

The Forecast observed that 2 GHz PCS "is not expected to replace any existing wireless technology although increased competition will certainly affect the growth rate of the other services."²⁷ The Forecast projected that, as indicated in the table below, that total "New PCS" penetration is expected to grow to 3.1 percent of the total U.S. population market (8.5 million subscriptions) within five years, compared with projected cellular penetration of 12 percent.

The theme of complementary growth was repeated by Amy Stephan, PCIA's Director of PCS, who declared that "not only will PCS develop, but existing services will grow with it, 'the entire pie will grow,'" and by Wayne Schelle, Chairman of American Personal Communications, who declared that "no other services will drown; they all will grow."²⁸

Service	1993		1998			2003		
	Subs (Ms)	Penetr'n (%)	Subs (Ms)	Penetr'n (%)	5 yr subs % Change	Subs (Ms)	Penetr'n (%)	5 yr subs % Change
New PCS			8.55	3.1%		31.11	10.4%	364.9%
Satellite	0.1	.04%	1.32	0.5%	1224.0%	4.11	1.4%	210.8%
Paging	19	7.4%	36.8	13.3%	93.7%	65.3	21.7%	77.4%
Data	0.05	.02%	3.36	1.2%	6630.2%	5.65	1.9%	67.8%
Cellular	13	5.0%	33.07	12.0%	154.4%	52.3	17.4%	58.1%
SMR & ESMR	1.5	.6%	5.19	1.9%	245.7%	8.95	3.0%	72.6%
Total	33.7		88.3		162.4%	167.4		89.6%

Source: 1994 PCS Market Demand Forecast, PCS Technologies Forecast Table

The following US population figures were used: 1992/255 million; 1993/258.5; 1998/275.8 million; 2003/300.3 million.

Note: Total subscriptions includes individuals with multiple subscriptions across services (i.e., there are more subscriptions than subscribers).

Goodstadt Projections

Barry Goodstadt, formerly senior consultant to Arthur D. Little, projected the relationship between cellular and PCS in two iterations -- first as a representative of

²⁷*Id.* at p.11.

²⁸*PCIA Bulletin*, February 4, 1994, at pp.6-7.

Arthur D. Little for the January 1994 PCIA conference, and then as a representative of EDS Management Consulting at a presentation to the FCC on March 24, 1994, sponsored by PCS Action.

The Arthur D. Little presentation projected that, absent PCS development, cellular would achieve subscriber penetration of 55.1 million by 2006. With PCS introduced in 1996, cellular would achieve penetration of 38.2 million, and PCS would achieve penetration of 25.4 million (totaling 63.6 million subscribers). Delaying PCS introduction to 2000 would result in cellular penetration of 45.3 million and PCS penetration of 9.8 million (totaling 55.1 million). Goodstadt observed that "you [presumably a PCS licensee] lose about 20 percent of the population every year you wait."²⁹

The Goodstadt projections for Arthur D. Little can be compared with those submitted to the FCC on March 24, 1994. In that study, Goodstadt revised his projections, concluding that PCS demand levels are reduced by 15 percent for each year of delay.

Absent any deployment of PCS, cellular was projected to reach penetration of 51 million by 2005. If PCS was introduced in 1996, it was projected to achieve penetration of 17 million and cellular penetration of 38 million by 2005 (totaling 55 million). Assuming PCS introduction in 1997 or 1998, PCS penetration was projected to reach 14.5 or 12 million, while cellular's share appears from the accompanying graphic to be about 41 or 43 million (thus totaling 55 to 55.5 million). The difference is a PCS market share of 22 or 26 percent of the wireless market in 2005.³⁰

The Goodstadt study stated that the results implied that "[r]eduction in demand for PCS due to delay may make for a less than attractive business proposition -- particularly since the cash flow in early years has a great influence on the attractiveness of the business case" and that "[s]lowing of licensing will strengthen the cellular position." ***In spite of the implication that cellular companies have something to gain from delay, CTIA has called for the FCC to move forward expeditiously with the licensing of the PCS industry -- because cellular carriers, too, have a desire to utilize the new spectrum to deliver new services.***

Another inference which may be drawn from the study is that the issue being debated between the lines is one of market share, and the desire of some potential entrants to ensure a higher market share through manipulation of the FCC's rules.

²⁹ "Evaluating PCS Markets," *PCS News*, January 20, 1994, at p.4.

³⁰ See "Effect of Delay on PCS Market Potential: Briefing to FCC PCS Study Group," dated March 23, 1994, and filed as an attachment to Letter from Ron Plesser, Piper & Marbury, to William Caton, Acting Secretary, FCC, re GEN Docket No. 90-314, March 24, 1994.

Mercer Management Projections

The Mercer Management survey indicated that the PCS market can be mapped into seven differentiated segments -- two business, and five consumer -- with widely varying responses to new services. The findings indicated that there is a "large market for low-ubiquity service (e.g., service to local area, frequented area) at low prices. Not everyone needs or wants premium wireless service."³¹

Yankee Group Projections

The Yankee Group has produced studies based on "Technologically Advanced Family" tracking surveys, which examine likely, possible and unlikely adopter populations. Based on their surveys, the "Digital Cellular and Personal Communications Services" report made the following projections.³²

Yankee Group PCS Projections**

	1991	1992	1993	1994	1995	1996	1997	1998
cellular	7.6	10.5	13.5	16.5	20.0	24.0	28.0	32.0
PCS	0.0	0.0	0.1	0.5	1.0	1.5	2.1	2.6
Paging	11.5	13.2	15.2	17.2	19.2	22.0	24.0	26.0
Mobile Data	0.25	0.50	1.2	2.1	3.0	4.3	5.7	7.4
Mobile Comp.*	0.0	0.0	0.023	0.075	0.255	0.795	1.515	2.595
PDA's	0.0	0.0	0.0	0.022	0.094	0.289	0.889	1.795

Source: The Yankee Group, 1993

* Portable computers with integrated wireless communications capability.

** Users stated in millions.

What is the upshot of these studies? The consensus is that the market is growing. The consensus is that, by and large, all services will experience growth. The precise amount of the growth, both for the entire market and for specific services, varies from study to study. In fact, the growth which we may expect is undeniably subject to variation, because we do not know precisely what it is that we are measuring. Are we measuring the right market, and the right characteristics? And, even if we are measuring the right markets, and are calculating the correct

³¹Mercer Management News Release, February 8, 1994, at p.2.

³²"Digital Cellular and Personal Communications Services," *Wireless Communications Forum*, July 1993, at p.67.

current cross-elasticity of these services, will those measures remain true into the near future?

As indicated in the preface to this section, CTIA prefers to maintain a healthy agnosticism about demand studies. They are indeed interesting, but they may tell us more about the student of the market, than the actual market which lies ahead of us.

