

WIRELESS RERC TECHNICAL PAPER

Access to Wireless Technologies for People with Disabilities: Issues, Opportunities and Policy Options

Findings of a Policy Delphi

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Abstract:

The ongoing innovation and development of wireless technologies has made a wide array of devices and services increasingly available in the United States; however, significant policy, economic and technological barriers to access of those technologies still exist for many people with disabilities (Baker and Bellordre, 2003). More than 51.2 million people, about 18 percent of the population, have some kind of long-term or conditional disability, suggesting that barriers to the adoption of wireless technologies affect a significant constituency (U.S. Bureau of the Census, 2006). Facilitation of equal access to technology-related services and devices, and wireless accessibility issues, can be addressed to varying degrees by the enforcement of existing legislation and regulations, augmented by new initiatives in disability and telecommunications policy and research to support increased access to wireless technologies that address the needs of the disability community.

Subsequent to identification of key issues surrounding wireless technology adoption by people with disabilities (Wireless RERC, 2003), the Rehabilitation Engineering Research Center on Mobile Wireless Technologies for People with Disabilities (Wireless RERC) conducted a policy Delphi to probe key stakeholders' opinions of what constitute the most significant issues surrounding the adoption and use of technologies by people with disabilities, as a precursor to the development of new policy approaches. Delphi participants represented several different areas of involvement with wireless technologies for people with disabilities: disability advocates, disability/wireless technology policymakers, and product developers/manufacturers. The Delphi instrument was arranged in four categories (forecasts, issues, goals, and options) over four key themes (access/awareness, economic, policy/regulatory, and technology). Respondents assessed the reliability of forecasts related to the future of wireless technologies, ranked the importance of key issues and barriers to increased wireless accessibility, and provided input for the subsequent development of potential policy initiatives to increase access to these technologies.

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Participants in the policy Delphi supported several predictions. All respondents believe that the “variety of services and applications available via wireless technologies will increase.” Likewise, those surveyed unanimously expect that “as wireless technologies become more established, they will be increasingly integrated into everyday applications.” Drawing on the results of three rounds of polling, the Wireless RERC developed a set of policy options and “fine-tuned” them using participating stakeholders from the disability community, wireless industry, and policymakers. In addition to the specific policy options developed (including generation of filings before the Federal Communications Commission), one of the goals of the Wireless RERC has been to use the products of its research to generate policy recommendations and other research initiatives that will increase the accessibility of wireless technologies and services for persons with disabilities.

1. Introduction

While the adoption of wireless technologies in the United States continues to become increasingly widespread, significant issues of access to these technologies persist for people with disabilities. In the U.S., more than 51.2 million people, constituting about 18 percent of the population, have some kind of long-term condition or disability, signaling that barriers to the adoption of wireless technologies affects a substantial population (U.S. Bureau of the Census, 2006). Equal access to technology-related services and devices and wireless accessibility issues can be addressed by legislation and regulations, as well as options developed from disability and telecommunications policy and research.

In response to these issues, the Rehabilitation Engineering Research Center on Mobile Wireless Technologies for People with Disabilities (Wireless RERC)² conducted a policy Delphi to probe key stakeholders’ opinions on the most significant issues surrounding the adoption and use of technologies by people with disabilities. The Wireless RERC policy Delphi, conducted between October 2004 (Round 1) and May 2006 (Round 3), probed key stakeholders’ opinions of the most significant issues for the adoption and use of mobile wireless technologies by individuals with disabilities. Specifically, the Delphi asked participants to assess the reliability of forecasts, importance of issues, desirability of goals, and feasibility of proposed options, in four areas: access and awareness, economic, regulatory and policy, and technology.

2. Methodology

The data for our findings was provided through a three round electronic Delphi (e-Delphi) method. The e-Delphi method is derived from the original Delphi method developed by Olaf Helmer and Norman Dalkey at the Rand Corporation during the 1950s and 1960s (Dalkey, 1969; Dalkey, Brown & Cochran, 1970). The Delphi method, as it was originally conceived, is a tool for military and economic forecasting based upon iterative surveys of experts in the given area under consideration (Cornish, 1977). Modern Delphi method relies upon expert opinion, professional experience, and sometimes intuition and tacit knowledge, in order to render a forecast on a given issue of importance.

Traditional Delphi method relies upon an iterative survey of experts with the intention of developing a better understanding, usually through the formation of a consensus, of problems, approaches, or future trends. A policy Delphi modifies those goals somewhat, and seeks to develop pro and con arguments about policy issues and

² Currently the Rehabilitation Engineering Research Center on Wireless Technologies for People with Disabilities (Wireless RERC) [<http://www.wirelessrerc.org>]

their resolutions (Turoff, 1970). This technique, employed here, allows a panel of experts to contribute elements to a complex situation with the intention of building a composite model of the situation under study. As Turoff and others defined it, a policy Delphi is less about the use of experts to generate a policy decision. Rather, it is more about employing a group of "advocates and referees" to present all the options and supporting evidence for a given issue, and "generates the strongest possible opposing views on the potential resolutions of a major policy issue." (Linstone and Turoff, 1975)

Policy Delphis have any of three important objectives: 1) To ensure that all possible options have been proposed for consideration; 2) To estimate the impact and consequences of any particular option; and 3) To examine and estimate the acceptability of any particular option. As conducted, the Wireless RERC policy Delphi considers possible options to increase use of and access to wireless technologies for persons with disabilities. The most important objective, however, was to consider the feasibility and acceptability of the options proposed. Policy Delphis rely upon six phases in the communication process between its participants: 1) formulation of the issues; 2) exposing the options; 3) determining initial positions on the issues; 4) exploring and obtaining the reasons for disagreements; 5) evaluating the underlying reasons; and 6) reevaluating the options (Linstone and Turoff, 1975).

In the case of the policy Delphi on wireless technologies and people with disabilities, an initial set of issues and goals were formulated prior to the first round through the development of a policy matrix and literature review. During the first two rounds of the Delphi, these issues and goals were presented to the panel for review. Open-ended responses were used to help formulate additional issues and goals through the Delphi. In addition, open-ended responses were used to gauge reasons for disagreement whenever a proposed issue or goal failed to receive a strong majority of support. In the first two rounds, options were also proposed and discussed, but the third, and final, round of the Delphi was committed solely to a consideration of the feasibility of options.

Policy Delphis adhere to four key principles: *anonymity*, which minimizes outside influences on the predictions panelists make and allows for candid responses; *asynchronicity*, the ability of participants to take part when and how they choose to; *controlled feedback*, as the results of one round of questions are used to inform the creation of the next; and *statistical response*, taking the opinions of experts on a given area and converting them into quantitative data. The Policy Delphi method is an iterative polling technique. Typically, a pencil-and-paper policy Delphi could run five or six rounds using such a technique. However, the use of an electronic Delphi, via an Internet site conceived for such a specific purpose, means that the Delphi may be satisfactorily completed in fewer rounds and with greater convenience for the participants. The current e-Delphi was conducted via the Human-Environmental Observatory's (HERO) e-Delphi system, hosted by Pennsylvania State University. This e-Delphi was conducted over the course of three rounds.

