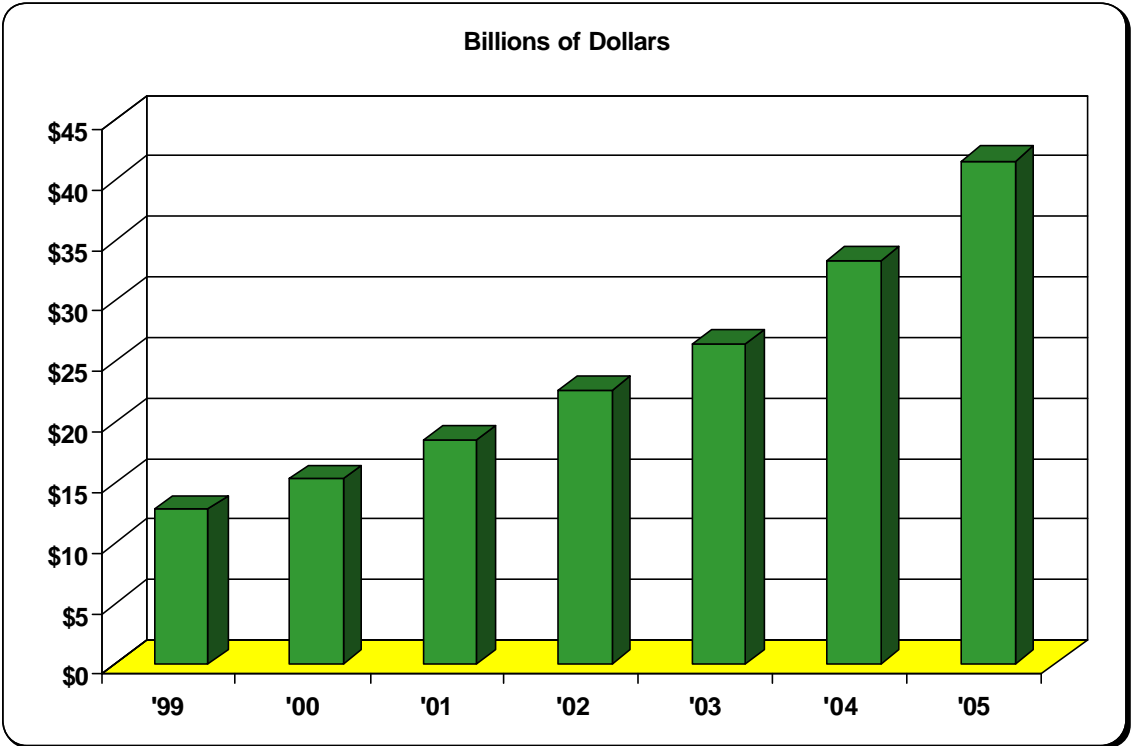


1 Executive Overview

This is the seventh year of Micrologic Research’s coverage of the wireless communications market. This year we have greatly expanded our coverage of the wireless data communications market. This study includes chapters on such topics as fixed broadband wireless, telematics, wireless LANs, and the Global Positioning System plus two chapters on Bluetooth. This chapter provides some of the top-level numbers that are broken into more detail in the remaining chapters. This chapter also discusses the methodology we followed in preparing the report.

