

# The Demise of Analog Cellular

Ray L. Hodges

**A**nalog cellular service, known as Advanced Mobile Phone Service (AMPS), became commercially available in 1983. At the time, industry forecasters projected that there would be 900,000 cellular subscribers by 2000.<sup>1</sup> In the 15 years since its introduction, analog cellular has far exceeded even the most optimistic expectations. The actual number will exceed *50 million* this year! Despite the overwhelming market success, however, its days are numbered.

A second generation of digital technology is now being implemented, which offers users more features at a lower cost. This raises the issue of how much longer the existing analog system can remain competitive. There are two primary market forces, which will ultimately determine the timing and demise of analog cellular:

- (1) Network providers are implementing highly-efficient multiple access digital technologies in new wireless buildouts or significant expansions. This is becoming an economic necessity in today's increasingly competitive environment.
- (2) Subscribers will increasingly pressure cellular providers to match the customer features—improved battery life, privacy, and clarity—provided by digital networks and handsets. If the providers fail to meet consumer demands, subscribers will subsequently abandon their current analog services and networks for newer digital alternatives.

## A Classic Case of Technology Substitution

The current wireless environment has all the elements of a classical technology substitution. Initially, a more efficient digital technology is introduced as an overlay or parallel service to existing analog service. The newer technology subsequently becomes the technology of choice for all new buildouts. In the final stage, the newer technology completely replaces the older technology.

Digital wireless technology is just now entering this final stage as cellular providers begin to replace some of their legacy analog systems. To date, they are primarily replacing some analog channels with digital at each cell site to gain additional capacity. For some time, at least, both technologies will be necessary to provide blanket geographical coverage for both existing analog cell users and newer digital service subscribers so as to avoid creating gaps in coverage. However, as cellular providers begin to replace their analog equipment with digital systems and subscribers transition their services from analog to digital, the dual mode system will no longer be required. The focus of this article is to present TFI's latest forecasts for the:

- Growth of wireless and PCS subscribers.
- Rate of displacement of the analog cellular network with multiple-access digital systems.



An early user of technology forecasting, Mr. Ray L. Hodges brings to Technology Futures 30 years of telecom expertise and experience, including 25 years with GTE Telephone Operations. His interests are focused on emerging wireless technologies and markets and their impacts on the public telecommunications network. As a TFI consultant, he has worked on technology forecasting related projects for Texas Instruments, Southwestern Bell, NYNEX, GTE, and Anchorage Telephone Utility. Ray is a member of the Institute of Electrical and Electronic Engineers and a senior member of the Society of Depreciation Professionals.

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### The Future Wireless Market

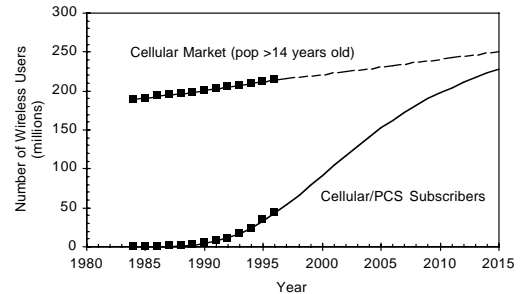
Our current forecast for wireless subscribers in the United States is based on trending an adoption pattern using 13 years of historical data. We assume the total U.S. wireless subscriber market consists of persons 15 years and older, which equals 80% of the total U.S. population. Aware that both cellular and PCS satisfy some of the same needs for personal communications services, our market growth forecasts for total wireless subscribers includes both analog and digital subscribers. If cellular adoption to date represents subscribers' preferences for mobility and portability, then its historical growth pattern should be a good indicator of the future wireless market. TFI's projections to 2015 for total cellular/PCS subscribers are presented in Table 1 and shown graphically in Figure 1.

**Table 1  
Historical and Projected Cellular/  
PCS Subscribers**

Year	Market (Population > 14)	Cellular/PCS Subscribers
1992	205	11
1993	207	17
1994	210	24
1995	212	33
1996	214	43
1997	216	55
1998	217	67
1999	219	79
2000	221	92
2001	223	105
2002	225	117
2003	227	130
2004	229	141
2005	231	152
2006	233	163
2007	235	172
2008	236	181
2009	238	190
2010	240	197
2011	242	205
2012	244	211
2013	246	217
2014	248	223
2015	250	228

Source: Technology Futures, Inc.

**Figure 1  
Historical and Projected Cellular/  
PCS Subscribers**



Source: Technology Futures, Inc.

There are currently about 55 million wireless subscribers in the United States, and we project that number will increase to nearly 200 million by 2010. This implies that, by 2007, there will be as many wireless subscribers as there are wireline subscribers today.

### Going All Digital

The new PCS providers are building out their networks and improving the quality, capacity, and cost effectiveness of the wireless infrastructure. High-capacity technologies such as CDMA, GSM, and TDMA have been tested, deployed, and adopted by customers. As important, PCS providers are adopting very aggressive and innovative pricing plans, thereby forcing cellular providers to match PCS in both price and features. This generally means that they must also offer digital service. Indeed, the largest cellular provider, AT&T Wireless, now offers digital service nationwide, and most cellular operators have digital overlays in their high growth areas. The result—most wireless network expansion and handsets are now digital. However, there is still a large embedded base of analog cell phones, and the analog network serves the important role of providing nationwide coverage for dual mode phones.