Supply/Demand Substitution in Services

One measure of competition is the degree to which services are substitutable. One indicator of that substitutability are the plans and projections of the companies involved in bringing those services to the marketplace. The following statements of intent of myriad companies -- cable companies, traditional SMR providers, ESMR companies, pure PCS pioneers, cellular companies, and interexchange carriers -- make clear that these companies view PCS as an opportunity, as one provider put it, "to cross-sell" services and features.

In fact, as the three graphics produced by EMCI and OneComm (then CenCall), and appearing here, indicate, both analysts and service providers envision a unitary market, driven by technological and service convergence, and competing on the basis of features and price.

American Mobile Telecommunications Association (AMTA)

Alan Shark of AMTA projected SMR involvement in PCS, by noting that "too many people forget that SMRs offer paging, private radio applications, customer service and repair, and they have a strong customer base. The logic is there for SMRs to install and service PCS wireless PBXs."³³

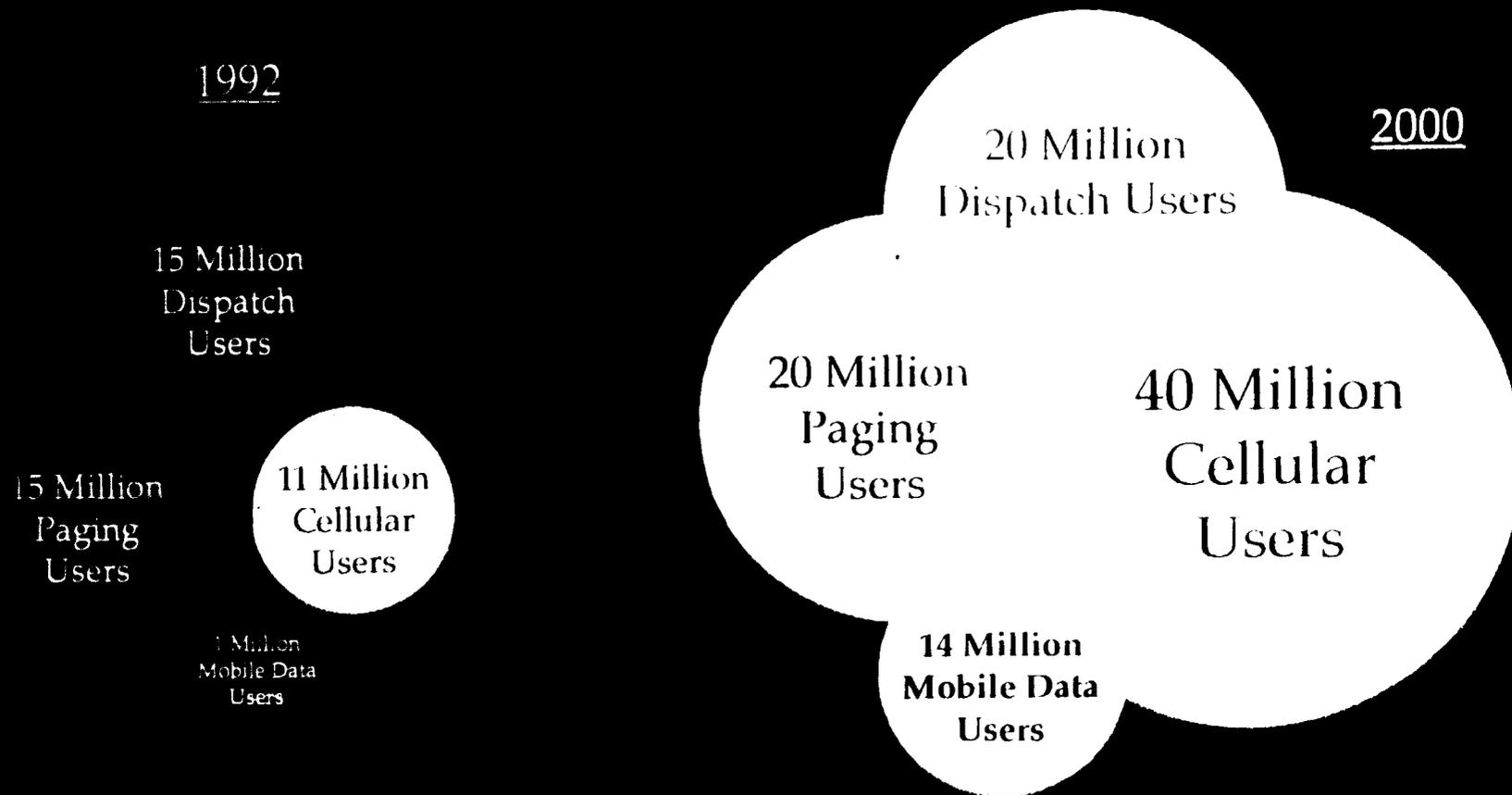
Columbia PCS Inc./Columbia Capital

Steve Zecola, President and CEO of Columbia PCS, has stated that "Columbia PCS Inc. will . . . offer[] customers one-stop shopping for local telephone service, long distance service and mobility service. We will provide a comprehensive replacement for existing local, long distance and cellular service."³⁴