1.1 Semiconductors for Wireless



'99	'00	'01	'02	'03	'04	'05
\$12.8	\$15.3	\$18.5	\$22.6	\$26.5	\$33.3	\$41.6

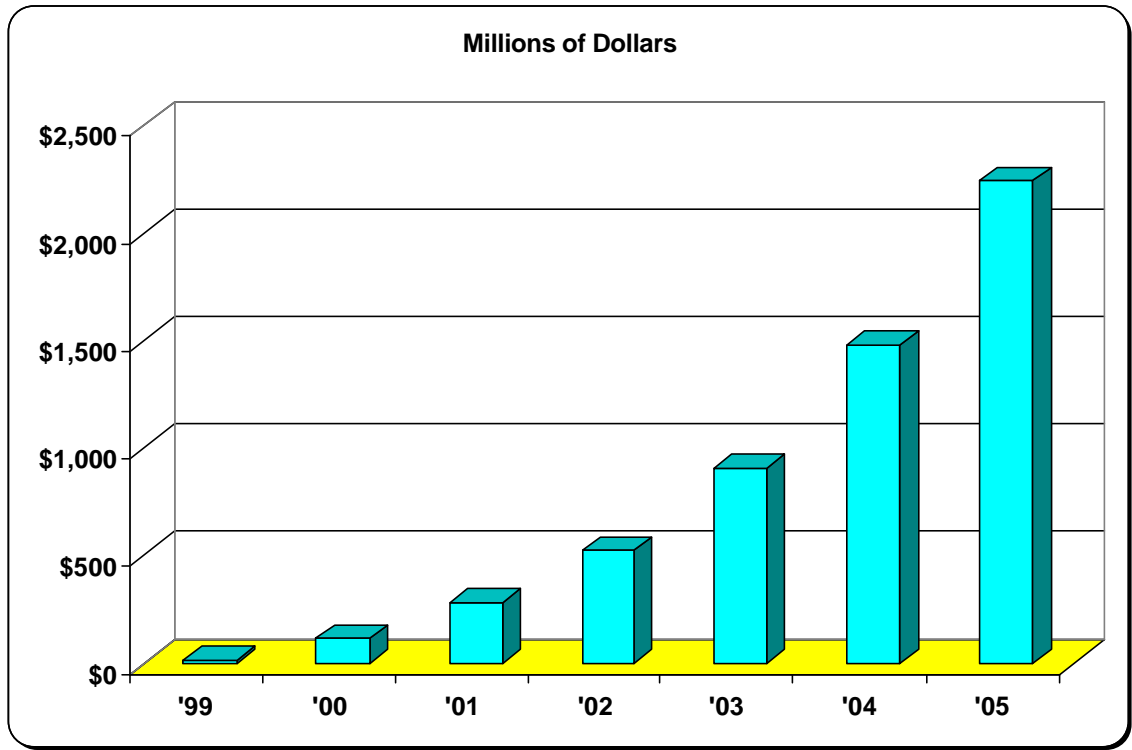
Source: Micrologic Research

Figure 1—1 Worldwide Wireless Chip Market

The two most important technologies that drive progress in wireless communications are software and semiconductors. Most wireless devices—such as cellular telephones and two-way pagers—depend upon embedded digital signal processors and microprocessors, the software that powers them, and the semiconductor circuitry that surrounds the processors.

Figure 1-1 graphs Micrologic Research’s forecast for revenues generated by the sale of semiconductor integrated circuits into the worldwide wireless communications market, which includes all forms of wireless communications and not just the wireless data applications discussed in this chapter. From 2001 through 2005, we forecast the worldwide market for semiconductors used in wireless applications will experience a compound rate (CAGR) of 22.5 percent to reach \$41.6 billion.

1.1.1 Silicon-Germanium Forecast

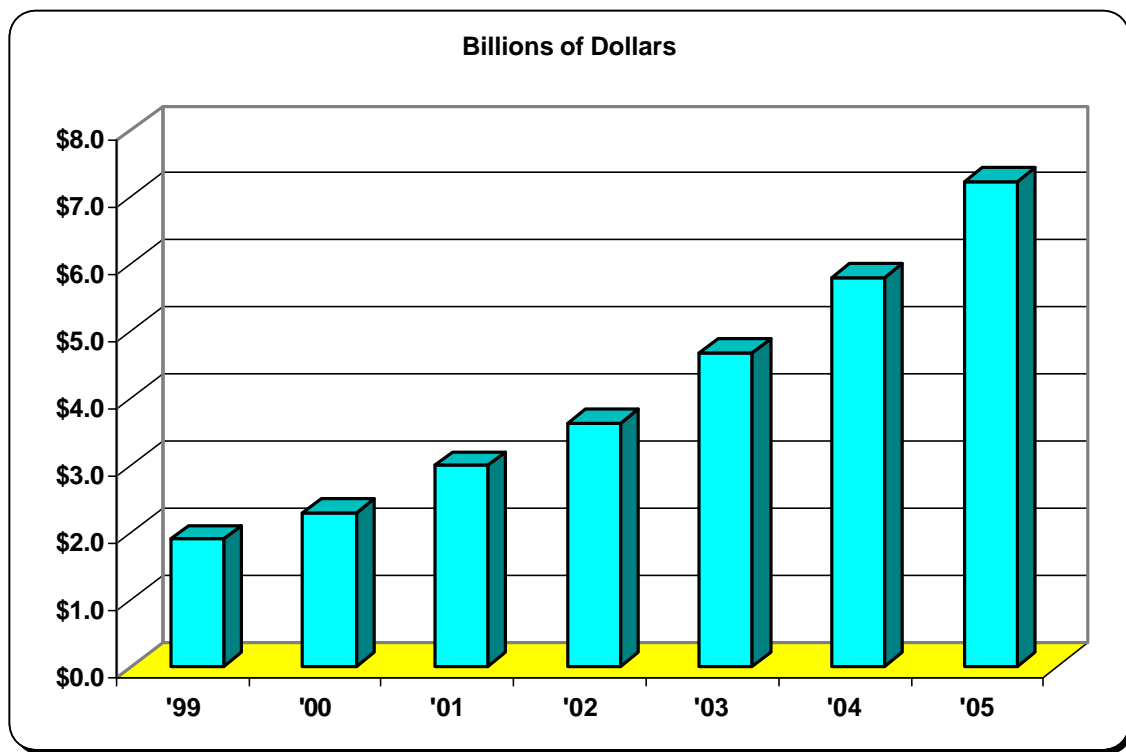


'99	'00	'01	'02	'03	'04	'05
\$18	\$117	\$283	\$523	\$907	\$1,484	\$2,242

Figure 1—2 – Worldwide SiGe Semiconductor Shipments

One of the technologies that are beginning to make wireless communications at higher RF frequencies possible is Silicon-Germanium (SiGe). Figure 1-2 shows that the SiGe market was just getting underway in 1999 when shipments totaled a mere \$18 million and that shipments jumped to \$117 million in 2000. We expect the use of SiGe to increase substantially, because semiconductor manufacturers have learned how to work with it and adapt it to inexpensive products such as Bluetooth. We forecast that the worldwide market for SiGe semiconductors, for all uses including wireless, will grow from \$283 million in 2001 to \$2,242 million in 2005, a CAGR of 67.8 percent.

