 1983
12. City of Faith Medical and Research Center, Tulsa, OK	Superconducting, 5 kG, whole body	1983
13. National Institutes of Health (NIH), Bethesda, MD	Superconducting, 5 kG, whole body	1983
14. University of Alabama, Birmingham, AL	Superconducting, 5 kG, whole body	1984E
15. Duarte CT, Duarte, CA	Superconducting, 5 kG, whole body	1984
16. Neurology Center, Washington, DC	Superconducting, 5 kG, whole body	1984
17. University of Iowa, Iowa City, IA	Superconducting, 5 kG, whole body	1984
18. Queens Square Hospital, London, U.K.	Superconducting, 5 kG, whole body	1984
19. National Heart Institute, London, U.K.	Superconducting, 5 kG, whole body	1984
20. Private clinic, Cologne, West Germany	Superconducting, 5 kG, whole body	1984
21. Private clinic, Frankfurt, West Germany	Superconducting, 5 kG, whole body	1984
22. Chiba University, Chiba City, Japan	Superconducting, 5 kG, whole body	1984
23. First Hill Diagnostic, Seattle, WA	Resistive, 1.5 kG, whole body	1984
24. Glasgow Hospital, Glasgow, Scotland	Resistive, 1.5 kG, whole body	1984
25. Shinsuma University, Cobe, Japan	Resistive, 1.5 kG, whole body	1984
26. Picker Clinical Research Center, Cleveland, Ohio	Resistive, 1.5 kG, whole body	1984
27. Picker Clinical Research Center, Cleveland, OH	Superconducting, 5 kG, whole body	1984

28. Picker Clinical Research Center, Cleveland, OH	Superconducting, 15 kG, whole body	1984
29. HIRST Research Center, London, U.K.	Superconducting, 20 kG, whole body	1984

Number of employees engaged in NMR imaging: 410
Other diagnostic imaging products: Computed tomography; ultrasonography; nuclear medicine; digital radiography; conventional X-ray; and fluoroscope
Other medical products: Electrocardiogram equipment. Parent company makes other electromedical equipment
Non-health-care-related products: None

SIEMENS MEDICAL SYSTEMS, INC.
186 Wood Avenue South
Iselin, NJ 08830
(Head office: West Germany)

Background: Siemens Medical Systems is a publicly owned subsidiary of Siemens A.G. of West Germany. As early as 1965, Siemens had a research group in NMR working on blood flow and blood viscosity. In 1978, the company made a commitment to develop NMR-imaging systems. The first engineering model was put into operation in 1980. A year later, Siemens made its first clinical placement of an NMR-imaging unit outside the company's plant. The company had a commercial prototype system available for placement in 1983.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Resistive	1.2 kG	Whole body	1980
Resistive	2 kG	Whole body	1981
Superconducting	5 kG[a]	Whole body	1983
Superconducting	15 kG[a]	Whole body	1983

[a]Probable commercial prototypes.

Collaborative arrangements with universities or medical centers: 6
1. Washington University, St. Louis, MO
2. University of Hanover Medical Center, Hanover, West Germany
3. Radiological Institute, Frankfurt, West Germany
4. Radiological Institute, Munich, West Germany
5. Mount Sinai Medical Center, Miami, FL
6. Allegheny General Hospital, Pittsburgh, PA

Clinical placement sites:

Hospital or clinic	NMR imaging system	Date of installation (E = expected)
1. University of Hanover Medical Center, Hanover, West Germany	Resistive, 2 kG, whole body	1982
2. Radiological Institute, Munich, West Germany (Dr. Heller)	Superconducting, 5 kG, whole body	June 1983
3. Mallinckrodt Institute, Washington University, St. Louis, MO	Superconducting, 5 kG, whole body	July 1983
4. Radiological Institute, Frankfurt, West Germany (Dr. Kuehnert)	Superconducting, 5 kG, whole body	September 1983
5. Allegheny General Hospital, Pittsburgh, PA	Superconducting, 5 kG, whole body	October 1983