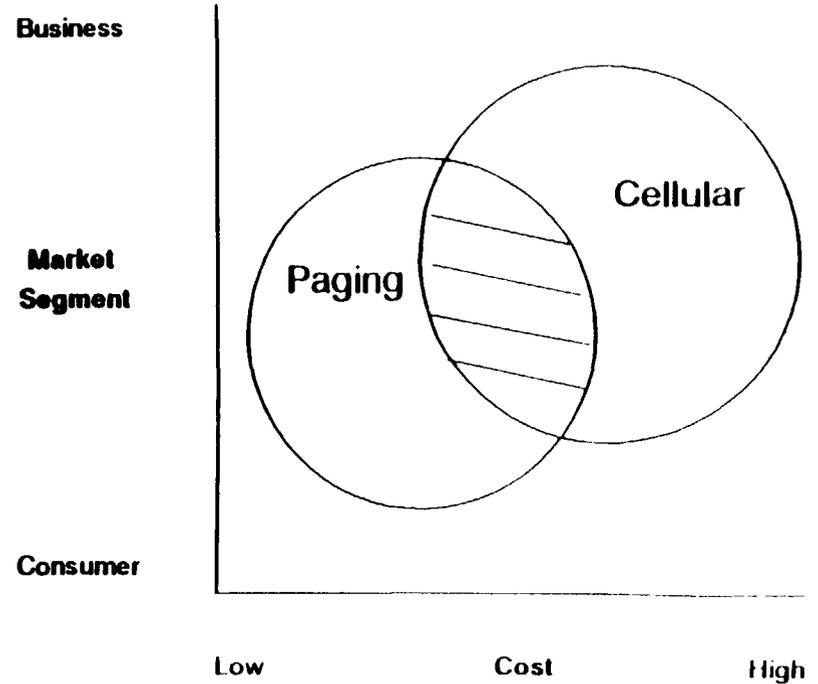
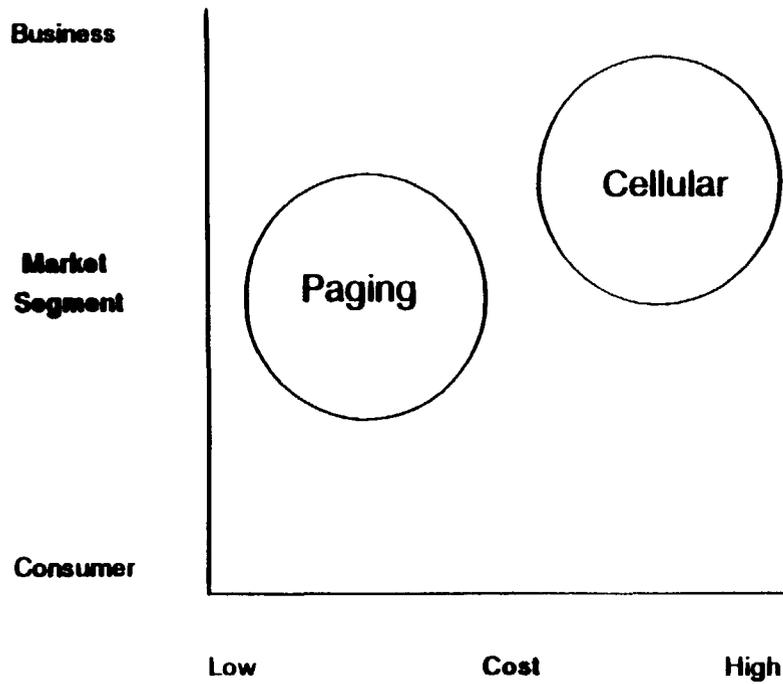
³³"Specialized Mobile Radio and Personal Communications Networks: Making Waves," *Wireless Communications Forum*, December 1993, at p.51.

³⁴"Columbia Capital Forms PCS Service Venture; Steven Zecola Named President and CEO," *PR Newswire*, February 15, 1994.

Integrated Services

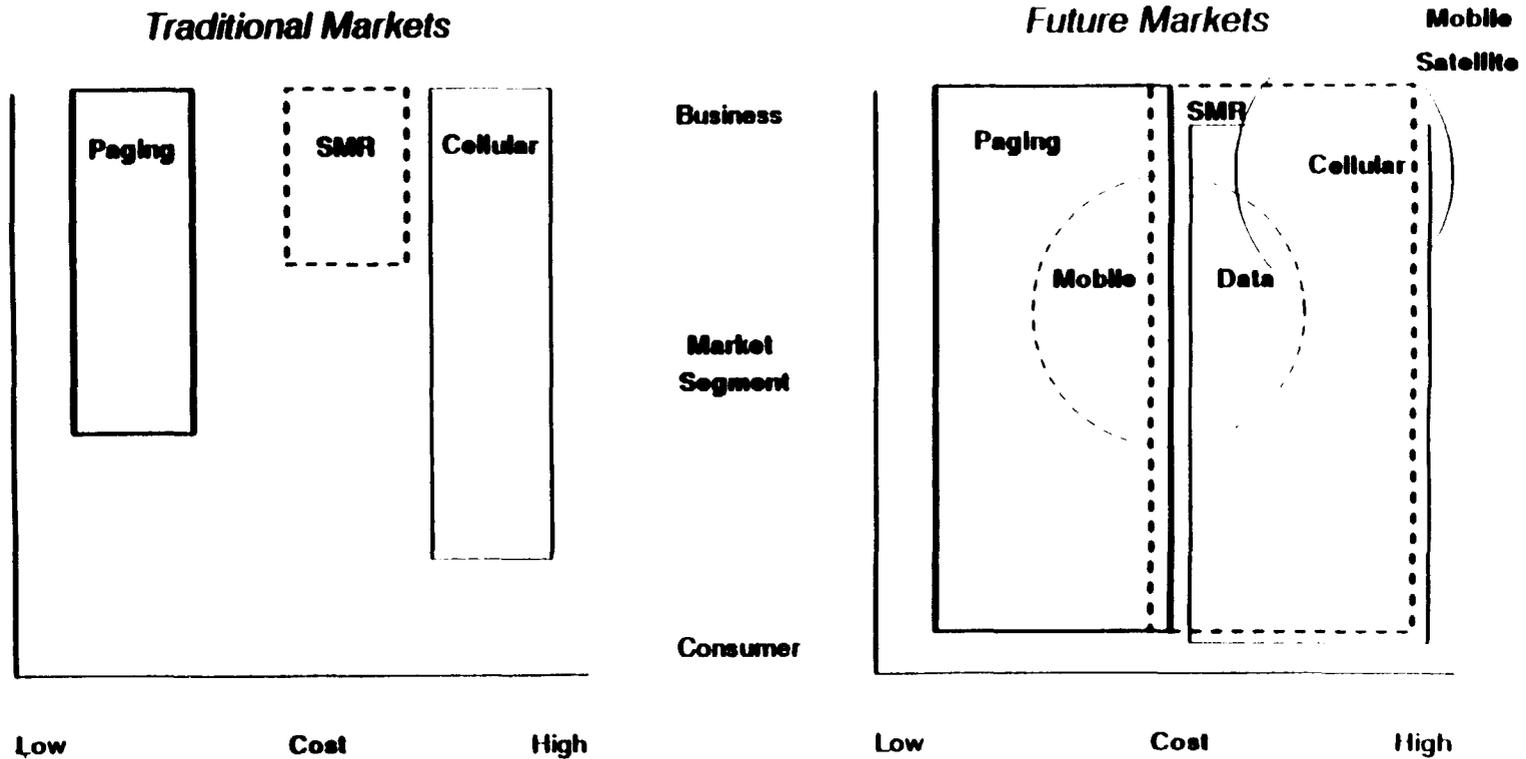


Changes in Market Positioning of Paging and Cellular Due to Price Sensitive Consumers



**Note: Excludes PCS.
Source: EMCI, Inc.**

Mobile Communication Target Markets, by Technology



Note: Excludes PCS.

Source: EMCI, Inc.