1.1.2 Gallium Arsenide Forecast



'99	'00	'01	'02	'03	'04	'05
\$1.9	\$2.3	\$3.0	\$3.6	\$4.7	\$5.8	\$7.2

Source: Micrologic Research

Figure 1—3 – Worldwide GaAs Semiconductor Shipments

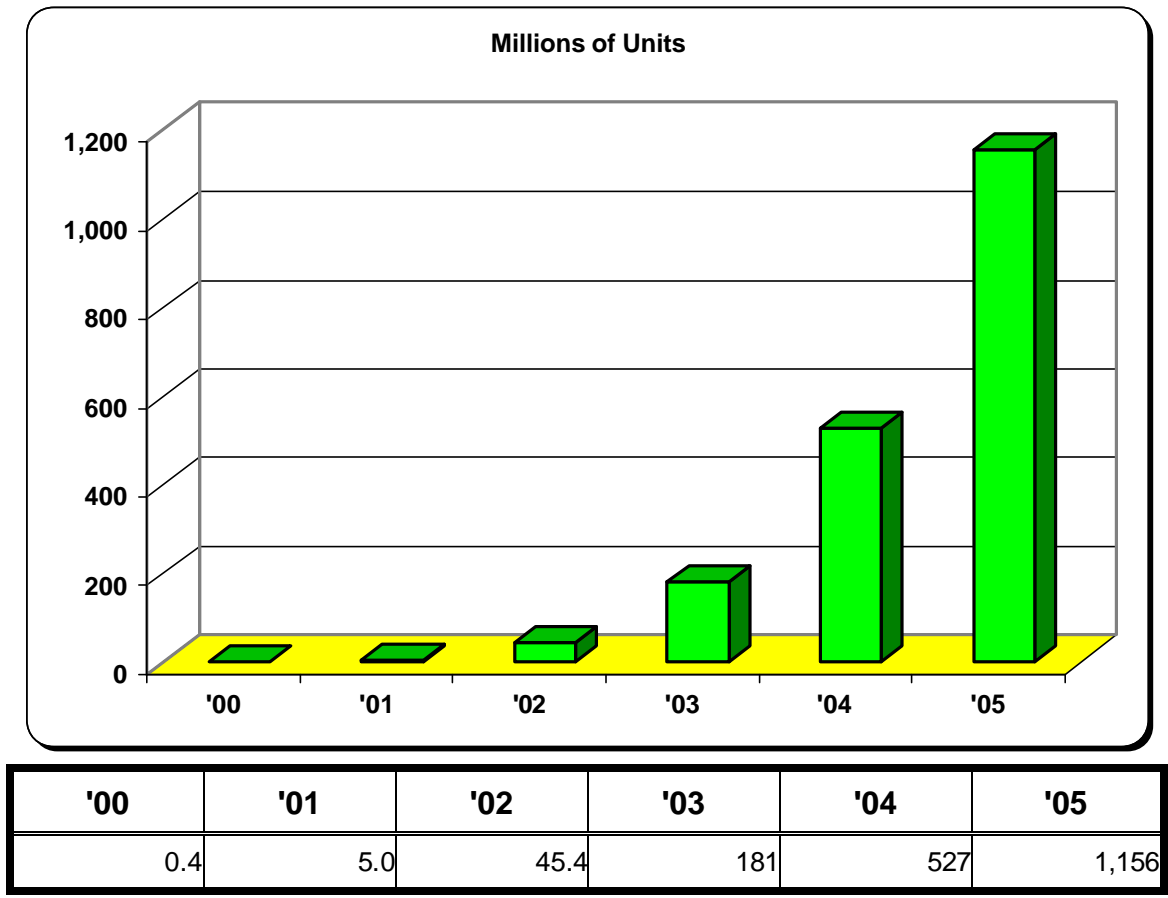
Although SiGe is becoming more popular in the receiver side of cellular telephones and other wireless devices, Gallium Arsenide (GaAs) is still preferred in the transmitter front end, because it is better suited to handle higher power.

ers. As Figure 1-3 shows, worldwide GaAs semiconductor shipments totaled \$1.9 billion in 1999 and \$2.3 billion in 2000. These figures are for all uses of GaAs semiconductors and are not limited to wireless. From 2001 through 2005, we expect the worldwide shipments of GaAs semiconductors to increase from \$3.0 billion to \$7.2 billion, a CAGR of 24.5 percent.

1.2 Selected Wireless Data Forecasts

This section contains some of the top-level statistics and forecasts from the remaining chapters of the *Wireless Data Communication 2001* market study. These wireless technologies and their markets are discussed in much more detail in the remaining eight chapters.

