
Identifying, Selecting and Implementing Assistive Technology In the Agricultural Workplace



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Identifying, Selecting and Implementing Assistive Technology In the Agricultural Workplace

A resource guide for rehabilitation professionals and other service providers designed to assist them in identifying, selecting and implementing assistive technology that is appropriate for the agricultural workplace.

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INTRODUCTION

The purpose of this guide is to provide assistance to rural rehabilitation professionals and other service providers in identifying, selecting and implementing assistive technology that is appropriate for the agricultural workplace. It is hoped that the information presented will improve the quality and efficiency of services currently being provided to individuals with disabilities who are engaged in agricultural production or related occupations.

The information provided in this guide is based primarily on the experiences and on-going research activities of the Breaking New Ground Resource Center and Outreach Program which provides assistive technology services to farmers and ranchers in Indiana and throughout North America, and The Easter Seal Society of Iowa's FaRM Program, a community-based effort serving the rehabilitation needs of Iowa farm families.

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Special thanks are extended to the many farm and ranch families who have been willing to allow us the freedom to experiment on coming up with the most appropriate types of assistive technology to address their needs along with strategies for implementing these technologies in their workplaces. We recognize that our efforts were not always successful and at times were frustrating for everyone involved. However, from our mistakes has grown experience that should be helpful to others in the years to come.

A special thanks goes to Arlan Bookwalter of Walton, Indiana, who gave permission for his case files to be used in preparation of some of the examples included in this publication.

DISCLAIMER

The Breaking New Ground Resource Center, The Easter Seal Society of Iowa, Purdue University and the other authors do not endorse, recommend, or certify any of the techniques, products, or modifications described in this publication as being safe or effective in solving a particular problem. Every individual with a physical disability has unique needs and various levels of abilities. Consequently, the potential hazards associated with each workplace modification or anticipated activity should be carefully assessed and eliminated where possible. Where specific hazards cannot be removed, they should be appropriately guarded against inadvertent contact. Appropriate warnings should be used where needed and operator instructions provided.

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I. What is Assistive Technology?

Assistive technology distinguishes us from the rest of the animal kingdom and makes us uniquely human. Numerous anatomical factors differentiate *homo sapiens* from other mammals; our large brains and our unusual ability to walk on our hind legs, with free forelimbs have allowed us to develop a high degree of manipulative ability. By manipulating objects, we quickly learned to put them to use for many and varied purposes—in other words, we invented technology. We have used assistive technology to feed ourselves, to build shelters, to get around, to communicate with one another, to work, and to play. Assistive technology extends human abilities and expands opportunities and horizons.

People with and without disabilities use assistive technology. In either case, technology allows people to accomplish what they would not otherwise be able to do. We could not fly without airplanes; and someone with quadriplegia couldn't travel down a hallway without a wheelchair. Telephones allow us to speak to people halfway around the world, while a TDD enables a person who is deaf or hearing-impaired to use the telephone. A tractor and plow enables a farmer to till 40 acres in a single day and, if that farmer is paraplegic, a lift will allow him or her to get onto the tractor.

Assistive technology, in other words, consists of practices, devices, tools, modifications, processes, and a special knowledge of science and engineering that are used to enable a person to perform desired tasks. In the context of this publication, assistive technology enables a person with a disability to complete desired tasks within an agricultural setting.

The Technology-Related Assistance for Individuals with Disabilities Act of 1988 (Public Law 100-407) defines an assistive technology device as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities." This definition has been adopted for other legislation, including the Individuals with Disabilities Education Act, the federal special education law as amended in 1990.

Assistive technology devices designed for people with disabilities can be categorized according to their intended purposes. ABLEDATA, a computerized database of mostly commercially available assistive technology, contains 17 categories of devices, including personal care, home management, seating, transportation, communication, recreation, controls and tools for the classroom and the workplace.