6. Mount Sinai Medical Center, Miami FL	Superconducting, 5 kG, whole body	November 1983
7. Mallinckrodt Institute, Washington University, St. Louis, MO	Superconducting, 20 kG, whole body	May 1984
8. St. Vincent Medical Center, Los Angeles, CA	Superconducting, 5 kG, whole body	April 1984
9. Pomona Valley Community Hospital, Pomona, CA	Superconducting, 15 kg, whole body	1984E
10. Loma Linda University Medical Center, Loma Linda, CA	Superconducting, 15 kG, whole body	1984E
11. Memorial Hospital Medical Center of Long Beach, Long Beach, CA	Superconducting, 15 kG, whole body	April 1984
12. Hershey Medical Center, Hershey, PA	Superconducting, 15 kG, whole body	NA
13. Boone County Medical Center, Columbia, MO	Superconducting, 5 kG, whole body	April 1984
14. Radiology Associates, Little Rock, AR	Superconducting, 10 kG, whole body	May 1984
15. St. Francis Medical Center, Peoria, IL	Superconducting, 5 kG, whole body	1984E
16. Digital Diagnostics, Baton Rouge, LA	Superconducting, 15 kG, whole body	1984E
17. Magnetic Resonance Imaging, Inc., Brooklyn, NY	Superconducting, 15 kG, whole body	1984E
18. Wendover Park Associates, Greensboro, NC	Superconducting, 10 kG, whole body	1984E
19. University of Minnesota, Minneapolis, MN	Superconducting, 10 kG, whole body	1984E
20. Ochsner Foundation, New Orleans, LA	Superconducting, 20 kG, whole body	1984E
21. University of Virginia, Charlottesville, VA	Superconducting, 10 kG, whole body	1984E
22. American Shared Hospital Services, San Francisco, CA	Superconducting, 15 kG, whole body	April 1984
23. Pacific Medical Center, San Francisco, CA	Superconducting, 10 kG, whole body	1984E
24. Siemens Headquarters, Iselin, NJ	Superconducting, 20 kG, whole body	March 1984
25. Flower Hospital, Toledo, OH	Superconducting, 10 kG, whole body	1984E
26. Magnetic Imaging Associates, Los Angeles, CA	Superconducting, 15 kG, whole body	1984E
27. Southwest Texas Methodist Hospital, San Antonio, TX	Superconducting, 15 kG, whole body	1984E
28. University Diagnostic Institute of Tampa, Tampa, FL	Superconducting, 10 kG, whole body	1984E
29. American Shared Services, San Francisco, CA	Superconducting, 10 kG, whole body	five systems expected in 1984-85
30. Florida Medical Association, Tampa, FL	Superconducting, 10 kG, whole body	1984E
31. Medical College of Virginia, Richmond, VA	Superconducting, 10 kG, whole body	1984E

32. Magnetic Resonance, Inc., Rockville, MD	Superconducting, 10 kG, whole body	1984E
33, Magnetic Resonance of Williamsport, Williamsport, VA	Superconducting, 15 kG, whole body	1984E
34. Mid Miami Assets MRI, Miami, FL	Superconducting, 15 kG, whole body	1984E
35. Harper Hospital, Detroit, MI	Superconducting, 15 kG, whole body	1984E
36. Faculty Medical Practice, Memphis, TN	Superconducting, 20 kG, whole body	1984E
37. New England Medical Center, Boston, MA	Superconducting, 10 kG, whole body	1984E
38. Long Island Jewish Hospital, New Hyde Park, NY	Superconducting, 20 kG, whole body	1984E
39. Methodist Hospital, Houston, TX	Superconducting, 5 kG, whole body	1984E
40. Nebraska Methodist Hospital, Omaha, NE	Superconducting, 15 kG, whole body	1984E
41, Mount Sinai Medical Center, Miami, FL	Superconducting, 15 kG, whole body	1984E
42. Methodist Hospital, Houston, TX	Superconducting, 20 kG, whole body	1984E
43. Fox Chase Medical Center, Philadelphia, PA	Superconducting, 20 kG, whole body	1984E
44. Private clinic, New York, NY	Superconducting, 10 kG, whole body	1984E
45. New Rochelle Radiology, New Rochelle, NY	Superconducting, 5 kG, whole body	1984E
46. Private clinic, Munich, West Germany	Superconducting, 5 kG, whole body	1984
47. University of Berlin, Berlin, West Germany	Superconducting, 5 kG, whole body	1984
48. University of Hiedelberg, Heidelberg, West Germany	Superconducting, 5 kG, whole body	1984
49. University of Hiedelberg, Heidelberg, West Germany	Superconducting, 15 kG, whole body	1984
50. University of Upsala, Upsala, Sweden	Superconducting, 5 kG, whole body	1984
51. University of Tokyo, Tokyo, Japan	Superconducting, 5 kG, whole body	1984