1.2.1 Bluetooth



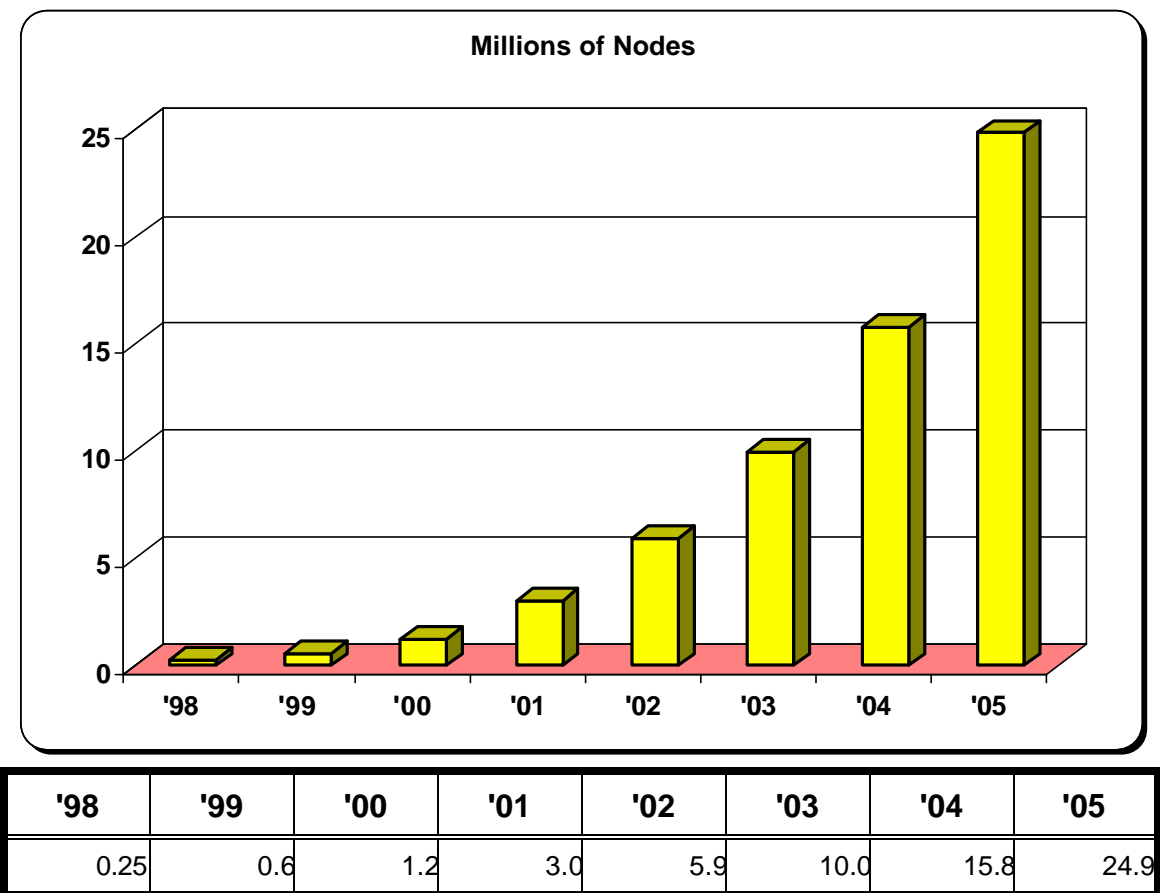
Source: Micrologic Research

Figure 1—4 – Worldwide Bluetooth Chipset Unit Shipments

The Bluetooth market is just beginning. Micrologic Research’s forecast for Bluetooth chipset shipments is graphed in Figure 1-4. Approximately 400,000 Bluetooth chipsets were sold worldwide in 2000. In 2001, we forecast that five million Bluetooth chipsets will be sold. Thereafter, we expect Bluetooth chipset shipments to grow at a compound annual rate of 290 percent to reach 1,156 million units in 2005.

1.2.2 Wireless LANs

Figure 1-5 graphs the number of wireless-LAN nodes shipped worldwide since 1998 and graphs Micrologic Research’s forecast for the number of nodes that will ship through 2005. From 250,000 nodes shipped in 1998, the market grew to 1.2 million nodes in 2000, a CAGR of 119 percent. We forecast that 3.0 million wireless-LAN nodes will ship worldwide in 2001 growing to 24.9 million in 2005, a CAGR of 69.7 percent.



