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**Chapter 3**

# **Market Penetration Model and Technology Assumptions**

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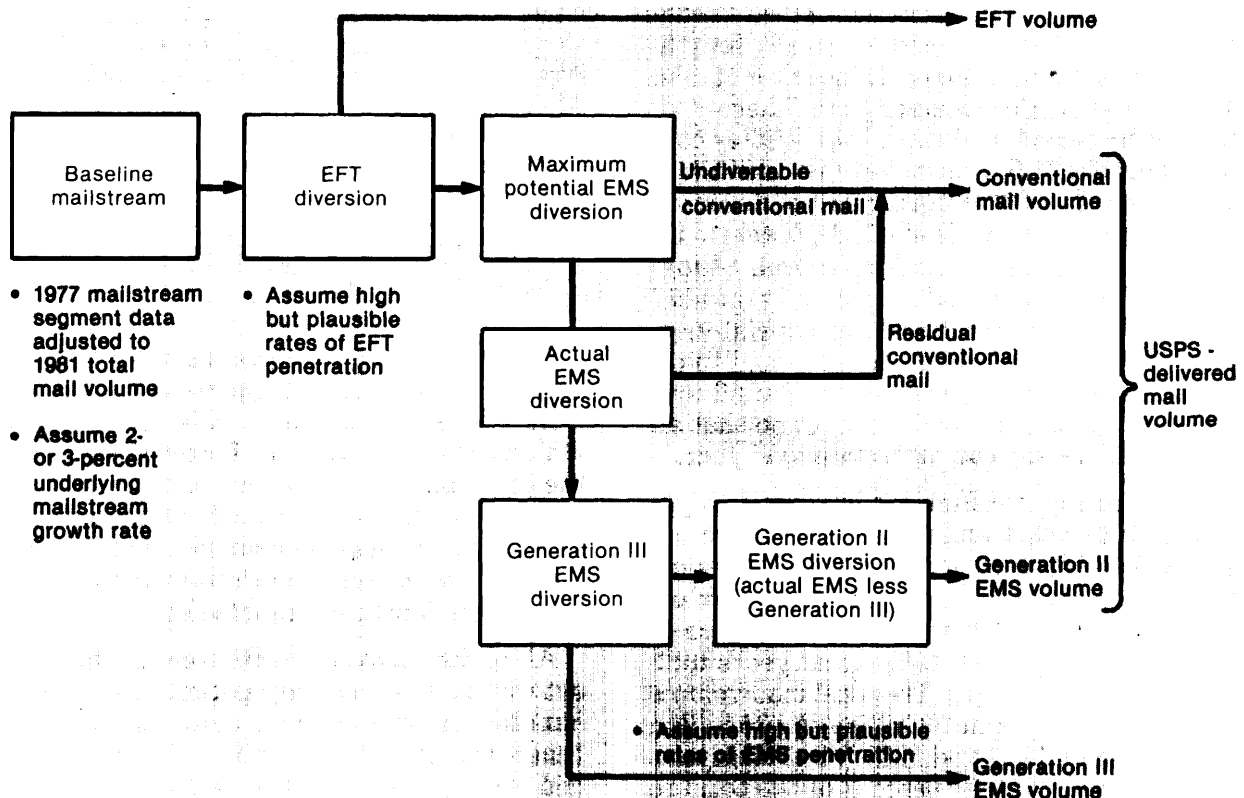
# Market Penetration Model and Technology Assumptions

## Introduction

The primary purpose of the market penetration model is to estimate the level of electronic and conventional mail volumes in 1985, 1990,

1995, and 2000. The basic elements of the model are shown in figure 1. (See app. A, fig. A-1, for further details.)

Figure 1.—Market Penetration Model



SOURCE: Office of Technology Assessment, see app. A, table A-1 for further details.

## Baseline Mainstream

As one input to the market penetration model, the baseline mainstream was divided into a number of different submarkets (subclasses of mail) in two ways—by mail content and by sender/receiver pairs. The mail content categories included correspondence, merchandise, bills, financial statements, and advertising, among others. Senders and receivers were grouped into households and nonhouseholds. Thus, the four possible sender/receiver pairs included household-to-household, household/nonhousehold, nonhousehold/household, and nonhousehold/nonhousehold.

The baseline volume for every class of conventional mail (first, second, third, fourth, other) was estimated for each category of mail content and sender/receiver pair. These estimates were based on data in two studies conducted for the U.S. Postal Service (USPS) by the University of Michigan Survey Research Center known as the *Household Mainstream Study* and *Nonhousehold Mailstream Study*, which in turn were based respectively on 1977 and 1979 mainstream data.<sup>1</sup> For consistency, the 1979 nonhousehold data were used to establish ratios among the types of mail and then applied to 1977 mail volumes so that all data would be for the 1977 calendar year.