Number of employees engaged in NMR imaging: 100

Other diagnostic imaging products: Computed tomography; ultrasonography; nuclear medicine; digital radiography; conventional X-ray; and fluoroscope

Other medical products: Assorted electromedical equipment

Non-health-care-related products: Parent company produces assorted electrical appliances and equipment

TECHNICARE CORP.
29100 Aurora Road
Solon, OH 44139

Background: Technicare is a publicly owned subsidiary of Johnson & Johnson. Johnson & Johnson made an initial commitment to NMR imaging as early as 1977, but major R&D effort did not begin until the acquisition of Technicare in 1979 from Ohio Nuclear. In 1980, the company completed its first engineering model. The following year Technicare made its first clinical placement of an NMR-imaging system. In 1982, the Magnet Corporation of America was acquired to build superconducting magnets for Technicare's NMR-imaging systems. That same year, Technicare had its first commercial prototype available for placement.

Current NMR-imaging models:

Magnet type	Field strength	Bore size	Year first available
Superconducting	15 kG[a]	Animal	1980
Resistive	1.5 kG[a]	Head only	1981
Superconducting	3 kG[b]	Whole body	1982
Superconducting	5 kG[a]	Whole body	1983
Superconducting	6 kG	Whole body	1983
Superconducting	15 kG	Whole body	1983

[a]Probable commercial prototype system(s).
[b]No longer available.

Collaborative arrangements with universities or medical centers: 17

1. Massachusetts General Hospital, Boston, MA
2. University Hospital, Cleveland, OH
3. Cleveland Clinic Foundation, Cleveland, OH
4. University of Kentucky, Lexington, KY
5. Indiana University, Indianapolis, IN
6. Hershey Medical Center, Hershey, PA
7. Millard Fillmore Hospital, Buffalo, NY
8. St. Joseph's Hospital, London, Ontario, Canada
9. Johns Hopkins University, Baltimore, MD
10. Ontario Cancer Institute, Toronto, Canada
11. Charlotte Memorial Hospital, Charlotte, NC
12. New York Hospital, New York, NY
13. Vanderbilt University, Nashville, TN
14. Defalquu Clinic, Charleroi, Belgium
15. University of Florida, Gainesville, FL
16. Baylor University Medical Center, Dallas, TX
17. Rush Presbyterian-St. Luke's Medical Center, Chicago, IL

Clinical placement sites:

Hospital or clinic	NMR imaging system	**Date of installation** (E = expected)
1. Massachusetts General Hospital, Boston, MA	Superconducting, 15 kG, animal	1981
2. Massachusetts General Hospital, Boston, MA	Resistive, 1.5 kG, head only	1981
3. University Hospital, Cleveland, OH	Superconducting, 3.0 kG, whole body	October 1982
4. Cleveland Clinic Foundation, Cleveland, OH	Resistive, 1.5 kG, whole body	November 1982
5. University of Kentucky, Lexington, KY	Resistive, 1.5 kG, whole body	December 1982