The Wireless RERC Policy Delphi, conducted between October and November 2004 (Round 1), June and July 2005 (Round 2), and February and May 2006 (Round 3) probed key stakeholders' opinions of the most significant issues for the adoption and use of mobile wireless technologies by individuals with disabilities. About 70 of 240 invited stakeholders participated in the Delphi. Participating stakeholders included members of the disability community, wireless industry, and policymakers. The instrument asked participants to assess the reliability of forecasts, importance of issues, desirability of goals, and feasibility of proposed options, in four areas: access and awareness, economic, regulatory and policy, and technology.

The results of the first two rounds of the Delphi are presented first. The first round asked a set of broad questions to determine a basis for developing more specific

and substantive questions. Open-ended questions, in which participants were permitted to provide any answer they wished to a given question, were also important in the development of subsequent questions. In the second round of the Delphi, participants were presented with results to those questions asked in the initial round that generated a strong consensus among the stakeholders, as well as new questions generated from the results of the first Delphi. In the third, and final, round of the Delphi, participants were presented with the results of the first two rounds. More importantly, however, a set of detailed options was offered so that participants could judge their feasibility as policy. These option items were developed from results of previous options proposed in the first two rounds of the policy Delphi, as well as responses to open-ended questions. An important difference here, however, is that the options were presented as specific actions to be taken and providing enough flexibility within each proposal to mitigate potential differences of opinion between stakeholders.

3. Overall Results

In the first round (see Appendix 1) of the policy Delphi, three findings distinguished themselves in particular: 1) problems with device compatibility; 2) ongoing awareness issues, especially on the part of manufacturers; and 3) economic concerns focusing less on the affordability of devices, but rather, more on the general level of employment of people with disabilities. Device incompatibility or poor interoperability was cited as the most important technology issue by the Delphi panel. Seventy (70) percent of respondents rated this "very important" and 22 percent rated it as "important." Compliance with Section 508 and Section 255 was also rated as very important (67 percent), but the importance of interoperability is a more significant finding. This finding suggests that users and experts perceive the need for accessibility standards, a topic probed more in depth in a successive round of the policy Delphi. The incompatibility issue was rated as more important than the development of new and innovative wireless applications, spectrum allocation, and wireless voice over Internet protocol (VoIP) services. Second, the number one awareness/access goal of the Delphi panel was to encourage manufacturers of wireless devices to include persons with disabilities in the review and evaluation of assistive or universally designed products and technologies. Eighty-one (81) percent of the participants replied that some system for product evaluation was a very desirable goal, and an additional 16 percent found that it was at least desirable. Third, the main economic goal expressed by panelists was related to increased employment opportunities for people with disabilities. When asked to rate the desirability of two economic goals, respondents favored increasing tax incentives for employers to hire people with disabilities over creating a national policy to lower the cost of mobile wireless devices. Additionally, when asked what goals would have the most benefit for people with disabilities, panelist responses ranged from, "better access to education, increase job and vocational training," to "more people with disabilities working side by side within companies," to "enforcing the ADA," to a desire for employers "to hire based upon the ability to perform the work without regard to the disability." These responses seem to indicate that employment opportunities are still the primary economic barrier for people with disabilities, more so than high costs of adopting new technologies.

The second round (see Appendix 1) of the policy Delphi sought to elaborate on some of the key issues and goals established in the first round. First of all, the second round established some of the primary issues pertaining to manufacturer and designer awareness of disability issues. In particular, the participants agreed that while manufacturers fail to design appropriately for people with disabilities, in reality, a much larger divide exists between designers/manufacturers, consumers/users, and retailers/intermediaries. Manufacturers are often oblivious to the barriers which face consumers with disabilities, but likewise, potential consumers of wireless products lack information necessary to select and use such technologies. This gap between the

producer and consumer may be bridged in several ways, including focus groups or “user forums” that might give manufacturers necessary input into understanding the needs of consumers with disabilities, while ensuring that users play an active role in the design process, better promotion and advertising of accessibility features by manufacturers; and perhaps most important, outreach and education of retailers who serve as intermediaries between the two groups. Second, the Delphi revealed that while accessibility requirements were one of the key limitations of wireless devices for people with disabilities, participants generally believed that making such requirements mandatory was not a feasible solution. Like most of the goals engaged by the respondents, market-based solutions and voluntary options were generally seen as most desirable and feasible. Finally, this insistence on voluntary options extended to policymaking, in which the Delphi group agreed on interagency coordination and increased coordination between public and private research as desirable.

Round 3 Results

In the third, and final, round of the Wireless RERC’s policy Delphi, participating stakeholders were presented with the results of the first two rounds. Thus, they were able to consider how the group voted as a whole on the forecasts, issues, and goals presented in the first two rounds. Delphi participants were also informed about which questions elicited a consensus among respondents (as in the forecasts) and which ones resulted in discernable blocs of opposition (regulatory and economic goals, for instance). Accompanying this presentation of the results from the first two rounds, the third round of the Delphi offered a series of policy options and asked participants to judge their feasibility as policy.

Policy Options

Access/Awareness Options

The third round of the Delphi asked respondents to consider the feasibility of five options related to access and awareness issues regarding wireless technologies for people with disabilities. Though in varying degrees, a majority of Delphi participants deemed these options feasible. The access/awareness options presented were among the most strongly supported in this final round of the Delphi. However, in the comments, respondents occasionally voiced concerns that the presented options might be disaggregated better to reflect the feasibility of certain aspects over others. Other participants occasionally noted that while certain options might be feasible as policy, they questioned their overall effectiveness.

First, Delphi participants were presented with an option to increase investment in public information campaigns about the availability, benefits, and use of wireless devices for people with disabilities. Such activities might involve the development of programs through the FCC Consumer & Governmental Affairs Bureau’s Consumer Affairs & Outreach Division and Disability Rights Office (DRO), at the federal level, as well as through State Assistive Technology Programs. Specifically, the option suggested (1) dissemination through factsheets and supporting material in association with key stakeholders including those companies designated as “Section 255 Manufacturers of Equipment” or encourage those manufacturers to develop focused advertising aimed at consumers with disabilities, and (2) public hearings to encourage increased stakeholder input into the regulatory process. **Despite some considerable opposition, a clear majority of Delphi respondents, 77 percent, believed this option was feasible (21 percent-very feasible; 56 percent-feasible). 21 percent of the participants, however, judged this option as “possibly unfeasible.”** A number of respondents noted that the first of these programs (encouraging manufacturers) is more feasible and likely more effective than the second (public hearings). Echoing such sentiments, some

participants noted that DRO might not have the resources to become involved in such options and, without technical staff, could not be involved in the process of product evaluation. Reflecting concerns about the ability of federal and state governments to be involved in such an option, some respondents suggested that the involvement of consumer groups, including the Hearing Loss Association of America and National Association of the Deaf, might be more effective. As one participant observed, "Since Section 255 requires consumer input, and these organization have historically participated, it would be a good idea to partner with them."