We often describe assistive technology for people with disabilities in terms of the environment in which it will be used most often. Environmental context can determine how a device will be used, as well as the process of acquiring it, and who pays for it. For example:

1. Technology can be provided in a medical environment, such as a hospital or rehabilitation facility, to enhance the rehabilitation process following an injury or disease. In this context occupational and physical therapists, doctors, nurses, speech pathologists, and other clinicians help people acquire the assistive technology they need. Health insurance, both private and public, often pays for the technology.

2. Assistive technology can be used in an educational setting to improve the educational and training opportunities of persons with disabilities. Teachers and rehabilitation professionals are involved to help decide which technology will contribute towards reaching established educational goals. Funding for the needed technology frequently comes from the responsible educational institution.
3. People also benefit from the application of assistive technology in the workplace. Enhancing functional abilities of people with disabilities through tools and other devices qualifies them for many employment opportunities and enables them to pursue vocations after injury or disease. Employers, vocational rehabilitation counselors and rehabilitation engineers and technologists help to identify appropriate technology; employers and vocational rehabilitation agencies often provide the funding.

Regardless of the setting, the primary responsibility for identifying, acquiring, and funding assistive technology lies with the people who will use it. People with disabilities and their family members can best identify problems, needs, and ways to enhance abilities. The uses of assistive technology are limited only by our imaginations. We have a long history of finding better ways to extend our reach and to improve our situation. If our ancestors had not dreamed of flying, would we ever have reached the moon?

What is assistive technology? The answer can be found in the answer to the question, "What if..."

II. Assistive Technology in Rural Applications

A. Impact of Disabilities on Rural and Farm Populations

1. *Causes of disability within the agricultural community*

Approximately 2.2 million farm families in the United States are responsible for the production of food and fiber essential to us all. In addition, about 2.7 million agricultural workers assist with this task on a full-time or seasonal basis. This relatively small proportion of the population has a significant responsibility considering how dependent we all are upon the agricultural products they produce.

History has shown that those engaged in agriculture-related activities are especially susceptible to disabling injuries. A recent report from the National Safety Council has classified agriculture as one of the most hazardous occupations in America (Accident Facts, 1995 Edition). If injuries involving children in the agricultural workplace were included, agriculture's injury rate would be even higher. Approximately 1 percent of the non-fatal farm injuries that occur each year prevent the farmer from continuing to farm because of a permanent disability (National Safety Council, 1988). This was an estimated 1,200 individuals in 1995. A greater, though undocumented, number continue to farm following an injury with an inability to perform essential work-related tasks, because of a permanent disability. Approximately 2 percent (see Table 1) of the full-time farm operators and workers participating in the National Safety Council accident survey have suffered permanent disabling injuries because of farm-related accidents (Accident Facts, 1986 Edition).

Table 1. Distribution of Farm Work Injuries by Severity (35 states)	
Severity	Percent
Slight	30.2
Severe	65.4
Permanent	2.0
Fatal	0.7
Unknown	1.7
TOTAL	100.0
Source: [Hanford]	

Farm injury studies completed by Purdue University and others have revealed that during a typical one year period, 1 out of every 9 farm families reported that a member of their family was involved in a farm accident requiring medical attention and resulting in at least one day of disability. In some states, this rate has been reported as high as 1 out of 7 families.

Farm work injuries can range from bruises to mangling injuries. Table 2 gives a distribution of the types of injuries reported in a 31-state farm injury study conducted by the National Safety Council.

Table 2. Distribution of All Farm Work Injuries by Type of Injury (31 states)			
Amputation	1.5%	Mangled	1.4%
Asphyxiation	0.4	Pinched	1.6
Bruise	12.6	Puncture	5.7
Burn	2.2	Sprain	15.5
Cut	23.2	Other	8.6
Eye injury	5.5	Multiple	6.0
Fracture	16.1		
		TOTAL	100.0%
Source: [Hanford]			

Just about any part of the body can be seriously injured in a farm accident. Legs, fingers, feet, and hands are most frequently injured. Table 3 lists various body parts with the percentage of injuries for each reported in the 31-state National Safety Council study.