Dial Page Plans

Bill deKay, Dial Page Executive V.P. of Business Development, has said "We think there will be a tremendous opportunity to cross-sell paging, cellular and SMR services" -- targeting existing customers, multiple technology users, multiple location companies, frequent travelers and companies with two-way private systems.³⁵ Using Motorola's Integrated Radio System (MIRS), Dial Page's ESMR subsidiary Dial Call intends to combine the capability for mobile phone, dispatch, two-way alphanumeric messaging and mobile data applications in their subscribers' units.³⁶

EMCI Projections

Economic and Management Consultants International (EMCI) contends in a recent report that the next generation of Specialized Mobile Radio "will combine spectrally efficient radio equipment with a wide array of mobile services including dispatch, telephone interconnect, messaging and advanced mobile capabilities."³⁷

EMCI, noting the erosion of the boundaries between the technologies and services which have traditionally been viewed as separate,³⁸ projects that the "combination of voice and data services, wide-area coverage and potential for transparent roaming agreements will position digital SMR as a leading mobile communications provider in the late 1990s." Annual analog SMR growth is estimated at about 150,000 subscribers, and EMCI projects that by 1998 66 percent of SMR radios in service, and 90 percent of sales, will be digital.³⁹

In fact, EMCI has also recently issued a report, "Positioning SMR in a PCS Marketplace," which repeats the conclusion that the SMR industry is well-positioned to compete in the expanding wireless marketplace.⁴⁰

Freedonia Group Projections

The Freedonia Group projects that "Despite competition from PCS, markets for

³⁵ *Land Mobile Radio News*, March 11, 1994.

³⁶ *Id.*

³⁷ "The State of SMR & Digital Mobile Radio: 1993-1994," noted in "Quick Studies" in *Wireless Communications Forum*, March 1994, at p.83.

³⁸ Consistent with the EMCI report on "The Changing Wireless Marketplace," December 1992, which is the source of the EMCI graphics appearing herein.

³⁹ *Id.*

⁴⁰ *Land Mobile Radio News*, April 1, 1994.

earlier-generation telecommunications modalities will continue to increase briskly. Portable cellular telephony . . . boasts an already-established infrastructure and a large existing subscriber base. The advent of dual-mode and ultimately all digital handsets will allow cellular to compete for higher-end, data-intensive users, while further declines in phone prices and service charges will draw in lower-volume, consumer-type users."⁴¹

The Freedonia Group also concludes that "Less versatile pocket pagers will experience more direct competition from PCS, especially at the cost-conscious consumer end of the market, which PCS vendors will target aggressively. Nevertheless, pagers will remain a popular low-cost wireless option for many users for whom one-way communications is sufficient. In addition, pager producers are meeting their functional competitors head-on, introducing new generations of sophisticated devices."⁴²

Moffet, Larson & Johnson

Richard Burke, Vice President with the engineering consulting firm of Moffet, Larson & Johnson (an affiliate of PCS pioneer American Personal Communications (APC)), has been quoted as believing that services will not vary much between "diverse wireless sectors," although PCS and SMR "might 'make a wonderful marriage,' describing a scenario in which SMR could continue to focus on regional systems and rely on PCS partners to extend their network ranges. For PCS . . . the attraction to SMR systems would be the access to their established customer base and entrenched regional networks. This combination, however, would raise such technical barriers as putting multiple nodes in one phone."⁴³

NEXTEL - MCI

However, one such alliance does exist, and several ESMRs are pursuing such multi-mode, multi-node devices. NEXTEL and MCI have joined hands, and said they will "provide consumers, business and government customers with MCI-branded services such as mobile calling services, alphanumeric messaging, dispatching and data transmission, all integrated in a single digital phone."⁴⁴

Robert Foosaner and Lawrence Krevor of NEXTEL have described Nextel's ESMR service as consisting of "an all digital, fully integrated mobile network

⁴¹"Wireless Phones," *Wireless Communications Forum*, March 1994, at p.82.

⁴²*Id.*

⁴³*Land Mobile Radio News*, February 28, 1994.

⁴⁴*Business Wire*, February 28, 1994.

combining advanced digital cellular telephone service, plus a 140-character alphanumeric pager, two-way dispatch radio and full featured voice mail -- all accessible through a single compact subscriber unit. It also incorporates 'intelligent network' capabilities that can permit customers to replace their individual cellular, pager and voice mail phone number with a single 'Personal Telephone Number' that direct calls to wherever the subscriber is located."⁴⁵

They have affirmed that NEXTEL's "greatest attribute . . . is that each of these advanced wireless services are integrated into a single network and accessed with a single subscriber unit. The services complement each other such that the integrated advantage is far greater than the sum of the individual advantages of each discrete service."⁴⁶

OneComm

In fact, this vision of a unitary product, combining services and features which have traditionally been regarded as separate, underpins the business plan of the ESMR company OneComm (formerly CenCall Communications), which is preparing to offer integrated mobile telephone, dispatch, messaging and data services to its customers. The communications solution which OneComm offers combines features in a single subscriber unit, with an attendant savings in billing for a single unit -- rather than multiple units.

Skytel Corp.

User profile information about paging customers, which is also suggestive of opportunities for product cross-elasticity in a converging telecommunications marketplace, was provided by Donald Warfield, Vice President - Strategic Marketing, Skytel Corp., at the *Datacomm '93 Fall* trade show. Warfield reported that the profile of Skytel's 160,000 domestic customers indicates that:

- 84 percent are substantial users of fax;
- 78 percent are substantial users of overnight delivery services;
- 60 percent carry portable cellular phones;
- 59 percent use laptop or palmtop computer;
- 87 percent use a desk-top computer; and
- 29 percent use electronic diaries and organizers.⁴⁷

⁴⁵"From Taxicab Radios to a Nationwide ESMR Network: Nextel's Plan for the Wireless Future," *Wireless Communications Forum*, March 1994, at p.76.

⁴⁶*Id.* at 78.

⁴⁷*Cellular Sales & Marketing*, December 1993, at p.3.

U S WEST NewVector

John DeFeo has observed that:

In addition to new PCS, there is other competition looming on the horizon. ESMR has 19 MHz available in each market. ESMR advocates are not sitting still waiting for new PCS and enhanced cellular players to act. These companies are revitalized players in the wireless marketplace. Paging is also becoming more important, and these new "data communicators" are providing limited text and some two-way capability. Mtel, through its Skytel paging network, and MobileComm are big players in this area.⁴⁸

All of these players in the wireless marketplace are defining their place in the future market -- and thereby summing up their vision of the competitive future. And it is in that future that the FCC will find the basis for determining how competitive the industry and all of its component parts really are, not in theoretical models nor in arguments over the motivations underlying past conduct or in the accuracy and validity of various measures of past rates and market shares (although such arguments may themselves be an indicator of the competitiveness of the marketplace, as players resort to the regulator to obtain competitive advantage).

How Will the Services Compete? - Positioning

Clearly implicit in the business plans and consultants' recommendations we have just reviewed is the notion that service providers in the broad PCS marketplace will compete in three ways: (1) by positioning, (2) by pricing, and (3) by exploiting the existing telecommunications infrastructure.

Positioning may be considered a key factor in the markets wireless providers target. For example, AT&T originally conceived of cellular phones as "car phones" and as a result both needlessly constrained the market definition of cellular, and significantly underestimated potential demand. (AT&T originally projected cellular penetration of one million customers by the year 2000.)