The resulting baseline mainstream is highlighted in tables 1 and 2 and detailed in appendix A (table A-1). It is possible that some shifting among the mail segments has occurred since 1977, although a comparison of data for the 1977 and 1980 fiscal years indicates no major changes. The total mail volume has grown from about 92 billion to 106 billion pieces between 1977 and 1980. First-class mail has decreased from 58 percent of the total to 56.6 percent; second-class mail has decreased from 9.4 percent to 7.9 percent; and third-class mail has increased from 26 percent to 28.5 percent of the total mail volume.<sup>2</sup>

<sup>1</sup>M. Kallick, W. Rodgers, et al., *Household Mailstream Study, Final Report*, prepared for the Mail Classification Division, USPS, 1978. Also, *Nonhousehold Mailstream Study, Interim Report for First Postal Quarter PFY 1979*, July 1979.

<sup>2</sup>*Annual Report of the Postmaster General*, fiscal 1980, pp. 28-29.

Table 1.—Baseline Mainstream

	To households	To nonhouseholds
From households . . . . .	7.60/o (7.1 billion pieces)	9.90/o (9.2 billion pieces)
From nonhouseholds. . . . .	53.3% (49.7 billion pieces)	29.20/o (27.3 billion pieces)

SOURCE: 1977 data, University of Michigan Millstream Study conducted for USPS; percentages shown are based on total 1977 mail volume of 93.3 billion pieces. See app. A, table A-2, for further details

Table 2.—Mail Content (illustrative)

	To households	To nonhouseholds
From households	Correspondence—7.1 percent of total mail volume	Negotiable Instruments (e.g., checks)—7.0 percent Correspondence—1.5 percent
From non-households	Third-class (mostly bulk rate) mail—10.2 percent Bills—9.5 percent Advertising—9.1 percent Financial statements—2.8 percent	Bills and financial statements—9.1 percent Correspondence—6.1 percent Advertising—5.7 percent

SOURCE: University of Michigan Millstream Study conducted for USPS. Percentages shown are based on total 1977 mail volume. See app. A, table A-2, for further details

Mail originating from nonhouseholds constitutes over four-fifths of the total mainstream. Nonhousehold-originated bills and financial statements alone account for over one-fifth of the total, advertising about one-seventh, and bulk rate mail over one-tenth. Of the one-fifth of the mail originating from households, most is either correspondence (letters and cards) or negotiable instruments (checks).

All mainstream segments were evaluated to determine whether they potentially could be handled (in whole or in part) by electronic funds transfer (EFT) and/or electronic mail and message systems (EMS). Those major segments judged to be vulnerable to penetration by EFT and/or EMS are listed in tables 3 and 4. (See app. A, table A-2, for a complete list.)

As shown in tables 3 and 4, accounting only for major mainstream segments, about two-thirds of the mainstream is vulnerable to penetration by EFT and/or EMS. This translates into about three-quarters of first-class mail

**Table 3.—Major Mainstream Segments Vulnerable to Penetration by Electronic Funds Transfer**

Mainstream segment	Mail class	1977 volume (billions of pieces)	Percentage of first-class mail	Percentage of total mail
Nonhousehold to household bills . . . . .	1	8.9	15.4%	9.50/0
Non household to household financial statements. . . . .	1	2.6	4.5	2.8
Non household to nonhousehold bills and financial statements. . . . .	1	8.4	14.6	9.0
Household to nonhousehold negotiable instruments . . . . .	1	6.5	11.3	7.0
Totals . . . . .		26.4	45.8%	28.3%

SOURCE: University of Michigan Mainstream Study conducted for USPS. Percentages based on total 1977 mail volume of 93.3 billion pieces and 1977 first-class mail volume of 57.7 billion pieces. First-class mail defined to include penalty and franked mail.

**Table 4.—Major Mainstream Segments Vulnerable to Penetration by Electronic Mail and Message Systems**

Mainstream segment	Mail class	1977 volume (billions of pieces)	Percentage of mail class		
			First	Third	Total
Household to household correspondence . . . . .	1	6.6	11.4%	—	7.1 %
Household to nonhousehold correspondence . . . . .	1	1.4	2.4	—	1.5
Non household to household third-class (mostly bulk rate) mail . . . . .	3	9.5	—	38.80/o	10.2
Nonhousehold to household advertising . . . . .	3	7.2	1.9	—	1.2
Nonhousehold to nonhousehold advertising . . . . .	3	3.0	4.0	—	2.5
Non household to nonhousehold correspondence . . . . .	1	5.2	9.0	—	5.6
Totals . . . . .		36.3	28.70/o	80.50/o	39.00/o

SOURCE: University of Michigan Mainstream Study conducted for USPS. Percentages based on total 1977 mail volume of 93.3 billion pieces and 1977 first-class mail volume of 57.7 billion pieces, and 1977 third-class mail volume of 24.5 billion pieces. First-class mail defined to include penalty and franked mail.

volume and about four-fifths of third-class mail. Actually, only the merchandise and miscellaneous segments and nonhousehold to nonhousehold legal/financial instruments were assumed to have no vulnerability. Legal/financial instruments were assumed to have no potential for electronic handling due to the frequent requirement for verified and original sig-

natures, endorsements, and documentation for many such instruments. Even here, the possibilities for electronic certified mail and electronic contract signing are being researched.<sup>3</sup>

<sup>3</sup>"Cryptographers Gather to Discuss Research," *Science*, vol. 214, Nov. 6, 1981, p. 647.