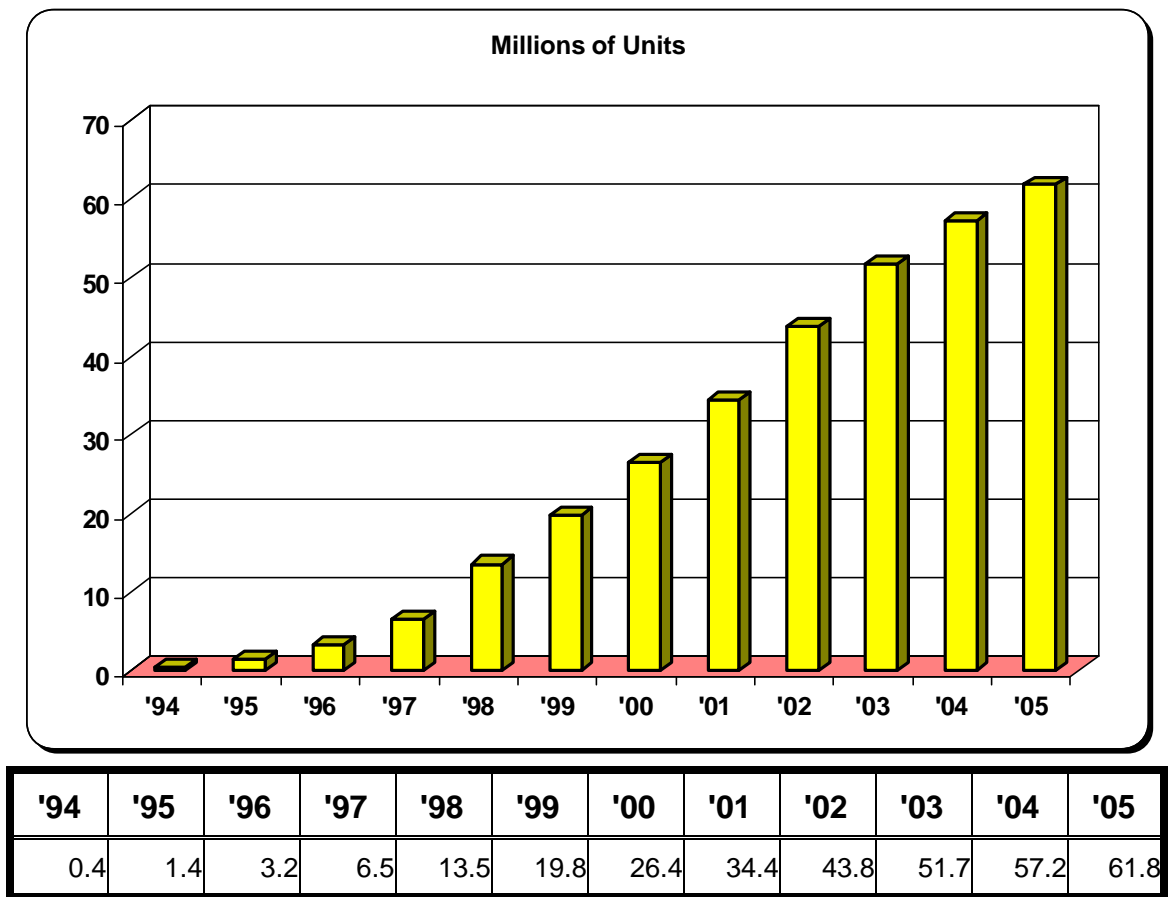
Source: Micrologic Research

Figure 1—5 - Worldwide Wireless LAN Node Shipments

1.2.3 DECT

Strictly speaking, DECT is a cordless telephone standard used primarily in Europe. However, DECT also includes data-communication capabilities, and DECT technology has been included in the HomeRF wireless LAN specifications. DECT itself has also been proposed as a wireless home-networking technology. For these reasons, we include DECT statistics and forecasts in *Wireless Data Communication 2001*.

Figure 1-6 graphs unit shipments of DECT cordless telephones, which increased from a mere 400,000 telephones in 1994 to 26.4 million units in 2000, a CAGR of 101 percent. We forecast worldwide shipments of DECT telephones will grow from 34.4 million in 2001 to 61.8 million in 2005, a CAGR of 15.8 percent.



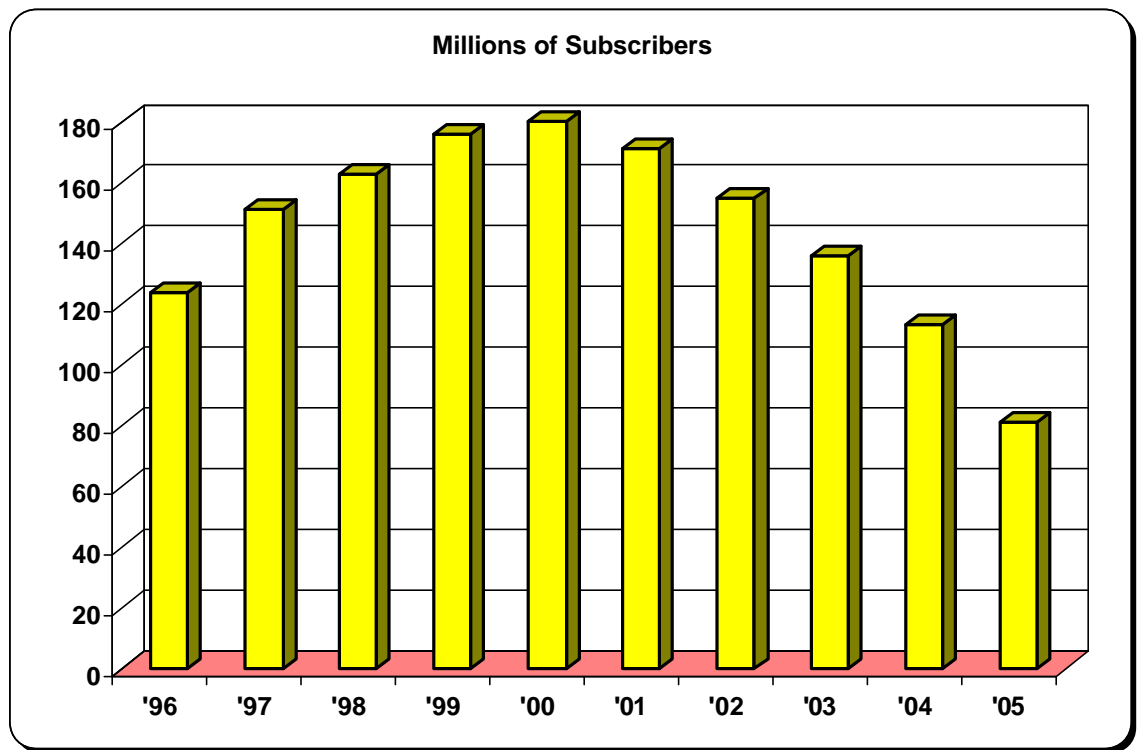
Source: The DECT Forum and Micrologic Research.