Providers and analysts are positioning wireless products in several ways. First, wireless products are positioned by identifying them (for example, PCS) as either business or consumer in nature, and then by features calculated to appeal to that market segment. Familiarity is one vehicle, in which the service is marketed as providing an enhanced version of an existing, familiar service -- such as cordless telephony.

⁴⁸"The PCS Challenge: Opportunities for Cellular Carriers in Tomorrow's Wireless Marketplace," *Wireless Communications Forum*, March 1994, at p.30.

Among other positioning factors are such features as the ability to limit the called party's availability to the caller (a feature appealing to the residential or personal user), and such user-friendly features as simplicity of handset design. As the following examples indicate, though, the other means of competition -- pricing and exploitation of existing infrastructure -- are not entirely severable from positioning as a competitive tool.

Bell Atlantic Mobile

Bell Atlantic Mobile's Pittsburgh trial of a one-number service exploited several of these competitive approaches. The trial, which used phones which functioned as a cordless phone working off a base station at home, and as a cellular phone operating off both macro- and micro-cells away from the base, built upon such a familiar model.

One finding was that, as Jim McHenry, general manager of technical applications at Bell Atlantic Mobile, explained: "Customers are not terribly concerned with whether a service is based on 2 GHz or cellular. They want ubiquitous coverage."⁴⁹ However, McHenry also concluded that, "In the end, price will drive the market."⁵⁰ McHenry described the results as showing that "cellular can hold its own and perhaps even has the advantage over emerging PCS offerings."⁵¹

The findings of the study also included the observation that "personal and business life can and will remain separate -- by user choice." As Bell Atlantic Mobile President Dennis Strigl said, "We have learned that Americans want mobility and accessibility, but perhaps even more importantly, they want the ability to design and define their own unique service features."⁵²

Mercer Management Projections

The experts interviewed for the Mercer Management report believe that PCS rivalry will be initially based on service characteristics (ubiquity, quality, easy-to-use features), and later on price -- although "many . . . fear" that there could be a price war similar to the airline industry "where price competition rules and excess capacity inhibits price increases."⁵³

⁴⁹"Bell Atlantic to Extend Trial for Single-Number Service," *Telephony*, October 4, 1993, at p.6.

⁵⁰*Id.*

⁵¹*Id.*

⁵²*Cellular Sales & Marketing*, November 1993, at p.4.

⁵³*Mercer Management News Release*, February 8, 1994, at p.3.

Telesis Technology Laboratories

Telesis Technology Laboratory, which is affiliated with Pacific Telesis Group, recently concluded a 1,500 member trial of pedestrian and vehicular PCS, using randomly selected business and personal users in San Diego.⁵⁴ The trial included various combinations of services and pricing plans, including a one-number offering, using automatic routing features from Pacific Bell's advanced intelligent network, and limited or defined coverage areas, with premium rates applying for calling outside those areas.⁵⁵ The trial indicated broad satisfaction and acceptance of a range of service features and pricing options.

The Yankee Group Projections

The Yankee Group ties the growth of cellular to a shift from the early-adopter market to mass market models, although it concludes that "income has become an ever more important indicator of a household member's likelihood of using a cellular phone."⁵⁶ The Yankee Group concludes that the inclusion of PCN-type services will help open up the residential market, as some 50 percent of North American households are interested in "neighborhood cordless PCN service" as compared to 7 percent cellular phone ownership.⁵⁷

The model the Yankee Group offers for exploiting this opportunity is built on the predicates of (1) keeping service prices low, (2) building the network and handling the traffic, and (3) achieving critical mass and economies of scale.⁵⁸

The use of the cordless phone model to market PCN also hinges on three factors: (1) quality, (2) range, and (3) battery life. The Yankee Group believes that such PCN will "introduce competition into the local telephone loop and local exchange far more than cellular has done. PCN will be an extension and an alternative to the local loop."⁵⁹

PCS competes in these visions by offering familiarity, or new features, or both.

⁵⁴"Pacific Telesis PCS Test Discovers 'Real' Market for Personal Services," *PCS News*, February 15, 1994.

⁵⁵*Id.*

⁵⁶"Digital Cellular and Personal Communications Services," *Wireless Communications Forum*, July 1993, at p.63.

⁵⁷*Id.* at p.64.

⁵⁸*Id.*

⁵⁹*Id.* at p.66.

How Will the Services Compete? - Pricing

*The trials and projections regarding positioning clearly indicate that price is an issue. In fact, it is a truism that demand is price-elastic. Earlier studies, such as Deloitte & Touche's monograph on "User Perspectives on the Future of Wireless Communications," observed that "the market perceives the three greatest barriers to increased penetration to be business, not technology issues: (a) price of the service to end users -- 72 %; (b) lack of universal coverage -- 60 %; and (c) price of the equipment -- 47 %."*⁶⁰

As the following studies indicate, how much the PCS handset will cost, and how the service is priced are factors in PCS demand. Significantly different assumptions about the prices charged for both PCS and competing services, such as cellular, may produce significantly different results. As one trial observed, potential barriers to prospective customers include: (1) the price of handsets, deposits, term commitments, etc.; and (2) "confusing and frustrating rate plans." But what those prices will be, where those barriers will fall, is a matter for the market to determine.

American Personal Communications

The importance of price as a factor in demand for PCS has been clearly acknowledged by APC. Then-President of APC Al Grimes observed last year that "if [an operator] can hit certain price points, there is an enormous market [for PCS]."⁶¹ APC was reported to have discovered "the service price breakthrough point -- where demand begins to expand -- ranges from \$ 40 to \$ 50 per month."⁶²

Scott Schelle of APC has also been described as expecting to sell handsets "the size of an eyeglass case for \$ 200 to \$ 250 each" and to market the service at a price of 22 to 35 cents a minute, regardless of when the call is made.⁶³ However, on July 13, 1993, *Communications Daily* reported that APC's Telepoint actual trial charges for handsets and monthly service were \$ 15 plus 13 cents per minute.

Bell Atlantic Mobile

Bell Atlantic Mobile's Pittsburgh one-number trial indicated that users were

⁶⁰Joseph S. Kraemer and Gerald M. Belson, "User Perspectives on the Future of Wireless Communications," *Deloitte & Touche 1992 Monograph Series*, at p.4.

⁶¹"Telocator, PCS Executives Unveil PCS Market Trial Results," *PCS News*, July 22, 1993, at pp.4-5.

⁶²*Id.*

⁶³Michael Martz, "Going Wireless: Telephone Industry Takes to the Air," *Richmond Times-Dispatch*, October 4, 1993.

willing to pay as much as \$ 40 more per PCS handset than for a cellular handset. Specific rate plans were described as still requiring development.