Q	Item	Scale			Definitely Unfeasible
		Definitely Feasible	Feasible	Possibly Unfeasible	
OA3.1	Develop new programs: through 1) the FCC Consumer and Governmental Affairs Bureau’s Consumer Affairs and Outreach Division and Disability Rights Office (DRO), at the federal level, as well as 2) through State Assistive Technology Programs, to increase investment in public information campaigns about the availability, benefits, and use of wireless devices for people with disabilities. Specifically, the DRO could initiate an expanded dissemination program of factsheets and supporting material in association with key stakeholders including those companies designated as “Section 255 Manufacturers of Equipment” [http://www.fcc.gov/cgb/dro/section255_manu.htm], or encourage those manufacturers to develop focused advertising aimed at consumers with disabilities. Secondly, DRO could facilitate additional sets of public hearings to encourage increased stakeholder input into the regulatory process.	21%	56%	21%	0%

Second, participating stakeholders were asked about an option to launch campaigns to educate manufacturers of wireless devices about the economic viability of universally designed products, existing markets of people with disabilities, and perhaps most important, larger untapped markets of aged individuals whose characteristics, from a design standpoint, mirror those of people with disabilities. Such campaigns, it was suggested, might be led by the National Institute on Disability and Rehabilitation Research (NIDDR) and its Wireless RERC, in collaboration with non-profit disability advocacy groups specializing in consumer issues. Industry groups such as TDI, Infnittec, and RESNA could develop an internal promotional campaign aimed at mass-market manufacturers and other non-niche marketers of wireless technologies emphasizing a voluntary, market-oriented approach with an orientation toward outreach and education. **A strong majority, 82 percent, believed this option to be feasible (30 percent-definitely feasible; 52 percent-feasible). However, a notable minority of respondents doubted the feasibility of such educational campaigns aimed at manufacturers (8 percent-possible unfeasible; 8 percent-definitely unfeasible).** Respondents in favor of this option contend that it remains important to raise awareness throughout the wireless industry, among manufacturers, service providers, and retailers, that “accessibility issues are important, some solutions are available, and accessible products will expand sales. Some respondents were a little skeptical about the effectiveness of these educational campaigns alone, however. One participant suggested

that industry might require some further incentives to participate, such as public funding of mainstream devices and services through disability-related programs, similar to existing state equipment distribution programs (EDPs) for TDD and TTY devices.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OA3.2	<p>Expanded Awareness/Outreach Campaigns: The National Institute on Disability and Rehabilitation Research (NIDRR), in conjunction with the Wireless RERC, and in collaboration with non-profit disability advocacy groups, to launch expanded campaigns targeted at manufacturers of wireless devices. This could be done either directly, or through trade associations such as the Cellular Telecommunications and Internet Association (CTIA).</p>	30%	52%	8%	8%

The Delphi instrument next probed the feasibility of training and education programs for educating retailers about the accessibility features of their products. Such programs, would be led by manufacturers of wireless technologies for people with disabilities or their respective trade associations, such as the Assistive Technology Industry Association (ATIA) or the Cellular Telecommunications and Internet Association (CTIA). One such program might involve the development of training sessions or classes to be hosted by large-scale retailers (Circuit City, Best Buy, Target, etc.), whom the manufacturer associations might target as partners in the initiative. Another could take the form of promotional and educational literature to be distributed to stores. **A decisive majority, 77 percent, of the Delphi participants agreed that such an option would be feasible (30 percent-definitely feasible; 47 percent-feasible). However, a significant number expressed doubts about the option (21 percent-possibly unfeasible).** Supporters of this option noted that they were especially enthusiastic about the fact that it would bring manufacturers in contact with retailers and consumers, providing channels from some consumer and retailer feedback and education. Larger retailers such as Best Buy and Circuit City, it was noted, "would be a challenging but good market....Since they are resellers, they typically don't think about accessibility as their issue to handle." Some participants suggested that support from retailers is key to the feasibility of the option and that rapid turnover of retail personnel is a serious issue to be addressed, especially in an area requiring high knowledge of products and disability. Other respondents, noting the importance of retailer "buy-in" for such initiatives, have questioned the motivations for industry to become involved in such an endeavor, though others in support of it argue that the industry and commerce side, not NIDRR or disability groups, are most appropriate for initiating retail educational campaigns.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OA3.3	<p>Industry based training and education programs: by manufacturers of wireless technologies for people with disabilities or by trade associations, for educating retailers about the accessibility features of their products. Development of training sessions or classes to be hosted by large-scale retailers (Circuit City, Best Buy, Target, etc.) in collaboration with manufacturer associations.</p>	30%	47%	21%	0%

Fourth, the Delphi instrument posed an option to develop user forums and “demo rooms” where consumers with disabilities can review wireless products and provide evaluations in a range of specialties. Private sector initiatives, such as iCan!, could provide consumer information and marketing services based on consumer polls, while the “demo rooms” of some state telecommunications distribution programs enabling users to audition TTY, TDD, and other AT equipment might be expanded to include wireless devices for persons with disabilities. **While a majority, 69 percent, agreed on its feasibility, Delphi participants were decidedly more divided over this option (30 percent-definitely feasible; 39 percent-feasible; 30 percent-possibly unfeasible).** Some participants in support of the initiative noted that user forums and “demo rooms” would provide industry a great opportunity to gather considerable amounts of consumer input, while others stressed its potential as a win-win solution for industry and consumers with disabilities. Criticisms of the option noted that wireless technologies change so rapidly that it might be impossible to keep demo rooms and their staff up-to-date. Others stressed the problems of outreach and funding, such as consumers not familiar with such initiatives as iCan!. A more nuanced criticism noted that demo rooms have a low usage and have a strong AT orientation but are weaker in the area of mainstream products and services.

Q	Item	Scale			Definitely Unfeasible
		Definitely Feasible	Feasible	Possibly Unfeasible	
OA3.4	User forums/"Demo Labs": Private sector initiatives to provide consumer information and marketing services.	30%	39%	30%	0%

Participants considered the feasibility of a *Consumer Reports*-styled guide to wireless devices for people with disabilities that would provide consumers with information about the usefulness and features of such technologies. Such a publication, the option suggested, might be developed and published by disability advocacy groups, especially those with a consumer-oriented focus, such as Cornucopia of Disability Information (CODI) or the Hearing Loss Association of America (formerly SHHH). Trade associations with a specific focus on people with disabilities, such as RESNA and the Consumer Advisory Network (CAN) of the Wireless RERC might help coordinate and be involved with such initiatives. **Respondents were somewhat divided about this option’s feasibility, though a majority of 77 percent believed it to be feasible (17 percent-definitely feasible; 60 percent-feasible).** However, 17 percent judged the option as possibly unfeasible, and 4 percent believed it to be definitely unfeasible. Even among this option’s strongest supporters, many Delphi participants worried that the volatile nature of wireless technology development would impede keeping such publications current and useful. Others have suggested that while a great idea, such publications would be expensive—“very,” in the words of one reviewer: “People always talk about this idea but don’t do the math.”

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OA3.5	Consumer Reports-type guide to wireless devices: Disability advocacy groups, especially those with a consumer-oriented focus, develop and publish a <i>Consumer Reports</i> -styled guide to wireless devices for people with disabilities, providing consumers with information about the	17%	60%	17%	4%

usefulness and features of such technologies.