Figure 1—6 - DECT Telephone Unit Shipments

1.2.4 Paging and Messaging

If you live in Europe, you may think that cellular telephony has displaced the wireless paging and messaging market. If you live in China or North America, you know that this market is still very much alive. Although simple numeric paging is in decline, wireless two-way messaging, often referred to as two-way paging, has become very popular among professionals who must have access to their Internet E-mail no matter where they are.

Figure 1-7 graphs the number of paging and wireless messaging subscribers worldwide, most of who are in China. Through the year 2000 worldwide paging and wireless messaging subscribers continued to grow, thanks two-way messaging and wireless access to Internet services. From 1996 through 2000, the subscriber base increased at a CAGR of 9.8 percent. However, we believe that the total number of paging and wireless messaging subscribers is now in decline. We forecast worldwide subscribers to decline from 171 million in 2001 to 81 million in 2005, an average annual decline of 17.0 percent.



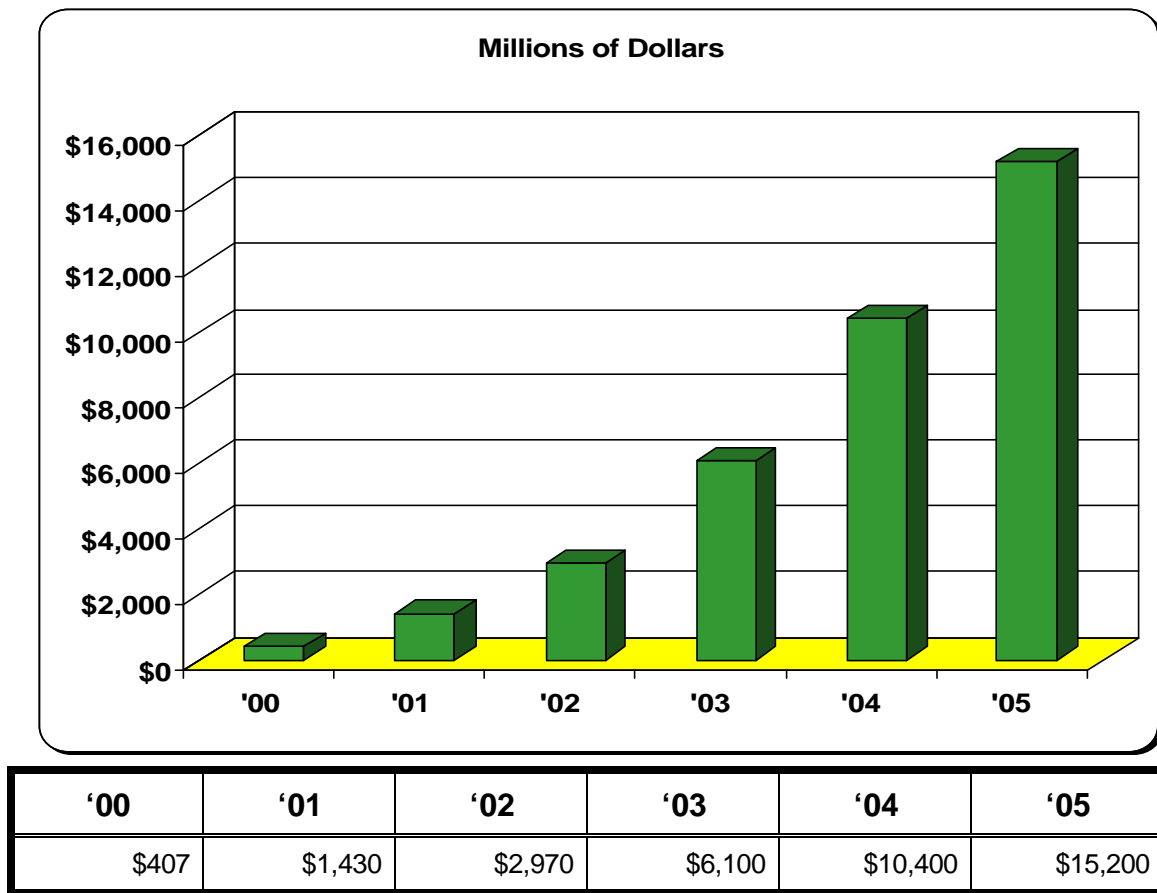
'96	'97	'98	'99	'00	'01	'02	'03	'04	'05
124	151	163	176	180	171	155	136	113	81

Source: Motorola & Micrologic Research

Figure 1—7 – Worldwide Paging and Messaging Subscribers

1.2.5 Broadband Fixed Wireless

Figure 1-8 graphs Micrologic Research’s forecast for revenues earned by supplying fixed broadband wireless services worldwide, which we estimate will grow to \$1,430 million in 2001 from \$407 million in 2000. From 2001 through 2005, we forecast worldwide revenues from the sale of fixed broadband wireless service will experience a CAGR of 80.6 percent to reach \$15,200 at the end of that period.