Ericsson

The April 1993 issue of *Business Communications Review* noted that Ericsson's Freeset was deployed on California State University's Long Beach campus, providing both PCS and landline service for \$ 21 to \$ 31 a month.⁶⁴

Goodstadt Projections

In developing the nationwide estimates presented to the FCC, Goodstadt priced PCS at \$ 35 a month, and cellular at \$ 50 a month. Like figures were used in producing an earlier market-specific estimate for walk-around PCS serving 64 percent of the population in the Chicago MTA, which study estimated that cellular penetration in 2006 would be 1.11 million compared to PCS subscribership of .375 million.⁶⁵

GTE

GTE's Tele-Go trial in Florida involves offering "the service at about \$ 40 a month for 800 minutes of calling within a three-quarter mile radius" (the caller's home area), plus an additional 15 cents per minute outside of the callers home area. (The market in which such out-of-area calling was available in the trial was comprised of the eight counties of central western Florida.) The results of the trial, according to John Garcia, Director of PCS Marketing for GTE Telephone Products and Services, indicate that while people "are willing to pay a substantial premium over basic phone service" for mobility, they want the service over a broader territory at a flat rate.⁶⁶

The trials revealed that potential barriers to prospective customers include: (1) the price of handsets, deposits, term commitments, etc.; and (2) "confusing and frustrating rate plans."⁶⁷

Hauser Communications, Inc. Projections

Hauser Communications concluded as the result of a study performed early last year that PCS was an extremely price-sensitive product and that "the price point for acceptance" of PCS as a mass-market consumer product is in the "\$20-per-month

⁶⁴"Players and Promises in PCS," *Business Communications Review*, April 1993.

⁶⁵"Evaluating PCS Markets," *PCS News*, January 20, 1994, at pp.3-4.

⁶⁶Michael Martz, "Going Wireless: Telephone Industry Takes to the Air," *Richmond Times-Dispatch*, October 4, 1993.

⁶⁷*Id.*

range." Hauser's findings indicated that only half as many respondents were willing to pay \$ 30 a month for unlimited local usage, as opposed to \$ 20 a month, and that there was little interest in PCS at \$ 50 a month.⁶⁸

Mercer Management Projections

According to a *Reuters* report, P. William Bane, Mercer V.P., declared that "Prices are going to drop like a stone. In the process, there are going to be a number of companies that will not make it." The Mercer Management survey concluded that "some consumers want access to wireless services only in their immediate surroundings if it costs less than service for a larger area." The interview-based study also reported that "wireless services will be used mainly for voice communications initially, with fax and data communications emerging very slowly and becoming more important over the next decade."

Mercer's supply-side analysis noted that it was possible for both large and small firms (and alliances) to drive down wireless costs to a level approaching that of wireline communications in many markets. Tactics to lower the cost structures include "innovative approaches to customer acquisition that break the existing cellular paradigm of high acquisition costs."⁶⁹

Mercer's analysis concluded that over-capacity and the ability of the market to support only a limited number of competitors suggest that many entrants will price aggressively from the start, that firms that establish positions early "could" have an advantage, but that some providers will fail.⁷⁰

Northern Business Information

Northern Business Information (NBI) has concluded that "many residential customers are likely to view PCS as a form of extended cordless telephony (permitting greater range of movement)." However, NBI has also concluded that means that PCS will be a highly price-sensitive market, measured against cordless telephony and not wired or cellular telephony, and that "the supplier with the cheapest service and the most efficient network will reap the greatest benefit."⁷¹

⁶⁸"Hauser Survey Finds Price is Key to Consumer Acceptance of PCS," *TR Wireless News*, July 29, 1993, at p.15.

⁶⁹*Mercer Management News Release*, February 8, 1994, at p.2.

⁷⁰*Id.*

⁷¹"Cooperation & Demand," *Wireless Communications Forum*, July 1993, at p.44.

Piper Jaffray Research & Models of Paging

Roger Redmond, an analyst for Piper Jaffray Research, has noted the rapid growth of paging, observing that "you can get a pager for as little as \$ 8 a month, versus \$ 75 for a cellular phone."⁷²

As of last year enhanced paging services offered by Arch and PageNet in metro areas ran about \$ 15 a month, while Mtel's nationwide service cost as much as \$ 70 a month.⁷³ But 1994 has seen steep price changes for paging service as companies prepare to re-orient their services for an increasingly-competitive market.

Technology Futures Inc. Projections

Monthly charges for PCS were projected to fall to under \$ 31 (in 1993 dollars) by 2003, as subscribership climbs from 16 to 38 million.⁷⁴ By 2001, monthly charges were projected to fall to \$ 36.

	1994	1995	1996	1997	1998	1999	2000	2001
Monthly Price	\$ 72	\$ 65	\$ 57	\$ 52	\$ 47	\$ 42	\$ 39	\$ 36
Subs. (000)	15,070	19,020	23,060	26,010	29,340	33,090	35,570	38,240

Source: Technology Futures, Inc.

Telesis Technology Laboratories

The Telesis Technology Laboratory San Diego trials experimented with both flat-rate and airtime-based plans, the customers paying an average of \$ 20 to \$ 50 a month for the PCS service. The trials indicated that customers were willing to pay under both plan formats -- flat-rate or usage-sensitive -- with a high degree of satisfaction expressed with the service.⁷⁵

Telocator/PCIA

PCS News reported on July 22, 1993, that Telocator's study on "PCS Market Trial Results" recommended that PCS handsets should be priced between \$ 200 to

⁷²"High-wire Investing: Can Telecommunications Stocks Live Up to Investors' Expectations?" *Kiplinger's Personal Finance Magazine*, March 1994.

⁷³"Players and Promises in PCS," *Business Communications Review*, April 1993.

⁷⁴Technology Futures, Inc. *Research Alert*, February 4, 1994.

⁷⁵*PCS News*, February 15, 1994.

\$ 300, and that total monthly charges for "telepoint and advanced telepoint services should be . . . between \$ 25 and \$ 50, ideally closer to \$ 25."⁷⁶

U S WEST/Mercury One-2-One

The Mercury One-2-One service which is offered in London includes a digital handset at the equivalent of \$ 375, with free off-peak local calling, and what *The Economist* describes as "cheap peak-rate calls (up to 50% lower than those of rival cellular operators), cut-price monthly network fees and a range of services such as voice-mail and call-forwarding."⁷⁷ This offers limited assistance in the U.S., however, given the highly-different cost of living and prevailing wages in the U.K.

The only clear conclusion which can be drawn from these studies is that it appears that PCS demand will be highly price-elastic, and highly variable among the differing visions of the PCS players. If PCS is cordless service, an upgraded form of a cordless home phone, demand has different characteristics than if it is a wide-area, business-oriented service. If defined in certain ways, people do want a smaller, lighter, cheaper product. If defined in others, and specifically equipped with superior and specialized functionalities, people are willing to pay as much or more for the service as they do for current services. The test will be in the marketplace.