6. Indiana University, Indianapolis, IN	Resistive, 1.5 kG, whole body	February 1983
7. Hershey Medical Center, Hershey, PA	Resistive, 1.5 kG, whole body	February 1983
8. Millard Fillmore Hospital, Buffalo, NY	Resistive, 1.5 kG, whole body	March 1983
9. St. Joseph's Hospital, London, Ontario, Canada	Resistive, 1.5 kG, whole body	March 1983
10. Ontario Cancer Institute, Toronto, Canada	Resistive, 1.5 kG, whole body	March 1983
11. New York Hospital, New York, NY	Superconducting, 5 kG, whole body	June 1983
12. Charlotte Memorial Hospital, Charlotte, NC	Resistive, 1.5 kG, whole body	February 1983
13. Defalque Clinic, Charleroi, Belgium	Resistive, 1.5 kG, whole body	April 1983
14. Vanderbilt University, Nashville, TN	Superconducting, 5 kG, whole body	July 1983
15. Shands Teaching Hospital, University of Florida, Gainesville, FL	Resistive, 1.5 kG, whole body	October 1983
16. Houston Imaging Center, Houston, TX	Superconducting, **3** kG, whole body	July 1983
17. Cleveland Clinic Foundation, Cleveland, OH	Superconducting, **6** kG, whole body	August 1983
18. Cleveland Clinic Foundation, Cleveland, OH	Superconducting, 15 kG, whole body	May 1984
19. Massachusetts General Hospital, Boston, MA	Superconducting, 6 kG, whole body	February 1984
20. Scottsdale Memorial Hospital, Scottsdale, AZ	Superconducting, 6 kG, whole body	September 1983
21. AMC Cancer Research Center and Hospital, Lakewood, CO	Resistive, 1.5 kG, whole body	June 1983
22. St. Luke's Hospital, Jacksonville, FL	Resistive, 1.5 kG, whole body	December 1983
23. Rush Presbyterian-St. Luke's Medical Center, Chicago, IL	Superconducting, 5 kG, whole body	November 1983
24. Greenberg Radiology Clinic, Highland Park, IL	Resistive, 1.5 kG, whole body	June 1983
25. North Shore University Hospital, Manhasset, NY	Superconducting, 6 kG, whole body	December 1983
26. University Park Imaging, Urbana, IL	Superconducting, 6 kG, whole body	June 1984
27. Veterans Administration Medical Center, St. Louis, MO	Resistive, 1.5 kG, whole body	February 1984
28. NMR SA, Barcelona, Spain	Resistive, 1.5 kG, whole body	January 1984
29. ML and Associates, New York, NY	Resistive, 1.5 kG, whole body	October 1983
30. University Hospitals of Cleveland/ Case Western Reserve University, Cleveland, OH	Superconducting, 15 kG, whole body	July 1984
31. Baylor University Medical Center, Dallas, TX	Superconducting, 6 kG, whole body	January 1984
32. Temple Radiology, New Haven, CT	Resistive, 1.5 kG, whole body	February 1984
33. Albert Einstein Medical Center, Philadelphia, PA	Resistive, 1.5 kG, whole body	March 1984
34. Nuclear Facilities, Brooklyn, NY	Superconducting, 5 kG, whole body	May 1984

35. NMR Diagnostic Center, Sun City, AZ	Resistive, 1.5 kG, whole body	January 1984
36. Garden State Medical Center, Marlton, NJ	Superconducting, 6 kG, whole body	June 1984
37. Magnetic Imaging of Bellville, Bellville, IL	Superconducting, 6 kG, whole body	March 1984
38. Private clinic, Union, NJ	Superconducting, 6 kG, whole body	August 1984
39. Ft. Worth Magnetic Imaging Institute, Ft. Worth, TX	Superconducting, 5 kG, whole body	August 1984
40. Broward NMR, Ft. Lauderdale, FL	Superconducting, 5 kG, whole body	January 1984
41. Clairval Hospital, Marseille, France	Resistive, 1.5 kG, whole body	December 1983
42. Private clinic, Hanover, West Germany	Superconducting, 5 kG, whole body	November 1983
43. Clinique du Park, Paris, France	Resistive, 1.5 kG, whole body	April 1984
44. Private clinic, Antwerp, Belgium	Resistive, 1.5 kG, whole body	April 1984

Number of employees engaged in NMR **imaging:** 100
Other diagnostic imaging products: Computed tomography; ultrasonography; nuclear medicine; digital **radiography**
Other medical products: Parent firm makes surgical instruments and supplies; dental equipment
Non-health-care-related products: None