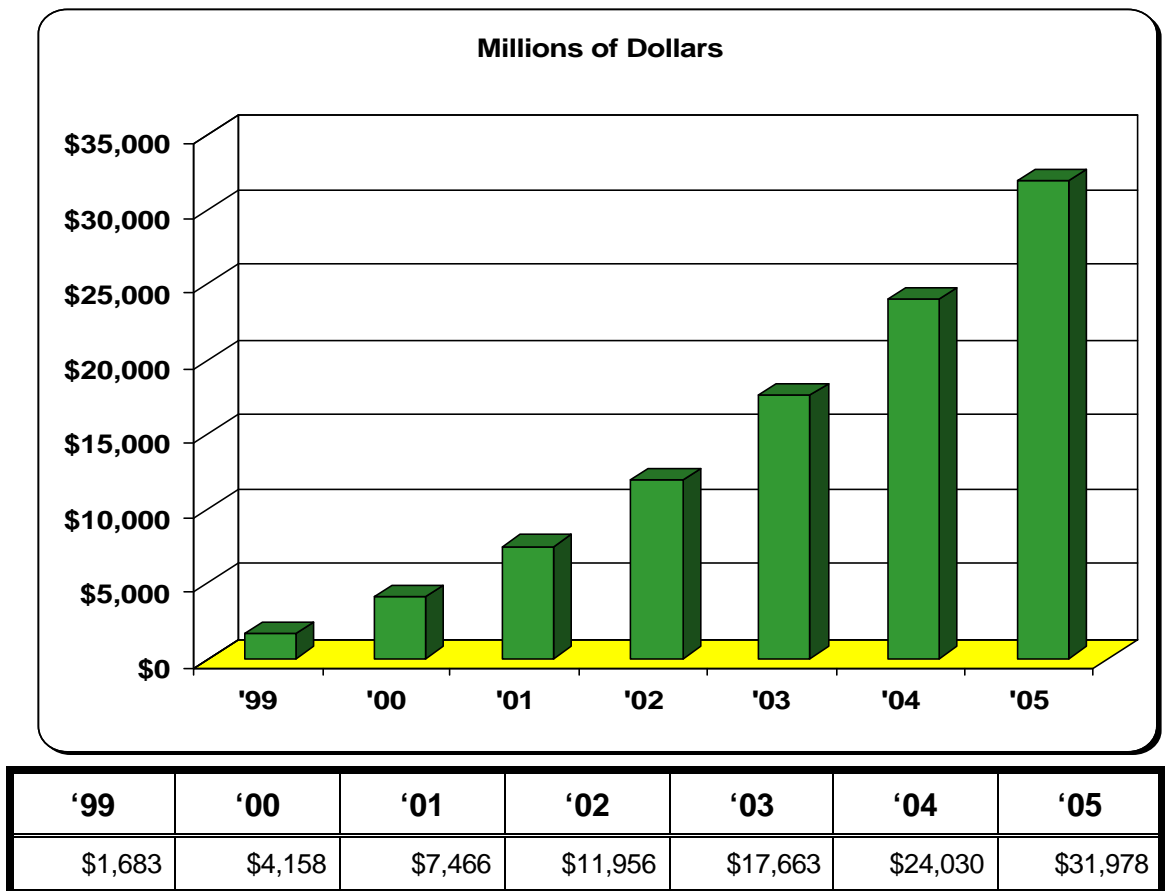


Source: Micrologic Research

Figure 1—8 – Worldwide Broadband Wireless Service Revenues

1.2.6 The Global Positioning System

Figure 1-5 graphs Micrologic Research’s forecast for revenues from the total worldwide sales of GPS equipment, which grew 147 percent from \$1,683 million in 1999 to \$4,158 million in 2000. We forecast that the worldwide market for GPS will grow from \$7,466 million in 2001 to \$31,978 million in 2005, a CAGR of 43.9 percent.