Several research firms have done short-term market forecasts of individual digital technologies, including CDMA, TDMA, and

GSM, which are reasonably consistent. We used Strategies Group's projections through 2000 to provide four near-term data points, which enabled us to compute a rate for our substitution analysis.<sup>2</sup> We treated all the digital wireless technologies as one single digital technology substituting for analog. There is, however, always the potential for one technology to dominate and displace the other digital technologies.

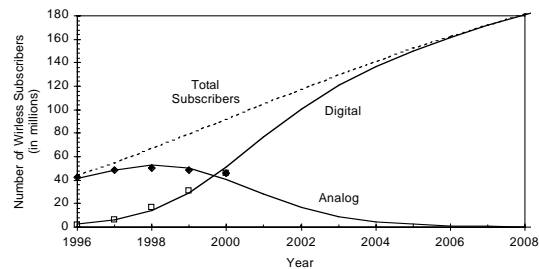
### The Push and Pull of Market Forces

It is not entirely clear at this time which strategy network providers will pursue. One scenario is to offer both analog and digital service until most of the legacy subscribers have abandoned analog services. A second scenario is to phase out the existing analog systems as quickly as possible so as to minimize the added cost of operating duplicate networks. There is already some evidence to suggest that analog cellular providers will use aggressive pricing plans and promotions to encourage subscribers to transition to digital sooner rather than later. We expect, however, that most operators will continue to offer both analog and digital until most subscribers have made the transition, and the digital systems are capable of providing full geographic coverage.

TFI chose to evaluate each of the scenarios described above using two different substitution models.<sup>3</sup> This allows us to forecast a range rather than a single data point. As can be seen in Figures 2 and 3, we expect digital to replace analog within eight to 12 years. In the scenario for Figure 2, the network operators, opting to cut costs and phase out the older technology as quickly as possible, *push* the newer digital technology into the marketplace with pricing and promotional incentives. In this situation, we project digital to fully replace analog within eight years.

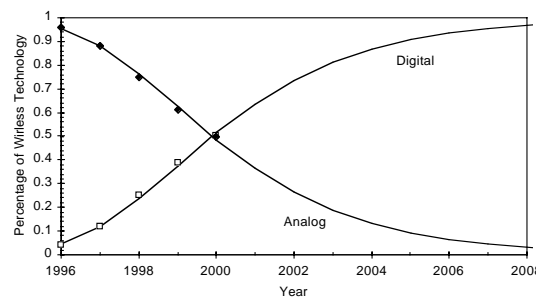
In Figure 3, consumers *pull* the technology into the marketplace at their own rate of adoption. In this situation, we project it will take up to 12 years for all subscribers to abandon the analog network. We believe

Figure 2  
Fisher-Pry: Digital Versus Analog Subscribers



Source: Technology Futures, Inc.

Figure 3  
Gompertz: Digital Versus Analog Subscribers



Source: Technology Futures, Inc.

that the most likely scenario, however, is somewhere in between, with network operators pushing consumers to abandon the analog cellular network within 10 years.

Perhaps more important than the data points given above, however, are our projections that over 50% of all wireless subscribers will be using digital technologies by 2000. Furthermore, we project that number will grow to approximately 90% by 2005. These forecasts imply the average remaining life of analog investment is only 2.5 years to 3.6 years.

### Summary

The success of analog cellular in the marketplace has far exceeded all early expectations. There is a large embedded base of analog cellular systems and dual mode phones, which currently provide

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complete geographic coverage for both legacy analog systems and the newer digital systems. This legacy analog system will continue to be necessary until either one of the digital technologies emerges as a clear market winner or all of the technologies can provide complete geographic coverage.

Clearly, multiple-access digital systems are superior to single access analog systems and will displace them. What remains unclear is whether the final replacement of analog with digital will be forced by the network operators or driven by consumer adoption. In either case, the substitution is underway and should be completed in the 2006 to 2010 timeframe. nto

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<sup>1</sup> F. Meeks, *Forbes* (March 1, 1993):80.

<sup>2</sup> Jennifer Files, "Wired for Wireless," *Dallas Morning News* (September 9, 1997):D1.

<sup>3</sup> We found that one of two models accurately describes most technology substitutions. These are the Fisher-Pry model and Gompertz model. The Fisher-Pry is generally applicable to the types of infrastructure upgrades typical of the telecommunications industry such as the replacement of analog switching with digital switching. This substitution is controlled by the network providers and is based on economic and competitive drivers. The Gompertz model is generally applicable to consumer-led substitutions such as the replacement of black-and-white television with color television. The consumer-led substitutions are typically keyed to their decision points, such as first purchases and replacement of broken or obsolete sets.