How Will the Services Compete? - Exploiting Infrastructure

One factor which has been described as key to rapid and affordable delivery of PCS has been exploiting the benefits of existing systems. Many analysts and providers have made this observation, both within and without the FCC's PCS proceeding, including David Freedman, Bear Stearns;⁷⁸ D.P. Behuniak, Bell Atlantic Personal Communications; Barry Goodstadt, EDS Management Consulting; Richard Siber, BIS Business Strategies; David Reed, FCC Office of Plans and Policy;⁷⁹ and Mark Lowenstein, Yankee Group.

In fact, the existing infrastructure may be exploited by providers already possessing such systems, or in partnership arrangements with companies possessing such systems. Either category would include companies such as cable companies, cellular providers, electric companies, local telephone companies, and others.

⁷⁶"Telocator, PCS Executives Unveil PCS Market Trial Results," *PCS News*, July 22, 1993, at p.5.

⁷⁷"The Personal Touch," *The Economist*, October 23, 1993.

⁷⁸Bear Stearns Wireless Communications Equity Research, *Telecommunications Untethered: Our Outlook for the Wireless Communications Industry*, January 12, 1994, at p.45.

⁷⁹David P. Reed, "The Cost Structure of Personal Communications Services," *IEEE Communications Magazine*, April 1993, at pp.102, 105-06.

Bell Atlantic Mobile

The nine month "Personal Line" trial, held in Pittsburgh, served 475 paying subscribers plus 100 non-paying users from Carnegie Mellon University. The trial used existing infrastructure and capabilities, including Bell of Pennsylvania's SS7 network, GTE's roaming network for out-of-network capability, IS-41 based call handoff, and standard MicroTac phones which functioned as a cordless phone working off a base station at home, and as a cellular phone operating off both macro- and micro-cells away from the base.⁸⁰

BIS Strategic Decisions' Projections

BIS Strategic Decisions' study "Mobile Professionals in Focus: Who They Are and How They Work" observes that "many products and services targeted for mobile professionals can be configured to rely on local, perhaps company-owned, infrastructures, rather than relying on publicly accessed networks in all cases. Long-term adoption, in turn will be less dependent on external infrastructures and can proceed more quickly than would otherwise be expected."⁸¹

GTE Trial Results

GTE's Tele-Go trial results produced the conclusion that cost structures must change in order to lower prices, including: (1) moving traffic on the existing LEC facilities (or using pico cells as an alternative); (2) matching acquisition costs with customer revenues (e.g., rethinking handset subsidies, sales commissions, new distribution techniques); (3) fostering a mass market for digital and better plant utilization (characterized as longer peak busy hours); and (4) sharing network components, including switching with other carriers, facilities with CATV, microwave and electric utilities, and sharing towers and buildings.⁸²

GTE's summary conclusions were that: (1) customers want more, not less, than they receive today; (2) LEC lines "offer great quality, reliability and connectivity for a very low price;" (3) duplication of networks "serves no one;" (4) "delivering combinations of services simply is the critical success factor for the PCS market;" (5) "targeted marketing techniques and brand differentiation are very important;" (6) without low cost plant profits are questionable; and (7) choosing the correct technology to deliver quality service "is a table stakes issue."⁸³

⁸⁰"Bell Atlantic to Extend Trial for Single-Number Service," *Telephony*, October 4, 1993, at p.6.

⁸¹*Land Mobile Radio News*, February 26, 1994.

⁸²"PCS Trials," GTE Presentation, Wireless '94, March 1994.

⁸³*Id.*

Specialized Markets - Data and Niche Applications

In fact, the broad definition of PCS does not ignore or omit the possibility of specialized or niche applications being developed. Indeed, the very breadth of the definition allows such services to be developed without forfeit or constraint because of the nature of the delivery mechanism or provider. Or it would if every would-be provider enjoyed equal opportunities in licensing.

Some companies which have greater incentives to develop specialized or niche applications are currently handicapped by restrictions on the amount of spectrum they can acquire in-region or in adjacent markets, which they otherwise would have a greater incentive to develop since they already provide voice services over their cellular systems.

Nonetheless, data services and specialized applications are being developed and deployed by cellular, SMR and ESMR providers, among others. Some of the projections for such services -- including users and revenues -- appear below.

BIS Strategic Decisions' Wireless Data Share Projections

BIS Strategic Decisions' study "Mobile Professionals in Focus: Who They Are and How They Work," which analyzes the market from the shape of the potential landscape, essentially composing a potential user profile from findings about organizational structure, or restructure, includes projections for the Mobile Data market.⁸⁴

BIS Projections for Mobile Data

	1992	1993	1994	1998
Mobile Data Users	215,000	364,000	685,000	4.3 million
Data Over Cellular	107,000	179,000	343,000	2.3 million
Mobile Data Revenues	\$ 198,000	\$ 290,000	\$ 498,000	\$ 2.3 million
Data Over Cellular Revenues	\$ 77,000	\$ 125,000	\$ 226,000	\$ 1.1 million

Source: BIS Strategic Decisions

⁸⁴Land Mobile Radio News, February 26, 1994.

These projections may be contrasted with the projections of:

- ◆ 5 million wireless data users by 1997 (Cliff Bean, A.D. Little);
- ◆ 13 million such users by 2000 (Booz, Allen & Hamilton);
- ◆ 2.6 million by 1997 (Forester Research);
- ◆ 9.4 million by 1997 (EMCI)
- ◆ 7 million by 1997 (AT&T Network Wireless Systems).

In fact, Barry Goodstadt projected growth from 2.3 million wireless data users in 1994, to 5.3 million in 1997, to 11.7 million in 2000 and 24.6 million in 2003.⁸⁵

Hatfield Associates' Projections

Hatfield Associates has performed a study of public references to demand for specialized PCS applications, and concluded that there is a documented need for a licensed, short-range, specialized PCS -- particularly to meet health care requirements for services such as heart monitoring, remote telemetry, home care, online database access, and bedside patient record-keeping; in-prison secure communications and surveillance systems; intelligent vehicle highway systems; and a wide variety of business and personal applications not adequately served by unsecured unlicensed systems.⁸⁶

When Will PCS Arrive?

Actual delivery of PCS services depends in part upon definition, and upon the delivery mechanism which you specify. If PCS is defined broadly, it may be delivered in 1994 using cellular spectrum, as suggested by Mark Lowenstein of the Yankee Group. If PCS is identified with the new spectrum allocation, then it has been projected as available from six to nine months after the PCS auction, as suggested by Richard Siber of BIS Strategic Decisions. (David Freedman of Bear Stearns has suggested that roll-out is possible within a year of licensing.)⁸⁷

Other analysts have variously projected delivery using PCS spectrum as possible before 1996 (e.g., as suggested by Barry Goodstadt, Arthur D. Little), or 1997 (e.g., as suggested by D.P. Behuniak, Bell Atlantic Personal Communications, Inc.). Barry Goodstadt has also indicated that roll-out might occur at any point between 1997 and 2000.