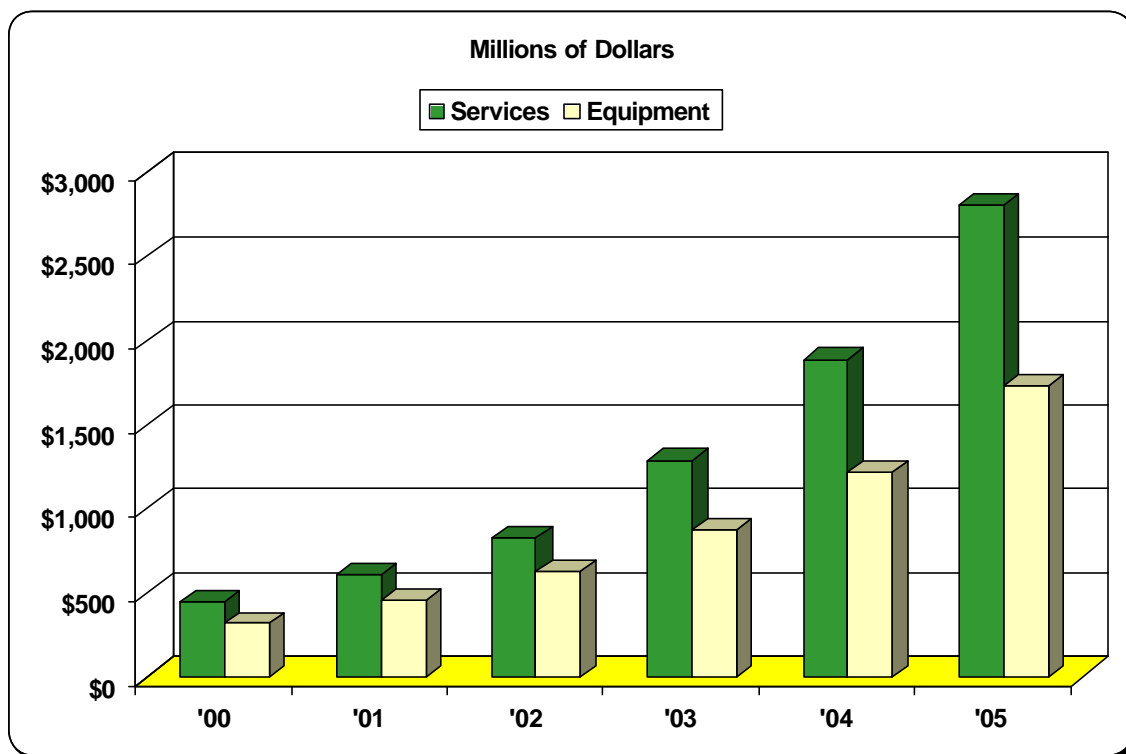


Source: Micrologic Research

Figure 1—9 – Worldwide Total GPS Shipments

1.2.7 Telematics

Figure 1-10 graphs Micrologic Research’s forecast for worldwide telematics revenues from the sale of services and equipment. We expect the telematics market to grow from \$770 million in 2000 to \$4.5 billion in 2005, a CAGR of 42.6 percent. We expect service revenues will be larger than the revenues from selling telematics equipment. Most telematics equipment will be sold with the car when it is new and will remain in service as long as the car is on the road. We expect the aftermarket for telematics equipment to be comparatively small. Services, on the other hand, will be a continuing source of revenue with subscribers receiving monthly bills.



	'00	'01	'02	'03	'04	'05
Services	\$450	\$610	\$832	\$1,286	\$1,887	\$2,810
Equipment	\$320	\$460	\$626	\$872	\$1,219	\$1,730
Total	\$770	\$1,070	\$1,458	\$2,158	\$3,106	\$4,540

Source: Micrologic Research

Figure 1—10 – Worldwide Telematics Revenues

1.3 Methodology

Wireless Data Communications 2001 is a complex study that covers a number of wireless data technologies. The methods we used to measure and forecast different segments of the wireless data market vary greatly by market segment. The wireless-LAN market has a history and an established market, whereas Bluetooth is a brand new technology whose public acceptance, costs of manufacture, etc. are more difficult to predict. The two markets require very different approaches.

Our basic approach to each of the markets was to talk to as many people in the markets as possible. For example, to develop the cost for the bill of materials for the Bluetooth market, we talked to and met with scores (that is not an exaggeration) of companies involved in the Bluetooth market including semiconductor suppliers, module designers, and equipment manufacturers. We tried to obtain the opinion of each on the cost of the components required to build a Bluetooth node. Cost estimates varied greatly both by manufacturer and by application. The cost of building Bluetooth into a cellular handset will probably not be the same as building a Bluetooth USB adapter.

From the information we gathered, we tried to come up with the average cost of materials for a Bluetooth node. We caution that the numbers should only be taken as a guide. Because the costs are averages, the cost of materials for many specific applications will vary greatly from our average estimates.

To use our other example, the Wireless LAN market was easier to analyze, because 802.11-based LANs have been shipping for several years, unlike Bluetooth, whose market is just beginning. There is a history of wireless LAN market data to analyze, and there is much more hard information available.

Broadband wireless access presents more difficulties. LMDS, for example, seems to be a technology that is much in demand, but this year two important LMDS suppliers declared bankruptcy and drastically slowed the build-out of their networks. History and market demand alone are not a sufficient basis for forecasting this market. The forecaster must also make assumptions about the availability of financing to continue installing infrastructure. We have the opinion that financing will be available, and we have made our forecasts accordingly.

If the above discussion makes it sound as if there is a lot of opinion and uncertainty in our forecasts, it is true. We wish it were possible to use a computer model to forecast wireless markets with confidence, but it is not. It is necessary to have forecasts in order to plan, even though we all know that the best forecasts will almost always be somewhat inaccurate and that the worst will sometimes miss the mark by a wide margin. We hope that our forecasts fall into the former category.