Table 3. Distribution of Body Parts Injured in Farm Work Injuries (31 states)			
Arm	8.2%	Head	6.9%
Back	9.9	Leg	13.3
Chest	3.3	Neck	1.0
Eye	6.1	Shoulder	2.6
Finger	12.6	Toe	1.5
Foot	11.5	Trunk	1.0
Genital	0.1	Multiple	6.8
Hand	9.2	Other	6.0
		TOTAL	100.0%
Source: [Hanford]			

Farmers and agricultural workers are also disabled as the result of non-farm or non-work related injuries. In fact, of the severely disabled farmers/ranchers who have contacted the BNG Resource Center over the past 13 years, motor vehicle and recreational accidents each accounted for more disabilities than farm-related mishaps. Of the 250 disabled farmers served by The Easter Seal Society of Iowa's Farm Family Rehabilitation Management (FaRM) Program, 35 percent were injured in non-farm accidents compared with 25 percent in farm-related accidents.

In addition to the disabling conditions caused by work-related injuries, 40 percent of farmers/ranchers and agricultural workers served by the FaRM Program are affected by other disabling conditions such as cancer, post-polio syndrome, MS, stroke, Cerebral Palsy, heart disease, arthritis, degenerative disc disease and many more. A study of Indiana farm operators completed at Purdue University in 1981 revealed that 66 percent were affected by at least one physical impairment. Over 30 percent cited musculoskeletal impairments, 25 percent indicated hearing impairments, 24 percent cited cardiovascular impairments, and 22 percent reported respiratory impairments (Tormoehlen). More than 17 percent responded that there were agriculture-related tasks on their farms that they were no longer able to perform, and over 19 percent said that because of their physical impairments they were hindered or limited in their ability to perform necessary farm-related tasks. Nineteen percent stated that they required assistance from a neighbor, employee, or family member to perform necessary tasks in their farm operations.

A comparison of general versus farm population data concerning the nature and scope of physical disabilities suggests that the rural and farm population have a greater proportion of disabled persons. According to the President's Committee on Employment of the Handicapped (Facts about Handicapped People), 9 percent of the general population suffer from some form of serious physical disability. Other sources of data suggest the figure is as high as 17 percent. In comparison, the data available on the proportion of farm operators and farm workers who are disabled suggests that between 15 and 30 percent are limited in their activities because of physical disabilities.

The nature of many family farm and agribusiness operations, often lacking manpower to maintain the operation in the event of injury or sickness, leads many individuals to remain on the job in less than good physical condition. A similar trend is also found with other rural residents. Factors such as increased travel time to health care facilities, greater difficulty in obtaining walk-in treatment, and increased waiting time to schedule medical treatment may result in minor health problems and or injuries developing into permanent disabilities.

2. *Physical disabilities among farm/ranch children*

Research relating to the scope and nature of physical disabilities among farm children is non-existent. Likewise, there is a lack of information concerning the potential rehabilitation needs of this population. However, the experiences of the BNG Resource Center over the past few years clearly indicates that there is a substantial population of adolescent children with severe physical disabilities living and working on farms who have yet to appreciatively benefit from many types of readily available rehabilitation programs and assistive technology.

In addition to the diversity of childhood disabilities that handicap both urban and rural children, farm and ranch children experience an unusually high number of physical disabilities caused by workplace injuries. No other workplace exposes

more young children to extremely hazardous conditions than does agricultural production. Research conducted by Purdue University and the National Safety Council has revealed that 4.6 percent of all permanent workplace injuries involve children between the age of 5 and 14 (Purschwitz and Field, 1987. ASAE 87-5514). If this data is applied to the estimated total of all farm accidents nationally (National Safety Council, 1996), approximately 6,400 children received disabling injuries in 1995.