## EFT Diversion

The next step in the market penetration model was to subtract from the baseline mail-stream the mail that could be diverted to EFT. While for some purposes EFT might be viewed as a special type of EMS, other EFT applications, such as the point-of-sale use of debit cards, could eliminate certain payment messages altogether. Accordingly, in this study EFT was considered to be separate from EMS. Mail diverted to EFT was considered unavailable for EMS. For mainstream segments such as bills and statements where both EFT and EMS could produce diversion, EFT diversion was assumed to occur first. The residual mail volume in each mail segment after EFT diversion was then considered the potential market for EMS diversion. The diversion to EFT was modeled using the logistic substitution process described in appendix B.

Based on the results of a separate OTA study,<sup>4</sup> current trends suggest that a significant consolidation of bills and financial statements is likely to take place via EFT, but that it will take many years. OTA has assumed that the use of EFT for bills and financial statements in the long run would result in a 90-percent reduction in total bills and statements received via conventional mail by the average household or nonhousehold. Thus, the maximum potential fraction (or penetration potential) of bills and statements that could be diverted to EFT is 0.9, as shown in table 5. OTA assigned an initial growth rate of 20 percent, as indicated in table 5. Given the nature of the logistic substitution process, a 20-percent initial growth rate would decline to a 5-percent growth rate for the 20th year out. It would take 20 years to progress from 5 to 75 percent of the maximum potential diversion. The year of 5-percent diversion (time when 5-percent diversion occurs) was estimated to be 1985. The year of 75-percent diver-

**Table 5.—Assumptions About Rate of EFT Penetration**

Year of 5 percent penetration—1985
Year of 75 percent penetration—2005
Initial exponential growth rate (1985)—20 percent
Growth rate at 50 percent penetration (year 2000)—5 percent
Penetration potential—0.9 for bills and financial statements
1.0 for negotiable instruments
Key technologies
Automated teller machines (ATMs)
25,000 in operation (1981)
ATMs estimated by industry to at least double by 1990 and could increase to 120,000 (an annual growth rate of roughly 10 to 20 percent):
• deposit
• cash withdrawal
• bill or loan payment
• cash advance
Point-of-sale terminals
87,500 in service (1981):
• check validation
• credit card authorization
• debit of transaction balance
Telephone bill payment (TBP)
302 financial institutions offer (1980)
TBP transactions estimated by industry to be growing by 27 percent a year:
• bill or loan payment
• account status inquiry
• interaccount transfer

SOURCE: Office of Technology Assessment, see app A, table A-3, for further details.

sion was estimated to be 2005. As shown in table 5, this growth rate is generally consistent with rates of growth projected by industry for key EFT technologies.

Likewise, the results of the OTA study suggest that EFT is likely to displace checks and other paper-based negotiable instruments, but that this displacement will take many years. OTA has assumed that all such instruments eventually could be displaced by EFT. Thus, the EFT penetration potential is 1.0 for negotiable instruments sent to households or nonhouseholds. As with bills and financial statements, OTA has assigned an initial growth rate of 20 percent and estimated the year of 5-percent diversion to be 1985. (See app. A, table A-3, for details.)

The OTA assumptions for bills and financial statements and for negotiable instruments were optimistic in the sense that the actual

<sup>4</sup>See OTA report *Sleeted Electronic Funds Transfer Issues: Privacy, Security, and Equity*, OTA-BP-CIT-12, March 1982. See also *EFT: The Next Fifteen Years*, Electronic Banking, Inc., June 1980, a working paper prepared for the above report.

penetration potential might be lower than 0.9 and 1.0, respectively. Therefore, the actual EFT penetration is more likely to be lower than assumed. EFT was defined, in effect, as an all-electronic service completely outside of

the mainstream. The assumptions about EFT may be affected by various intangible considerations important to EFT and EMS users, especially those relating to consumer preferences and institutional marketing strategies.

## EMS Diversion

As noted earlier, the residual mail volume in each mail segment after EFT diversion is the potential market for EMS diversion. EMS diversion is divided between Generation II and Generation III and was calculated through use of the same logistic substitution process used for estimating EFT diversion (see app. B). The terms Generation II and Generation III are explained and compared in figure 2.