⁸⁵/d.

⁸⁶"An Analysis of the Need for Specialized PCS Systems," *Wireless Communications Forum*, December 1993, at pp.42-46.

⁸⁷Bear Stearns Wireless Communications Equity Research, *Telecommunications Untethered: Our Outlook for the Wireless Communications Industry*, January 12, 1994, at p.48.

CTIA is at one with all of the analysts and commentators who have called for the Commission to resolve the outstanding issues with dispatch, and to move forward with the auctioning and licensing of PCS spectrum.

Appendix

A Sampling of PCS Trial Results

The following provides somewhat extended summaries of the overall results of various PCS trials which were noted above.

Bell Atlantic Mobile

Bell Atlantic Mobile has trialed, and is extending the trial of, a single-number service using existing cellular technology and both landline and analog cellular networks. The nine month "Personal Line" trial, held in Pittsburgh, served 475 paying subscribers plus 100 non-paying users from Carnegie Mellon University. The trial used Bell of Pennsylvania's SS7 network, GTE's roaming network for out-of-network capability, IS-41 based call handoff, and standard MicroTac phones which functioned as a cordless phone working off a base station at home, and as a cellular phone operating off both macro- and micro-cells away from the base.⁸⁸

The Pittsburgh trial was described as showing that "cellular can hold its own and perhaps even has the advantage over emerging PCS offerings," according to Jim McHenry, general manager of technical applications at Bell Atlantic Mobile. He explained that "Customers are not terribly concerned with whether a service is based on 2 GHz or cellular. They want ubiquitous coverage. In the end, price will drive the market."⁸⁹

The findings of the study included that "personal and business life can and will remain separate -- by user choice." As Bell Atlantic Mobile President Dennis Strigl said, "We have learned that Americans want mobility and accessibility, but perhaps even more importantly, they want the ability to design and define their own unique service features."⁹⁰

While indications were that users were willing to pay as much as \$ 40 more per handset than for a cellular handset, specific rate plans were described as still requiring development. The trials are to be extended both in Pittsburgh for another year, and in Washington D.C.

⁸⁸"Bell Atlantic to Extend Trial for Single-Number Service," *Telephony*, October 4, 1993, at p.6.

⁸⁹*Id.*

⁹⁰*Cellular Sales & Marketing*, November 1993, at p.4.

BellSouth In-Building Trial Results

BellSouth initiated a 90-day test of an in-building cellular system in Richmond, VA, to demonstrate the integration of in-building and mobile services through a single handset. The trial includes use of a PBX configured to route calls to both wireline and wireless handsets, and bills in-building service on a flat-rate basis, and external usage on the normal CellularOne airtime and access basis. The trial has reducing voice mail volumes as one customer objective.⁹¹

GTE Tampa Trials

GTE Corporation conducted two market trials of PCS service in 1992-1993, using 3,000 residential customers in Tampa, FL, and 350 business participants in Nashville, TN, and Research Triangle Park, NC.

The residential trial, called Tele-Go Phone service, included "an improved-quality cordless-telephone service at home with the advantages of cellular-like mobility away from home."⁹²

The trial included the option of replacing subscribers' wired in-home service with the wireless unit. Fifty percent of the participants actually disconnected the LEC line. Service options included a vehicular/high-mobility service with a fixed-rate home service area and premium charges for use outside of the home area, as well as a more limited telepoint-type service which limited in-bound calling when the customer was outside of the home area, although out-bound calling was still possible throughout the eight-counties of west central Florida.

The business trial, called Tele-Go Business Service, combined in-building and wide-area wireless centrex and PBX services, available throughout an extended 3,500 square mile PCS coverage area.⁹³ The objective was to test mobility requirements, functionality and features for the business customer.

The findings of GTE's Tele-Go residential trial included: (1) that the demand for mobility extends beyond the cellular marketplace, and that residential users were "enthusiastic about mobility;" (2) the customer perceptions differ from cellular's image; (3) that usage patterns were complementary to current cellular usage; and (4) that "innovative low cost marketing techniques will be required to overcome entry barriers."

⁹¹ *PCS News*, March 1, 1994.

⁹² "GTE Launches Nation's Largest PCS Customer Trial," *PR Newswire*, August 25, 1992.

⁹³ "GTE Announces Second Phase of PCS Research Project -- Wide-Area Centrex and PBX Services for Business Customers," *PR Newswire*, April 28, 1993.

The findings of the business trial included: (1) that there are many in-office mobility applications; (2) that there were significant gains in productivity; (3) that service quality is at a much higher standard. GTE noted that the key point was that "integration with existing equipment [is] critical."

Customers' perceptions and requirements for PCS included: (1) that the image should be technologically simple; (2) that pricing should be easy to understand; (3) that entry barriers must be low; (4) that there should be "familiar ergonomics;" and (5) that there should be comparable quality standards for networks. The conclusion GTE drew as a key finding was that the "industry must expand its image and service brands."

Barriers to entry include: (1) the price of handsets, deposits, term commitments, etc.; (2) recognition of the need for wireless; (3) confusion over the choices for wireless; (4) "confusing and frustrating rate plans;" (5) perception of wireless services; and (6) fear of technological obsolescence. GTE identified a need for customer education about the benefits of wireless.

The findings included the conclusions that the cost structures must change in order to lower prices, including: (1) moving traffic on the existing LEC facilities (or using pico cells as an alternative); (2) matching acquisition costs with customer revenues (e.g., handset subsidies, sales commissions, new distribution techniques); (3) a mass market for digital and better plant utilization (characterized as longer peak busy hours); and (4) sharing network components, including switching with other carriers, facilities with CATV, microwave and electric utilities, and sharing towers and buildings.

The findings included observations as to the prospect for cannibalization of the existing cellular customer base. The observation was that the prospect for cannibalization depended on the positioning of the PCS offering. The findings included the observations that efforts at cannibalization may only "accelerate cellular demand in a limited market segment versus fundamentally expanding the market" and that "cellular carriers may want to cannibalize themselves first." The findings also included notation that "portable numbers implies portable carriers" and the "efforts to reduce churn will pay large dividends for the industry later." The bottom line conclusion was that "the market for PCS voice is 5 times larger than today's cellular."

The GTE findings included observations that distribution and brand recognition are key factors for PCS, and that the current distribution system (principally exclusive to carriers) posed the challenges of current cost versus a lower revenue per subscriber, and an orientation to "pull strategies not missionary selling."

The results led to the conclusions that the traditional orientation of cost reduction and provision of low cost universal service will be altered pursuant to customer demands for more service options, increased competition, changing market