For example, the BNG Resource Center, during a one-year period, had contact with several boys under the age of 12 who had lost one or both arms in augers and power-take-off shafts, feet and hands in other agricultural machines, and spinal cord injuries from livestock accidents, falls from hay mows and accidents involving all-terrain vehicles (ATV's). In nearly all of these cases, the parents and child wanted information on assistive technology that would enable them to continue participation in farm or ranch activities. Because of this interest, the focus of two issues of the Breaking New Ground newsletter has been on physically disabled children living and working on farms.

3. *Physical disabilities among older farm/ranch residents*

As with farm and ranch children, there is little documentation concerning the magnitude and nature of physical disabilities among older farm and ranch residents. As the farm population has declined and the younger farm residents have left to find employment in urban settings, the interest in knowing about and assessing the needs of those who chose to remain on the land has decreased.

Surprising to many is the high proportion of farm operators who are over 65. The Census of Agriculture data (Bureau of Census, 1987) indicates that over 21 percent of all farm operators are over the age of 65. This compares to only 2.2 percent of the non-farm industrial work force over 65.

Tormoehlen, in his study of physical disabilities affecting farm operators, found that the average age of the surveyed group was 51 and that approximately 17 percent were hindered in completing essential work-related activities due to their disability. He further noted that this population was heavily dependent upon family, neighbors and friends to complete essential tasks.

There is no question that the rural population is rapidly aging. Furthermore, this population has experienced dwindling financial resources. Depressed land values have meant less income at the time of retirement. The fact that most farm workers do not fall under comprehensive worker's compensation programs and that farm families are underinsured create serious financial problems if a disability develops. In 1986, 17.6 percent of the rural elderly fell below the federal poverty level compared with 10.9 percent of their urban counterparts. Seventeen percent of the rural population has no health insurance compared with 14 percent in urban areas. Similarly, only one-fourth of the rural poor are eligible for Medicare, compared with 43 percent of inner-city poor. This problem is further compounded by the lack of many

publicly supported services which are common place in most urban settings. There is no question that an older resident of a farm or ranch with a physical disability has much to gain from the introduction of rehabilitation services and the appropriate application of assistive technology.

4. *Summary — Need for rural rehabilitation services*

Based on the previously discussed data, the BNG Resource Center estimates that more than 500,000 farm/ranch family members and agricultural workers in the United States have physical disabilities which hinder them from completing essential work-related tasks or might eventually force them to prematurely discontinue farming. Furthermore, this population is probably the most isolated from rehabilitation services and resources, such as independent living centers and rehabilitation centers, which have the potential for reducing the impact of their disability.

Since their establishment, the BNG Resource Center at Purdue University and the FaRM Program in Iowa have responded to over 17,000 individual requests for information regarding rehabilitation technology from farm and ranch family members and rural rehabilitation professionals. Requests have been received from all states, five Canadian provinces, and about a dozen foreign countries. The severity of the disabling conditions is reflected in the following table which categorizes the type of disabilities represented in a sample of 187 farmers from the BNG Resource Center mailing list who responded to a recent survey.

Table 4. Disability of Farmers (N=187)		
Handicap	Number of Farmers	Percent of Farmers
Paraplegic	68	36.4
Upper Limb Amputee	29	15.5
Quadriplegic	23	12.3
Lower Limb Amputee	18	9.6
Musculoskeletal	14	7.5
Neurological	14	7.5
Lower Leg Impairment	9	4.8
Respiratory	6	3.2
Vision	5	2.7
Polio	5	2.7
Hearing	4	2.1
Back Problems	4	2.1
Muscular Dystrophy	3	1.6
Cardiovascular	2	1.1
More Than One Handicap	28	15.0
Source: [Wilkinson]		

Experience has shown that for every disabled individual who reaches out for rehabilitation assistance by taking the time to make a telephone call or write a letter, there are many more who remain unserved, isolated from the potential benefits of rehabilitation services. Reasons for this include pride, lack of communication skills, low perception of the needs, and ignorance of service availability.