The EMS diversion model was based on a set of EMS technology assumptions discussed below, highlighted in table 6, and detailed in appendix A (table A-4). The assumptions relate to the following six categories of technology as applied to the various combinations of mail content and sender/receiver pairs:

1. Generation II EMS systems with early electronic printers (no color). This category includes such industry offerings as Mailgram, Datapost and Tyme-Gram, and USPS offerings such as E-COM.
2. Generation II EMS systems with advanced electronic printers (including a color capability).
3. Electronic data processing and office automation. This category includes Generation III technologies such as computer networks, communicating word processors, public and private message and packet-switching networks, and facsimile systems oriented toward nonhousehold use.
4. Home computer terminals. Included are home computers and associated communications concepts/services such as PC Net (Personal Computer Network).
5. Viewdata/teletext. This category includes services, primarily to the home, based on

the use of the television set and the telephone.

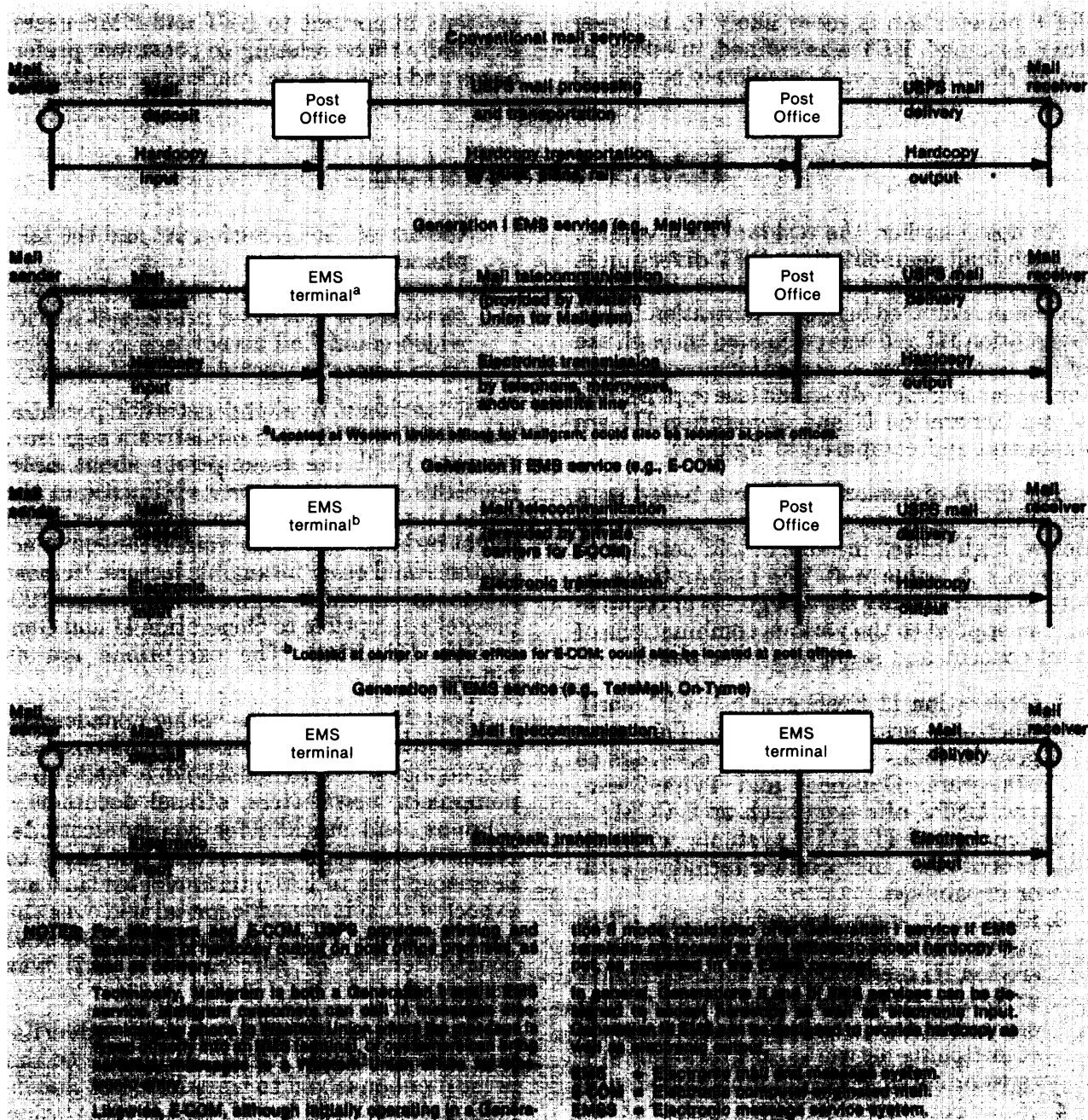
6. Inexpensive hardcopy receiver. Facsimile receivers or character printers at a price which could find acceptance in a majority of homes are included in this category.