Economic Options

Participants in the options round of the policy Delphi were decidedly split over the feasibility of the proposed economic options. While there was some support for the expansion of tax incentive programs to help employ persons with disabilities and promote the use of wireless technologies by them, there was also considerable disagreement over the expansion of existing equipment distribution programs and increasing income caps for access to wireless technologies by persons with disabilities.

First, participants deliberated over the expansion of state equipment distribution programs (EDPs), which generally follow one of two models: a voucher program that provides users with grants that may be used to purchase equipment from EDP approved suppliers, or a loan program that either provides clients with pre-purchased devices loaned on an as-needed basis or direct loans to obtain equipment. Such an initiative would involve manufacturer trade associations and disability advocacy stakeholder in collaboration with the Telecommunications Equipment Distribution Program Association (TEDPA) to develop links between manufacturers and state EDPs. The FCC’s Disability Rights Office (DRO) might also play a supporting role in such efforts. **Support for this option was decidedly mixed: 9 percent thought the option definitely feasible; 45 percent-feasible; 36 percent-possibly unfeasible; and 9 percent-definitely unfeasible.** While this initiative did have considerable support, most respondents pointed to two factors against its favor. First, many note that the FCC lacks jurisdiction over such programs that might help them succeed and the Commission shows no interest in developing federal standards for equipment distribution. Second, respondents note the presence of many budget problems at the state level that impede the expansion of such programs.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OE3.1	Expand existing equipment distribution programs: Manufacturer trade associations and disability advocacy stakeholders collaborate with the Telecommunications Equipment Distribution Program Association (TEDPA) to develop links between equipment manufacturers and state equipment distribution programs.	9%	45%	36%	9%

Second, the Delphi instrument asked respondents about the feasibility of expanding federal and state level initiatives to provide employers with additional motivations to employ people with disabilities. Also, participants were asked to consider increasing tax incentives at the state and federal levels to promote the use of wireless technologies by people with disabilities. **In spite of some opposition to the feasibility of this option, a majority, 68 percent, responded that the option was feasible (14 percent-definitely feasible; 52 percent-feasible). 23 percent of the Delphi participants believed such programs were possibly unfeasible, and an additional nine percent declared them definitely unfeasible.** Supporters of this option have observed that the current Bush administration has been supportive of programs to increase employment of persons with disabilities and that such tax incentives might be incorporated within programs to fulfill such ends. Somewhat cynically, however, other supporters voiced sentiments that tax incentive programs are

“the most politically likely solution” under the current administration. Critics of this option note that currently available tax incentives, such as those for architectural and transportation barrier removal, have gone largely unused by employers. Others questioned whether policy options to increase employment of persons with disabilities and improve their socioeconomic status more generally might realistically promote the use of wireless technologies by persons with disabilities, arguing that accessibility of the hardware is the main barrier to their use, not the ability to purchase them.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OE3.2	Expand existing tax incentive programs: Expanded federal and state level initiatives could provide employers with additional motivations to employ people with disabilities. Tax incentives could also be developed at the state and federal level to promote the use of wireless technologies by people with disabilities.	14%	52%	23%	9%

Finally, participating stakeholders considered the feasibility of a policy option to raise income caps imposed by assistance and distribution programs of such technologies. Given the greater expense of wireless technologies, this option asked whether increasing income caps to higher levels might enable greater access to wireless devices for persons with disabilities. **Perhaps the most divisive economic option, a majority of the participants viewed this initiative as possibly unfeasible (57 percent). A minority of respondents believed it to be feasible (definitely feasible-10 percent; feasible-31 percent).** Of the respondents who regarded increases in income caps as a feasible option, many noted that while wireless technologies might be less expensive than the assistive technologies covered under many equipment distribution programs, the higher recurring costs of wireless technologies warrants serious consideration for this economic option. More striking, however, were those respondents who tempered their enthusiasm for the option with concerns about their ability to become policy. The strongest criticism of the proposed option came from several respondents who suggested that such an option was counter to the goal of encouraging mainstream wireless devices for persons with disability. One participant suggested that rather than raise income caps, perhaps the state’s purchasing power should be used to motivate manufacturers to improve accessibility for persons with disabilities. In addition, the same stakeholder suggested that perhaps an economic study of the policy impact was necessary to determine the cost-benefit of the status quo versus a proposed mainstream program.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OE3.3	Increase income cap levels: Given the greater expense of wireless devices, especially those designed specifically for people with disabilities, increase the income caps to a higher level, to enable greater access to wireless devices for people with disabilities.	10%	31%	57%	0%

Regulatory/Policy Options

Participants in the Delphi study deliberated on the feasibility of two proposed regulatory/policy options. One of these, a regulatory enforcement study to determine whether current legislation and rulemaking has increased access to wireless technologies by persons with disabilities, elicited the greatest support from the Delphi panel. In addition, a majority of respondents also affirmed the feasibility of a policy option designed to strengthen the relationship between public sector and private sector research and development of wireless technologies that would benefit persons with disabilities. Both of these regulatory/policy options received some of the strongest support from the Delphi participants.

First, respondents were asked about the feasibility of developing a study or survey to determine whether the enforcement of Section 255 of the 1996 Telecommunications Act and Section 508 of the Rehabilitation Act of 1973 has been effective and resulted in greater access to and accessibility of wireless technologies for people with disabilities. This option developed from a consensus among participating stakeholders that too little is known about the impact that Section 255 and Section 508 have on mediating barriers faced by persons with disabilities. **Support for the feasibility of this option was among the highest of those presented. 86 percent of participants found such a study or survey would be feasible (50 percent-definitely feasible; 36 percent-feasible). Only a remaining 13 percent thought the option was possibly unfeasible.** While respondents expressed concerns over the costs of conducting such a study, nearly all of them asserted that it would be worthwhile.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OR3.1	Conduct regulatory enforcement study: Develop a study or survey to determine whether the enforcement of Section 255 of the 1996 Telecommunications Act and Section 508 of the Rehabilitation Act of 1973 has been effective and resulted in greater access to and accessibility of wireless technologies for people with disabilities in general, and within the workplace, specifically.	50%	36%	13%	0%

Second, participating stakeholders were asked to consider the feasibility of increasing links between public sector and private sector research and development of wireless technologies of people with disabilities. To develop such initiatives, the instrument noted that relationships between the federally sponsored Wireless RERC and its partners in the private sector might provide a model for developing such linkages, especially the Wireless RERC’s Industry Forum. In addition, trade associations such as RESNA might also play a role in strengthening relationships between public sector and private sector research. **A majority of participants, 90 percent, agreed on the feasibility of this proposed option (36 percent-definitely feasible; 54 percent-feasible). A small percentage of respondents expressed doubts about its feasibility (four percent-possibly unfeasible; four percent-definitely unfeasible).** Many participants noted that this goal of improving relationships between the private and public sectors should be a central part of the RERC’s missions, even if they may not be currently involved in such, and some noted that a few of the RERC’s are currently engaged in such initiatives. Regarding industry, it was expressed that consumer advocacy groups such as the Hearing Loss Association of America and the American Foundation for the Blind might be more appropriate than trade associations such as RESNA, or at least partnered with them. Some respondents in favor of the initiative have noted the problem that inadequate funding might pose to such a venture.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OR3.2	Develop expanded public sector/private sector research initiatives: Increase links between public sector and private sector research and development of wireless technologies for people with disabilities.	36%	54%	4%	4%

Technology Options

Finally, respondents were asked to evaluate the feasibility of two technology related options, of which a majority supported both. First, they were asked about the development of new interoperability and technology standards. Though there were considerable doubts about the feasibility of such an option, more respondents than not endorsed it. However, a second option to improve EAS services and emergency communications for persons with disabilities won the highest support of all of the options presented in the Delphi.