The maximum market penetration potential was estimated for each mainstream segment. As with EFT, the assumptions about EMS penetration potential were optimistic in the sense that the actual penetration potential might be lower due to restrained consumer acceptance and other intangible factors. In most instances, the entire segment was judged 100-percent susceptible to Generation II and Generation III EMS. The exceptions are as follows.

About 30 percent of the "other nonadvertising" segments (nonhousehold to nonhousehold and nonhousehold to household) is made up of pamphlets, newsletters, official documents, coupons, and stockholder communications. Items of this type were judged not likely to be susceptible to EMS technologies that are expected to achieve widespread use over the next 20 years. Hence a maximum potential penetration of 70 percent ( $P = 0.7$ ) was estimated.

The displacement of direct mail "advertising" and greeting "cards" segments to the home (nonhousehold to household and household to household) by TV-based Generation III home terminals was judged to be limited by the constraints of the video medium. Thus, a maximum Generation III penetration potential of 30 percent (0.3) was estimated for these segments.

Figure 2.—Comparison of Conventional Mail Service With Generations I, II, and III EMS Service

SOURCE: Office of Technology Assessment; and National Academy of Sciences, *Electronic Message Systems for the U.S. Postal Service*, 1976.



**Table 6.—Assumptions About Rate of EMS Penetration (illustrative)**

<p>Early Generation II EMS (using current technology black and white printers) for correspondence, bills, third-class bulk mail:</p> <p>Year of 5 percent penetration—1983</p> <p>Year of 75 percent penetration—1996</p> <p>Initial exponential growth rate (1983)—30 percent</p> <p>Advanced Generation III EMS (using inexpensive home hardcopy receiver) for nonhousehold to household bills and statements:</p> <p>Year of 5 percent penetration—1990</p> <p>Year of 75 percent penetration—2010</p> <p>Initial growth rate—20 percent</p> <p>Advanced Generation II EMS (using high resolution color printers) for advertising, greeting cards:</p> <p>Year of 5 percent penetration—1995</p> <p>Year of 75 percent penetration—2015</p> <p>Initial growth rate (1995)—20 percent</p> <p>Generation III EMS (using public and private message and packet-switching networks, communicating word processors, computer networks) for intraoffice correspondence:</p> <p>Year of 5 percent penetration—1983</p> <p>Year of 75 percent penetration—1996</p> <p>Initial growth rate (1983)—30 percent</p> <p>for interoffice correspondence:</p> <p>Year of 5 percent penetration—1984</p> <p>Year of 75 percent penetration—2004</p> <p>Initial growth rate (1984)—20 percent</p> <p>Generation III EMS (using viewdata/teletext) for household to household cards:</p> <p>Year of 5 percent penetration—1985</p> <p>Year of 75 percent penetration—2005</p> <p>Initial growth rate—20 percent</p>	<p>Advanced Generation III EMS (using home computer terminals) for household to household correspondence:</p> <p>Year of 5 percent penetration—1987</p> <p>Year of 75 percent penetration—2007</p> <p>Initial growth rate (1987)—20 percent</p> <p>for nonhousehold to household correspondence and bulk mail:</p> <p>Year of 5 percent penetration—1987</p> <p>Year of 75 percent penetration—1997</p> <p>Initial growth rate (1987)—40 percent</p> <p>Key technologies:</p> <p>Home computers:</p> <ul style="list-style-type: none"> <li>• 500,000 installed (1980)</li> <li>• Estimated by industry to grow to 4.5 million installed by 1985 and 33 million by 1990 (roughly a 50 percent annual growth rate).</li> </ul> <p>Video computer games:</p> <ul style="list-style-type: none"> <li>• Revenues increased from \$308 million in 1978, to \$968 million in 1979, to \$2.8 billion in 1980 (roughly a 300 percent annual growth rate).</li> </ul> <p>Mini and small business computers:</p> <ul style="list-style-type: none"> <li>• Revenues of about \$9.4 billion worldwide (1980)</li> <li>• Estimated by industry to continue to grow at 25 to 35 percent a year.</li> </ul> <p>Computer software products:</p> <ul style="list-style-type: none"> <li>• Revenues of about \$1.5 billion (1980)</li> <li>• Estimated by industry to grow at 30 percent annually over the next 5 years.</li> </ul> <p>Data communications:</p> <ul style="list-style-type: none"> <li>• Estimated revenues of about \$4 billion (1979) and growing at 30 to 35 percent a year.</li> </ul>
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SOURCE: Office of Technology Assessment, see app. A, table A-4, for further details.

## Generation II Growth and Timing Estimates

The attractiveness of Generation II services is determined primarily by the capabilities and cost effectiveness of the devices for converting the electronic signals back to hardcopy. Devices that have black and white capability only and limitations in page size and print style are frequently not as attractive as conventionally printed material. Also, printing systems must be very cost effective or EMS prices will be too high to compete successfully with conventional mail.