Delphi participants were first asked about the feasibility of developing a voluntary set of standards for product interoperability, compatibility, and accessibility for users with disabilities. The Delphi instrument suggested that manufacturer trade associations such as ATIA, CTIA, and RESNA might work in collaboration with federal agencies such as NIDDR and the FCC’s Disability Rights Office, Wireless Telecommunications Bureau, and Office of Engineering and Technology. **Despite considerable doubts over its feasibility, a majority of participants, 58 percent, supported this option (31 percent-definitely feasible; 27 percent-feasible). 31 percent of participants, however, viewed the option as possibly unfeasible, and nine percent thought it definitely unfeasible.** This option elicited a wide variety of opinion, but four major sentiments were discernable. First, a minority of respondents who generally supported the development of common standards questioned making them voluntary, noting that Section 508 provided a better model for the basis of such guidelines. Second, a number of participants contended that it would be better to work with existing standards and simply add accessibility to them. Their reasoning is that separate standards efforts would flounder alongside other, better developed standards efforts such as the ISO JTC1 SWG-A initiative. A third outlook questions whether manufacturers might become involved in such efforts out of a fear that they might endanger proprietary technologies and processes. Finally, some participants questioned the particular roles of stakeholders in such an effort. Some suggested that developing standards was a process that would involve many more groups than the FCC and manufacturers. Others argue that industry alone should pursue such standards; the government’s role should be to provide motivation and incentives, not oversee the process.

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OT3.1	Develop new interoperability and technology standards: Develop a voluntary set of standards for product interoperability, compatibility, and accessibility for users with disabilities.	31%	27%	31%	9%

Second, Delphi participants assessed the feasibility of developing initiatives through the FCC Enforcement Bureau’s Emergency Alert System to develop guidelines and protocols for manufacturers of wireless devices for people with disabilities, in order to enable people with disabilities to receive and recognize EAS alerts. This option also

suggested the involvement of disability stakeholders to seek FCC advice for rulemaking, through the Disability Rights Office and Wireless Telecommunication Bureau’s 911 Services Division, to mandate Enhanced 911 (E-911) capabilities for wireless devices and services accessible to and used by people with disabilities. **This option received the most support of all of those presented to the Delphi respondents. An overwhelming majority, 94 percent, believed it to be feasible (40 percent-definitely feasible; 54 percent-feasible). Only 4 percent thought it was possibly unfeasible.** Supporters of this option noted that such policies were likely to have broad public support that could help in building consensus among the multiple conflicting interests of stakeholders, and as one participant noted, “The option is not only feasible, but essential.” In the aftermath of the 2005 hurricane season, many parts of this proposed option were already under development via rulemaking in the FCC. While some participants praised the FCC’s actions on this issue, some pondered how extensive such rulemaking might be. Perhaps more relevant for the disability community was the observation of one respondent: “This option will probably happen without a lot of prodding by disability stakeholders, but they should be prepared to explain their special needs.”

Q	Item	Scale			
		Definitely Feasible	Feasible	Possibly Unfeasible	Definitely Unfeasible
OT3.2	EAS Alert and Emergency Communication Initiatives: Develop initiatives through the FCC Enforcement Bureau’s Emergency Alert Service to develop guidelines and protocols for manufacturers of wireless devices for people with disabilities, in order to enable people with disabilities to receive and recognize EAS alerts. In addition, disability stakeholders should seek FCC advice for rulemaking, through the Disability Rights Office and Wireless Telecommunications Bureau’s 911 Services Division, to mandate E-911 capabilities for wireless devices and services accessible to and used by people with disabilities.	40%	54%	4%	0%

4. Comments and Analysis

4.1 Overview

Over the course of its three rounds, the policy Delphi on wireless technologies and persons with disabilities changed somewhat. At the outset of the Delphi, there was pronounced emphasis on economic and technological barriers to the adoption of wireless technologies by persons with disabilities. However, during the first two rounds, it became apparent that access/awareness issues warranted more attention. Moreover, whereas emphasis was placed early in the Delphi on awareness of wireless technologies by consumers with disabilities, equally important was addressing the awareness of designers and manufacturers to the needs of persons with disabilities. In the second round, retailer awareness about the accessibility features of their products and an ability to demonstrate these features and help customers with disabilities select the best products for their needs emerged as an important issue to be addressed. The fact that participating stakeholders in the Delphi agreed on the feasibility and importance of five policy options related to access and awareness, more than any other issue, speaks volumes about its salience in addressing barriers to the adoption of wireless technologies by persons with disabilities.

The Delphi also revealed a number of tensions inherent in the process of addressing wireless technologies and persons with disabilities, while also attempting to discern the sentiments of the participants on these issues. First, the Delphi instrument raised the issue of whether the policy options generated in the course of the Delphi should be framed as mandates or as voluntary or market-based initiatives. Respondents expressed strong support for initiatives that were either voluntary or collaborative efforts, such as developing manufacturer or designer standards. Conversely, there was little support for policy mandates regarding the accessibility of wireless technologies by persons with disabilities. With some minor exceptions, Delphi participants generally noted that efforts to increase the use and accessibility of wireless technologies was to improve the understanding of manufacturer, designer, and retailer awareness about the existence of markets for such technologies and how the needs of various disability groups could be taken into account when designing and marketing relevant products. Likewise, economic options, participating stakeholders advocated, should be based upon incentives rather than mandates, even as the Delphi respondents noted a need for broad measures to increase the employment and improve the socioeconomic status of persons with disabilities.

Related to the preference of the Delphi participants for voluntary or market-driven initiatives, was a prevailing sentiment for the mainstreaming of wireless devices for persons with disabilities. Addressing the acknowledged tension between assistive technology and universal design, respondents sided with the latter. Their indication that wireless technologies for persons with disabilities should be mainstream technologies with accessibility features rather than wholly separate assistive technology devices suggests a broader belief in the integration of persons with disabilities into society, and in achieving such objectives through the market. For example, participants noted that the goal of achieving accessibility through mainstream products meant that wireless technologies would become less expensive for persons with disabilities, thus minimizing the need for economic options to make them affordable or policy options to provide for their distribution.

Hence, while the Delphi did reveal some major differences of opinion, especially regarding the proposed options, respondents generally were in agreement on the major issues pertaining to access/awareness, economics, policy, and technology of wireless technologies for persons with disabilities. Given the wide array of stakeholders involved, the importance placed on heightening access and awareness among consumers, manufacturers, designers, and retailers emerged as the leading concern. Also, a preference for market-based or voluntary solutions rather than mandated ones, as well as for mainstream devices rather than an AT approach, were also salient themes.

4.2 Forecasts, Issues, and Goals vs. Options

One notable discontinuity which emerged from the Delphi was the high level of consensus that most forecasts, issues, and goals received, versus the often fractious support for the proposed options. While a majority of the participants agreed on the feasibility of almost every option proposed, such support was not nearly as overwhelming as for the previous three categories. Indeed, discernable blocs of support for the policy options were evident. In explaining this phenomenon, it may be possible to note that while the stakeholder groups taking part in the process agreed on a common set of desired ends—most notably, increased access to and usability of wireless technologies by persons with disabilities—they diverged on the means to achieve such goals.

The options receiving the greatest breadth of support were those related to heightening access to and awareness of wireless devices. Each of the five options received a majority of support; nevertheless, several options revealed the existence of conflicting groups. Most notably, the first access/awareness option (OA3.1), the

development of new programs through federal and state agencies, did receive 77 percent of support regarding its feasibility. Supporters, many of whom were disability advocates or related professionals, argued that the federal government should play a larger role in promoting awareness of and access to wireless technologies for persons with disabilities. Yet, a notable 22 percent of respondents expressed reservations over the same option. Several stakeholders in this group noted that both support and funds for this option were lacking in the FCC and other federal agencies. While this group represented a distinct minority, the presence of stakeholders with knowledge of this topic means that doubts over this option's feasibility should be taken seriously. A similar situation may be found with the option on "demo rooms" (OA3.4). While a majority of stakeholders thought the option to be feasible, a vocal minority with experience in the issue expressed concerns that this option would promote an assistive technology rather than mainstream products approach, and that such initiatives would be difficult to implement because of the ever-changing nature of the technology involved (i.e. new models mean that staff could not be adequately educated on the technologies).

5. FINDINGS/OUTCOMES

As noted above, the findings of the Wireless RERC's policy research on wireless technologies and persons with disabilities strongly suggested the need for the development of an expanded array of policy approaches and options to address the potential for and current shortcomings of wireless technologies to impact society in general, especially the lives of people with disabilities.

To this end, the Wireless RERC has had the opportunity to impact policy change, in an organic manner flowing from the Center's policy change process. As a consequence of the Center's monitoring and assessment activities, the Center has identified opportunities to provide input into the FCC regulatory process. Drawing on Center findings, the Center filed comments with the FCC in 2003, 2004, and 2007, responding to specific rulemaking proceedings. In the FCC's calls for comments on an *Order, Order on Reconsideration, and Notice of Proposed Rulemaking* (FCC 03-112) on the Telecommunications Relay Service (TRS) and speech-to-speech (STS) services for persons with hearing and speech disabilities, the RERC urged the FCC to consider the role of such services in emergency situations. Again, in responding to comments filed by various advocacy groups for the deaf and hard of hearing, the RERC emphasized to the FCC the importance of providing parity of service with respect to emergency communications and expand TRS requirements so as to allow text messages to become a regular part of emergency communication services.

In a *Notice of Proposed Rulemaking* [FCC 04-189] regarding the future of the Emergency Alert System (EAS), the Wireless RERC's comments recommended a major upgrade of EAS, including mandatory participation by broadcast stations, an expansion of EAS rules to cover new digital technologies, and expanding EAS to new devices essential for providing emergency information to people with disabilities. Recommended were new technological pathways for EAS communications including wireless data networks that have the potential of reaching millions of Americans in remote locations, both fixed and mobile. The RERC also recommended more comprehensive planning and coordination among state and federal agencies and focus on the benefits of digital and alternative technologies for people with disabilities. In a second filing, the Center recommended that the FCC further encourage and support IP Relay and comparable text messaging services for wireless devices, recommended making IP Relay mandatory for states, requiring services to be offered 24 hours per day, 7 days a week, and promoting open standards that will allow multiple platforms for text-to-text communication to flourish. The wireless RERC suggested that the FCC encourage wireless manufacturers to build in TTY capability so as to enable more reliable emergency communications for users with disabilities.

The RERC uses the results of policy research activities to: 1) consult with stakeholders on activities of interest, 2) produce informative newsletters, 3) Generate

filings before the FCC, and other pertinent agencies, and 4) contribute to actions in other related venues. While outcomes are complicated to determine in social science, one way of ascertaining policy impact is in the degree to which the RERC comments and input are reflected in agency documents. Evidence of the efficacy of the RERC process can be inferred by the inclusion of several of our comments in FCC rulemakings (FCC, 2005). Further, Center findings have also been published in periodic reports on the website and disseminated to members of the consultative policy network, and to other interested stakeholders.

Moving forward, the Center policy research process will be refined drawing on input provided in the Delphi process. The cross-cutting nature of the Center's research suggests that the Center could be enhanced by expansion of expert resources. To this end the RERC is developing a virtual network of technology policy experts who will collaborate on applied policy initiatives. The "Collaborative Policy Network" will bring together experts in various aspects of the policy process to provide support to the Wireless RERC as well as to other RERCs conducting research in the telecommunications and information technology-related fields. The team will assist with monitoring of legal, regulatory, and policy activities (primarily pertaining to the four issue areas) at the Federal and State level, and help identify and develop appropriate policy response.

The Wireless RERC continuously monitors the policy environment by tracking legislative, regulatory, judicial, and industry activities as they relate to advanced communications, information technology, technology access, and vulnerable populations. Center efforts in this area are expected to continue to serve to keep constituents in the technology, policy, academic, and research communities well-informed on the latest developments and issues that impact the advanced communications policy landscape, and to help promote the increased access to wireless technologies for people with disabilities.

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Appendix 1: Delphi Findings Round 1/2

Forecasts

Responding to the reliability of forecasts related to the future of wireless technologies, participants in the Delphi concurred with several predictions. In particular, all respondents believe that the “variety of services and applications available via wireless technologies will increase.” Likewise, those surveyed unanimously expect that “as wireless technologies become more established, they will be increasingly integrated into everyday applications.” When asked what services and applications via wireless technologies would be most prominent in the foreseeable future, participants identified home electronics device control, location identification and GPS integration, secure financial transactions, Voice over Internet Protocol (VoIP), and video/multimedia applications as most important. On the more focused issue of aging and people with disabilities, consensus was somewhat lower. However, 92 percent of the respondents agreed that “as the population ages and the possibility of more people with disabilities increases, more attention will be focused on accessibility issues.”