For the purposes of this study, OTA assumed that the electronic printers available in the 1980's will be limited in resolution and flexibility and will lack color capabilities. Advanced electronic printers, which are expected to become available at cost-effective prices in the 1990's, will add greater resolution, grey

scale, and color capabilities and probably will include greater flexibility in materials handling. Recent technology and product announcements suggest that advanced printers may be available earlier than assumed for this study.

Generation II EMS services using early electronic printing capabilities, if priced competitively with mail service, could begin to find substantial use by nonhousehold senders in the next few years. For correspondence, bulk statements, and other nonadvertising content, OTA estimated a 5-percent diversion of existing mail to Generation II EMS by 1983, with a high initial rate of growth (30 percent) which could lead to a 75-percent market share about 13 years thereafter, as summarized in table 6. The use of Generation II for advertising purposes, however, is expected to be largely delayed until color capabilities become available, and even then growth will be slower to the ex-

tent that cost and relative inflexibility continue to limit the advantages of electronic color printing over conventional printing. Thus, for the advertising segment (nonhousehold to nonhousehold and nonhousehold to household) a 5-percent market share was forecast for 1995, with an initial growth rate of 20 percent.

Households will not be able to initiate a significant volume of Generation II EMS until home terminals capable of originating text come into widespread use. About 500,000 home computers had been sold by 1980,<sup>5</sup> though many of these were not equipped for communications. OTA assumed that it will take several more years before 5 percent of households, or roughly 4 million homes, are equipped with communications-capable home computers, and that there will be additional delays before many of these home computers are used routinely for correspondence. Thus, OTA assumed that the EMS market share for correspondence originating in the home will not reach 5 percent before 1987. A high initial growth rate (30 percent) was projected, which is consistent with growth rates projected by industry for home computers, as indicated in table 6.

The requirement for a color capability is expected to put greeting cards in the same position as advertising, thus delaying a 5-percent market share for Generation II EMS until 1995.

### Generation III Growth and Timing Estimates

Generation III EMS services between nonhousehold senders and receivers are expected to be based largely on electronic data-processing and office automation technologies. There are strong incentives within this sector for keeping information in electronic form and for machine processing by the receiver. As a result of these incentives, there is a healthy competition among several technologies for this market, including word processors, computer-

based message systems, intelligent communication networks, and store and forward message systems. Until recently, this competition has tended to impede the development of standards among different vendors supporting each technology, and for information exchange between systems based on the different technologies. The International Standard Organization, the Consultative Committee for International Telephone and Telegraph, and the U.S. standards groups continue to work on developing standards. The process of agreeing on and then implementing standards has been slow but appears to be accelerating. The time required to achieve and implement standards at a variety of system levels will be a principal determinant of the rate of growth of Generation III message systems within the nonhousehold sector.

The problem will be easiest to resolve within individual companies. OTA estimated a 5-percent market share for Generation II EMS in 1983, and initial growth at a fast rate (30 percent). As shown in table 6, OTA estimated a 75-percent market share for Generation III EMS intra-office correspondence in 1996. A slower initial growth rate (20 percent) was projected for interoffice correspondence due to incompatibility and the number of different standards issues involved. These rates of growth are generally consistent with industry projections (listed in table 6) for small business computers, computer software, and data communications.

The standards problem will begin to be resolved first for correspondence, which requires a minimum of content standardization. OTA estimated a 5-percent market share in this segment in 1984. Generation III will become attractive for bills and statements when the recipients can automatically process the information received. This requires considerable standardization of data elements and formats. OTA anticipated a slow penetration of these complex standards to other sectors, in part due to the software development required to employ them. Initially, exchanges frequently are likely to be via hand-carried or mailed computer tapes substituting for numerous paper

<sup>5</sup>U.S. Congress, Office of Technology Assessment, *Computer-Based National Information Systems: Technology and Public Policy Issues* OTA-CIT-146, September 1981.

documents. Five-percent penetration in this market for Generation III is not expected to occur until 1985.

Generation III systems will begin to replace advertising within the nonhousehold sector when "online" catalogs and order entry systems are implemented between corporate buyers and their suppliers. Such systems will require extensive software development and standardization. Thus, OTA projected an additional 2 years (compared to bills and statements) to reach a 5-percent penetration of advertising (1987).

Generation III systems involving the household as either sender or receiver will be paced by the rate of acceptance of one of three principal home terminal technologies—the home computer terminal, the video-based viewdata/teletext terminal, and the inexpensive home hardcopy receiver.

A home computer terminal or its equivalent will be required for households to originate correspondence. As discussed above, OTA projected that a 5-percent market share for message services using home terminals would occur about 1987. By that time, however, many standards issues relating to home computer services are likely to have been resolved. Hence, OTA assumed very rapid initial growth (40 percent) for Generation III correspondence and other nonadvertising messages between households and nonhouseholds.