Q	Item	Scale			
		Highly Reliable	Reliable	Risky	Unreliable
FT1.1	Variety of services and applications available via wireless technologies will increase. How certain are you that this projection is reliable?	71%	29%	0%	0%
FT2.1	As the population ages and the possibility of more people with disabilities increases, more attention will be focused on accessibility issues. How certain are you this projection is reliable?	54%	38%	8%	0%
FT2.2	As wireless technologies become more established, they will be increasingly integrated into everyday applications. How certain are you that this projection is reliable?	79%	21%	0%	0%

Disability Issues

Access/Awareness

Participants in the policy Delphi attempted to discern the foremost issues related to access to wireless technologies and services by people with disabilities, as well as awareness by designers and manufacturers about the needs of this population. Ninety-five (95) percent of the participating stakeholders agreed that “people with disabilities may be unaware that assistive technology (AT) or universal design (UD) wireless technologies exist or could be of benefit to them” represented a very important or important issue. More prominent than a belief in total unawareness among people with disabilities, however, is a more nuanced belief that the affected population lacks knowledge in the selection and use of such technologies. One-hundred (100) percent of respondents identified as very important or important the observation that “consumers with disabilities lack awareness of how to select and use accessible technology devices.” Invited to suggest reasons for this lack of awareness among consumers with disabilities, participants identify a lack of information disseminated to the general population, an inability or unwillingness on the part of manufacturers to advertise the devices or their

accessibility features, the fact that retailers fail to pass on such information to their customers, and a lack of advertising or information in general. In particular, many comments emphasize the need for a second-hand review of assistive technology (AT) products in order to provide consumers with disabilities with a greater knowledge in the selection and use of devices and services.

Responses were not limited to access and awareness issues among consumers, but engaged designer and manufacturer sensitivity, as well. A significant majority of key stakeholders, 95 percent, regard “manufacturers who may believe that the market for wireless devices designed for people with disabilities is too small and specialized to target” as a crucial issue to be addressed. Nearly as many participants agreed on the importance of focusing on manufacturers and product designers who may be unaware of accessibility issues, such as difficulties faced by people with sensory impairments in navigating multi-level interfaces. Somewhat fewer respondents, though still comprising a clear majority, identified “manufacturers who fail to advertise adequately or promote the accessibility features of their products” as an important issue.

Q	Item	Scale			
		Very Important	Important	Slightly Important	Unimportant
IA1.1	People with disabilities may be unaware that assistive technology/ universal design (AT/UD) wireless technologies exist or could be of benefit to them. How important is this issue?	65%	30%	5%	0%
IA1.2	Manufacturers may believe that the market for wireless devices designed for people with disabilities is too small and specialized to target. How important is this issue?	76%	19%	3%	3%
IA2.1	Manufacturers and product designers may be unaware of accessibility issues (for example, difficulties in navigating multi-level interfaces). How important is this issue?	67%	33%	0%	0%
IA2.2	Manufacturers fail to advertise adequately or promote the accessibility features of their products. How important is this issue?	54%	42%	4%	0%
IA2.3	Consumers with disabilities lack awareness of how to select and use accessible technology devices. How important is this issue?	71%	29%	0%	0%

Economic Issues

Participants in the Delphi also grappled with the potential for wireless devices to ameliorate the economic disadvantages often faced by people with disabilities, while also acknowledging that the same devices that might help those individuals are also inaccessible for those unable to afford them. The strongest majority, 97 percent, of participants in this category agreed that the “availability of wireless-based services or tools to improve accessibility for people with disabilities” is a very important or important issue. However, almost as many respondents, 92 percent, acknowledged the importance of wireless devices as generally less affordable for people with disabilities, as well as a more specific observation that additional costs for assistive technology and accessibility modifications make wireless devices less affordable for people with disabilities. Asked to elaborate on how wireless devices might be made more affordable for people with disabilities, participating stakeholders most commonly replied that the integration of accessibility features into mainstream products for the creation of economies of scale might be the best solution. Others suggested that the merger of disability and aging markets, government purchases for bulk discounts, or provision of

tax incentives or vouchers might be the best means for making wireless technologies more affordable to people with disabilities.

Q	Item	Scale			
		Very Important	Important	Slightly Important	Unimportant
IE1.1	Wireless devices are generally less affordable for people with disabilities. How important is this issue?	62%	30%	5%	3%
IE1.4	Availability of wireless based services or tools help improve accessibility for people with disabilities. How important is this issue?	70%	27%	0%	3%
IE2.1	Additional costs for assistive technology and accessibility modifications make wireless devices less affordable for people with disabilities. How important is this issue?	61%	35%	4%	0%

Regulatory/Policy Issues

Respondents appeared to have been more divided over the issue of the importance of specific regulatory and policy issues than on any other issue addressed by the Delphi. Nevertheless, a clear majority agreed on the importance of three issues. First, the largest proportion of participants, 95 percent, acknowledged as very important or important the observation that “wireless devices are currently subject to few accessibility requirements.” Second, and somewhat more divided over its importance, 87 percent of those taking part recognized as very important or important the “participation of Congress and other key stakeholders in crafting alternative policy initiatives to reduce barriers to the use of wireless technologies.” Third, 78 percent of respondents agreed on the “increased use of interagency strategic planning to improve coordination among federal agencies” as a very important or important issue. Given the greater differences of opinion that existed in this category, participants were asked, “What specific regulatory and policy issues regarding wireless technologies for people with disabilities were currently being neglected?” Many responded that a need existed for the federal government to address the full accessibility of telecommunications equipment, including an expansion of Section 255 of Telecommunications Act of 1996.

Q	Item	Scale			
		Very Important	Important	Slightly Important	Unimportant
IR1.1	Increased use of interagency strategic planning to improve coordination among Federal agencies. How important is this issue?	46%	32%	16%	5%
IR2	Participation of Congress and other stakeholder groups in crafting alternative policy initiatives to reduce barriers to use of wireless technologies. How important is this issue?	46%	41%	11%	3%
IR2.1	Wireless devices are currently subject to few accessibility requirements. How important is this issue?	52%	43%	4%	0%

Technology Issues

Delphi participants were also asked to assess the importance of technological matters related to wireless devices for people with disabilities, and their evaluations varied from issue to issue. An overwhelming majority of respondents, 92 percent, identified "device incompatibility or poor interoperability" as a very important or important issue. Asked specifically what they believed were the most important incompatibility or interoperability problems with wireless devices, respondents identified three issues in particular: TTY to Internet protocol text conversion, hearing aid compatibility, and the different operating systems, languages, and standards which exist between mobile and fixed devices. 95 percent of the individuals who took part in the Delphi affirmed the importance of "compliance with Section 508 of the Rehabilitation Act of 1973 and Section 255 of the Telecommunications Act of 1996." When asked to elaborate on the key impediments to enforcement of Sections 508 and 255, respondents most commonly answered that there was a lack of enforcement for these rules. Other notable comments suggested that consumers do not realize that enforcement is a complaint-driven process, there exists an ignorance of the laws' provision, companies lack a willingness to comply with the laws, and interestingly, impediments are created by a lack of interoperable video relay devices.

Consensus was somewhat lower regarding two other issues. Though viewed as significant by most, participants were somewhat divided between identifying as "very important" (51 percent) and "important" (43 percent) the "coordination of E-911 efforts to avoid 'piecemeal' or disconnected availability of services among public safety answering points, jurisdictions, state public utility commissions, wireless carriers, equipment manufacturers, and local wireline carriers." Likewise, participants also differed on whether "incorporation of speech-to-text and text-to-speech features in wireless technologies" constitutes a "very important" (50 percent) or "important" (50 percent) issue to be addressed. Attempting to probe further what the Delphi participants viewed as central technology issues, they were asked what accessibility features or capabilities they believe are absent from wireless technologies. Many comments noted a lack of speech input and output for device operation functions as the most important feature missing from wireless technologies. Others identified text-voice in real-time, simplicity for users with cognitive impairments, small text size/poor contrast/unreadable visual displays, and tactile buttons and features as the most important aspects missing in wireless devices.

Q	Item	Scale			
		Very Important	Important	Slightly Important	Unimportant
IT1.2	Device incompatibility or poor interoperability. How important is this issue?	70%	22%	8%	0%
IT1.6	Coordination of E-911 efforts to avoid "piecemeal" or disconnected availability of services among public safety answering points, jurisdictions, state public utility commissions, wireless carriers, equipment manufacturers, and local wireline carriers. How important is this issue?	51%	43%	5%	0%
IT1.7	Compliance with Section 508 of the Rehab Act of 1973 and Section 255 of the Telecommunications Act of 1996? How important is this issue?	67%	28%	6%	0%

IT2.1	Incorporation of speech-to-text and text-to-speech features in wireless technologies. How important is this issue?	50%	50%	0%	0%
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Policy Goals

Awareness/Access Goals

Participants in the Delphi were also asked about the desirability of certain goals related to the awareness of and access to wireless technologies by people with disabilities. Two of these goals, in particular, elicited strong support from the respondents. A decisive majority, 97 percent of Delphi participants, identified as very desirable or desirable the “development of programs to encourage manufacturers of wireless devices to include people with disabilities in the review and evaluation of assistive or universally designed products and technologies.” Asked to elaborate on what efforts manufacturers should make to increase the participation of people with disabilities in such an evaluation process, participant responses ranged from including people with disabilities as a resource, consulting, or focus group for product designers, to manufacturers working with advocacy groups, to including people with disabilities in product test groups or marketing groups.

In addition to goals of increasing manufacturer awareness, Delphi participants were also asked about goals to improve the awareness of product designers. Though divided over just how preferable the goal might be, nearly all respondents (96 percent) identified an “increased emphasis on universal design principles in place of an emphasis on assistive technology” as a very desirable or desirable objective. Asked how manufacturers of universally-designed products should increase the participation of people with disabilities in their design, respondents suggested paying consumers for their evaluations, working with advocacy and professional groups, hiring engineers and designers with disabilities, using test or focus groups, and providing tax incentives.

Regarding retailers, the participants unanimously viewed increased “awareness of accessible technologies and features among retailers and other intermediaries between manufacturers/designers and consumers/users” as very desirable (75 percent) or desirable (25 percent).

Q	Item	Scale			
		Very Desirable	Desirable	Undesirable	Very Undesirable
GA1.4	Develop programs to encourage manufacturers of wireless devices to include persons with disabilities in the review and evaluation of assistive or universally designed products and technologies. How <i>desirable</i> is this objective?	81%	16%	3%	0%
GA2.1	Increased emphasis on universal design principles in place of an emphasis on assistive technology. How <i>desirable</i> is this objective?	50%	46%	4%	0%
GA2.2	Increased awareness of accessible technologies and features among retailers and other intermediaries between manufacturers/designers and consumers/users. How <i>desirable</i> is this	75%	25%	0%	0%

objective?



Economic Goals

Respondents to the Delphi differed substantially regarding the desirability of the economic goals posed. Only one item, whether “providing tax incentives for employers to hire persons with disabilities” is a desirable goal, received support from a majority of participants (53 percent-very desirable; 39 percent-desirable), though not without significant opposition from within the group. Given that a majority of the participants supported ways to increase employer willingness to hire people with disabilities, the instrument asked the group for specific programs or initiatives besides tax incentives that might be effective. The leading responses included an emphasis on more affordable or compatible assistive technologies, support for telecommuting, educational and training programs for people with disabilities, anti-discrimination training and information, research on employees with disabilities in the workplace, and the provision of universal health care coverage. At least one participant advocated more punitive measures by mandating that employers have a certain percentage of employees with disabilities on their staff.

Q	Item	Scale			
		Very Desirable	Desirable	Undesirable	Very Undesirable
GE1.2	Tax incentives for employers to hire persons with disabilities. How <i>desirable</i> is this objective?	53%	39%	6%	3%

Regulatory/Policy Goals

As with economic goals, Delphi participants were also divided regarding the desirability of the proposed regulatory and policy goals. Nevertheless, a majority of the group agreed on the desirability of three objectives. A goal to “develop increased coordination between private and public research and development” received the greatest support (67 percent-very desirable; 33 percent-desirable). However, support was somewhat more divided for two other goals: “national funding for research and development of wireless devices and communication tools that support increased access” (50 percent-very desirable; 42 percent-desirable), and “increased interagency coordination in disability-related research and development” (50 percent-very desirable; 50 percent-desirable). Given the differences regarding the desirability of the recommended regulatory and policy goals, Delphi participants were asked what specific research and development goals (public, private, or collaborative) for wireless devices and communication tools for people with disabilities would be most desirable. While the answers provided by participants were varied and broad in scope, the most common theme included research programs on interoperability and standards setting, studying various design approaches to determine best practices, and involving consumers through publicly-shown prototypes.

Q	Item	Scale			
		Very Desirable	Desirable	Undesirable	Very Undesirable
GR1.2	National funding for research and development of wireless devices and communication tools that support increased access. How <i>desirable</i> is this objective?	50%	42%	8%	0%
GR2.1	Increased coordination between private and public research and development. How <i>desirable</i> is this objective?	67%	33%	0%	0%
GR2.2	Increased interagency coordination in disability related research and development. How <i>desirable</i> is this objective?	50%	50%	0%	0%

Technology Goals

There was greater agreement among the Delphi participants regarding the technology goals they were asked to evaluate. Two objectives, in particular, generated strong support from the panel. A goal to develop “compatible platforms between wireless and other mobile devices used by people with disabilities” was viewed as most desirable (70 percent-very desirable; 27 percent-desirable). When asked what they believed were the greatest impediments to the development of compatible platforms between wireless devices and those mobile technologies used by people with disabilities, respondents’ answers fell into two basic categories: a lack of standards, either mandatory or voluntary; or that economic or market reasons fostered an attitude that such compatibility was not required. Support from the Delphi participants for another goal, the “development of national policy coordinating emergency communications devices and services for people with disabilities,” was also very strong (62 percent-very desirable; 32 percent-desirable). When asked what efforts would be most useful in developing emergency communications for people with disabilities, answers included the development of better interfaces between AT and emergency devices and services, alerts for wireless devices, training for emergency operators, and E-911 availability for such devices.

Q	Item	Scale			
		Very Desirable	Desirable	Undesirable	Very Undesirable
GT1.1	National policy coordinating emergency communications devices/services for people with disabilities? How <i>desirable</i> is this objective?	62%	32%	5%	0%
GT1.2	Compatible platforms between wireless and other mobile devices used by people with disabilities? How <i>desirable</i> is this objective?	70%	27%	3%	0%