For correspondence between households, Generation III EMS growth is expected to be slower, since both sender and receiver must be equipped with a terminal device. For example, with 50 percent of households equipped, only 25 percent of household pairs on the average would have a terminal available at both ends. For this reason, the projected initial growth rate for household-household Generation III EMS correspondence is slower (20 percent).

Viewdata/teletext systems are most likely to penetrate the advertising and greeting card segments involving household receivers, though the maximum penetration potential is

limited. These systems are projected to achieve a 5-percent market share somewhat ahead of home computers—OTA estimated 1985. Advertising by viewdata/teletext is expected initially to grow very rapidly (40 percent), since it is paced only by availability of the home receiver. The greeting card segment is likely to grow slowly, again because of the requirement that both sender and receiver be equipped.

The use of Generation III EMS services to transmit bills and financial statements to households requires home terminals as a prerequisite. In addition, it seems likely that many consumers will desire a hardcopy of their statements or bills for tax records and other purposes, thus making consumers more reluctant to accept bills and statements over a viewdata-like terminal. OTA assumed that home hardcopy equipment sales will be delayed 3 years behind video terminal sales and will grow at a slower rate, thus affecting the use of Generation III for bills and statements. OTA estimated that inexpensive hardcopy printers capable of reproducing the contents of a TV display will be produced in volume quantities for under \$200 (1980 dollars) per unit when market penetration reaches 5 percent (1990).

### **Relationships Between Generation II and Generation III Estimates**

Generation II growth rate and timing estimates are not assumed to have any significant effect on the rate *or* timing of mail diversion to EFT systems or on the rate and timing of Generation III growth. The latter assumption may seem surprising at first since Generation II and III are in some sense competing. However, while the decision to send messages by Generation II as opposed to conventional mail is almost entirely at the discretion of the sender, the decision to receive mail electronically—and hence via Generation III—is largely at the discretion of the receiver. Thus, if Generation III is available, the recipients of

messages will elect Generation III instead of hardcopy delivery when it suits their purposes or is convenient to do so, regardless of whether the hardcopy comes from conventional mail or is the output of a Generation II system. Thus, the rate of penetration of Generation III is not likely to be significantly affected by the state of penetration of Generation II.

It may also be thought that Generation III is but a simple extension of Generation II—perhaps just running a telecommunication line from a Generation II terminus to the ultimate user. In this view, earlier introduction of Generation II would speed the introduction of Generation III. However, many Generation III EMS systems are quite different in character from Generation II EMS systems. Therefore, sending greeting cards by view-data, transmitting bills or statements between computers, reading messages from a computer-based message system, or placing orders against a supplier using an online catalog and order entry system are not functional extensions of a store and forward message system like that which forms the basis for Generation II. Both developer and user decisions for Generation III message systems are expected to be quite independent of the status of Generation II.

## Alternative Generation II Growth and Timing Estimates

The assumptions outlined above for the growth and timing of Generation II EMS are intentionally on the high side (i.e., optimistic in terms of rate and extent of development), but still are plausible in terms of technical, economic, and market realities. Henceforth, this set of assumptions will be referred to as the baseline alternative for Generation II EMS development.

In order to test the sensitivity of the market penetration model and the projected mail volumes to changes in the baseline Generation II EMS assumptions, OTA has defined three other alternatives, as presented in table 7: 1) very high Generation II EMS growth, 2) moderate Generation II EMS growth, and 3) slow

**Table 7.—Assumptions for Generation II Growth Alternatives**

High but plausible Generation II EMS growth (baseline alternative):

- Peak volume (year 1995) about 60 to 75 percent of RCA projected year 2000 volume
- Early Generation II—5 percent penetration in 1983  
initial growth rate 30 percent
- Advanced Generation II—5 percent penetration in 1995  
initial growth rate 20 percent

Very high Generation II EMS growth:

- Peak volume (year 1995) about 110 to 130 percent of RCA projected year 2000 volume
- Early Generation II—5 percent penetration in 1983  
initial growth rate 40 percent
- Advanced Generation I—5 percent penetration in 1992  
(accelerated by 3 years)  
initial growth rate 30 percent

Moderate Generation II EMS growth:

- Early Generation II—5 percent penetration in 1987  
(delayed by 4 years)
- Peak volume (year 2000) same as very high alternative peak in 1995
- Advanced Generation II—5 percent penetration in 1993
- Initial growth rates same as very high growth alternative

Slow Generation II EMS growth

- Peak volume (year 2000) about 25 percent of RCA projected year 2000 volume
- Generation II growth rates cut in half compared to moderate growth alternative—20 percent for Early Generation II  
—15 percent for Advanced Generation II

SOURCE: Office of Technology Assessment (see fig 8, ch. 4, for graphic comparison of alternatives).

Generation II EMS growth. When compared to the 1977 estimates made by RCA for the USPS with respect to EMSS,<sup>6</sup> the baseline alternative (high but plausible Generation II growth) would project a peak volume of about 60 to 75 percent of the RCA peak of 25 billion messages. The very high growth alternative would project a peak of 110 to 130 percent of the RCA peak, and the slow growth alternative about 25 percent of the RCA peak. The moderate growth alternative would project a peak of 55 to 65 percent of the RCA peak, but would show a growth track substantially slower than the baseline alternative but faster than the slow growth alternative. (See ch. 4, fig. 8, for a graphical comparison.)

<sup>6</sup>RCA Government Communications Systems Division, *Electronic Message Service System: Growth and Economic Analyses*, Camden, N. J., 1977, p. 6-13.

These alternatives are used in later chapters to test the sensitivity of the projected mail volumes, first-class revenues and costs, and labor

force requirements to assumptions about the growth and timing of Generation II EMS.

## Underlying Mainstream Growth

Between 1970 and 1980, the overall volume of mail handled by USPS grew at an annual compounded rate of about 2.2 percent. Between 1900 and 1977, the annual compounded rate of growth was about 2.0 percent. Therefore, OTA used an estimate of 2 percent as the baseline underlying rate of growth in the mainstream. In other words, absent any diversion, it was assumed that the mainstream would grow by about 2 percent per year over the next 20 years (the timeframe of this study).

However, there are several indications that this assumption may be on the low side. For example, the University of Michigan study estimated an annual mainstream growth rate of 2.9 percent prior to technological diversion.<sup>7</sup> Also, in 3 of the last 4 years the actual rate of growth in the mainstream exceeded even this 2.9 percent level.\* The USPS estimated rate of growth for fiscal year 1981 is 3.5 percent.<sup>8</sup> Finally, between 1947 and 1977, the annual compounded mainstream growth was about 3.2 percent.

Table 8 summarizes the various justifications for assuming a 2- v. a 3-percent underlying mainstream growth rate. The balance of evidence appears to suggest that a 2- or even 1-percent rate is typical of economically depressed periods, while the rate has been 3 percent or more during better economic times.

These possibilities were accommodated in the market penetration model by making sensitivity runs of the model under different sets of assumptions, and by adjusting all results upward by 10 percent to be consistent with

**Table 8.—Alternative Assumptions About Underlying Mainstream Growth Rate**

Justifications for 3-percent underlying growth rate	
1947-77	average mainstream growth = 3.2 percent per year
1977-81	average mainstream growth = 4.2 percent per year
1951-77	average first-class mail growth = 2.8 percent per year
University of Michigan mainstream study estimate <sup>a</sup> = 2.9 percent per year	
Justifications for 2-percent underlying growth rate	
1970-80	average mainstream growth = 2.2 percent per year
1900-77	average mainstream growth = 2.0 percent per year (includes 1930's depression and both World Wars)
1951-77	ratio of first-class mail to disposable personal income declined from 76 million letters per \$1 billion to 57 million letters per \$1 billion <sup>b</sup>
Justifications for 1-percent underlying growth rate	
1971-76	average mainstream growth = 1.1 percent per year
1971-76	average first-class mail growth = 0.7 percent per year

<sup>a</sup>M. Kallick, W. Rodgers, et al., *Household Mailstream Study, Final Report*, prepared for USPS Mail Classification Division, 1978.

<sup>b</sup>John F. McLaughlin, et al., *Telephone-Letter Competition A First Look*, Harvard University, 1979.

SOURCE: Office of Technology Assessment

the estimated fiscal year 1981 USPS overall mail volume. Sensitivity runs were carried out for both a higher (3 percent) and a lower (1 percent) underlying mainstream growth rate. The results of selected sensitivity runs are presented in chapter 4.

The one-time 10-percent adjustment in results for consistency with 1981 data was needed because the actual mainstream growth during the 1977-81 period far exceeded the 2-percent annual rate that was assumed initially. As noted in chapter 4, the market diversion model was based on 1977 mainstream data, which was the only detailed data available at the time of the study. The model assumed that, under the baseline growth of 2

<sup>7</sup>Kallick, Rodgers, et al., op. cit.

\*5.1 percent for fiscal year 1978; 2.9 percent for fiscal year 1979; 6.5 percent for fiscal year 1980; and 3.5 percent (estimated) for fiscal year 1981.

<sup>8</sup>Per Nov. 22, 1981, telephone conversation with Lou Eberhardt, USPS Public Information Office.

percent per year, the total mail volume would grow from about 93 billion pieces in 1977 to about 100 billion pieces in 1981. The actual USPS mail volume grew from about 92 billion pieces in 1977 to an estimated 110 billion pieces for fiscal year 1981.<sup>9</sup> In order to compensate for this higher-than-expected growth

rate, all results of the computer modeling were increased by 10 percent to make the projected and actual figures for 1981 consistent and to remove the effects of the 1977-81 growth discrepancy from future year projections. Without the 10-percent adjustment, future year projections would have been penalized for this discrepancy.

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<sup>9</sup>Ibid.