B. Barriers to Providing Assistive Technology Services in Rural Settings

1. Barriers to services

Several studies have been done on a local or regional basis to identify the barriers to the effective delivery of rehabilitative services to rural residents. The Arkansas Rehabilitation Research and Training Center conducted a needs assessment on several rural areas and identified the following eight barriers (NIHR, 1983):

1. Economic Limitations (income levels which are 20 to 40 percent lower than for urban residents).
2. High Unemployment and Underemployment (lack of suitable employment opportunities which will accommodate individuals with disabilities).
3. Health Care (shortage of health care professionals and a general absence of preventative and health maintenance activities).

4. Limited Educational Opportunities (rural educational institutions often lack adequate facilities, qualified staff and specialized educational programming and services).
5. Restricted Transportation (isolation, non-existent public transportation and low income greatly restrict travel opportunities).
6. Attitudes (poor image of those with disabilities and agencies which provide services to those individuals).
7. Ethnicity (complications of providing services to individuals within various ethnic subcultures).
8. Inadequate Data (limitations in knowing the needs prevent the development of effective plans of action).

A 1985 study by The National Rural Health Care Association stated that:

"Migrant and seasonal farmworkers face serious social problems: poverty, poor nutrition, unsafe and unsanitary living and working conditions, physical isolation in remote rural areas, a mobile lifestyle, and for some conditions such as parasites, rates of illness comparable to those in developing nations. The lack of health care services or the inability to use available services is widespread."

The report further stated that some of the obstacles to delivery of health care services are:

1. Lack of transportation;
2. Language barriers;
3. Limited health clinic hours;
4. Farmworkers' lack of money to pay for basic health care services and lack of health insurance coverage; and
5. Major cutbacks in existing support programs.

These observations concerning the health care delivery system for migrant and seasonal farm workers applies equally to the delivery of rehabilitation services to many rural residents.

In 1986, the Independent Living Research Utilization Program (Richards, 1986) in Houston, Texas, identified eight rural independent living barriers: housing, attitudes, transportation, finances, architectural barriers, limited job opportunities, limited recreational/social opportunities, and difficulty in accessing information.

The Rehabilitation Engineering Society of North America (RESNA) Rural Special Interest Group, has identified several barriers relating to the application of

rehabilitation technology to rural settings. These include: information dissemination, consumer awareness of available technology, funding, potential liability exposure, and existing service delivery methods.

2. *Need for professional resources*

In general, many rural communities have fewer resources to allocate to health care services, education and other human services found in urban settings. Consequently, individuals in need of specialized services often receive lower levels of service or go without. This situation appears to be especially true with respect to all forms of rehabilitation services, including securing assistive technology.

Until recently, there have been few resources for the rural rehabilitation professional to turn to for the solution of an assistive technology problem. Few modifications and assistive devices that are appropriate for use by farmers, ranchers and agricultural workers have been documented, and there has been no central source of this type of information. The result has generally been the frequent "reinventing of the wheel" and the accompanying frustrations by the service provider and consumer.

Several developments have occurred in recent years that have contributed to increasing public awareness in rural areas concerning disability issues and filling the voids that have existed with respect to assistive technology services. These include:

1. Increased awareness at the federal level of inadequacies in rural health and safety programs. Considerable press coverage has recently been given to these issues which has stimulated increased expectations for better services within rural communities.
2. Establishment of the Breaking New Ground Resource Center at Purdue University in 1979 which has generated considerable attention for the unique needs of farmers, ranchers and agricultural workers with physical disabilities. Out of these efforts have come a variety of resource materials including Volume I and II of "Agricultural Tools, Equipment, Machinery and Buildings for Farmers and Ranchers with Physical Disabilities." The Breaking New Ground Newsletter, published by the Center, is currently distributed to farmers, ranchers, rural rehabilitation professionals and rural educators throughout North America.
3. The interest generated among professionals by the two International Conferences on Rural Rehabilitation Technologies hosted by the University of North Dakota, Grand Forks.
4. Over nine years of experience gained by the BNG Outreach Program in Indiana and the FaRM Program in Iowa, utilizing a community-based approach to the delivery of specialized rehabilitation services to rural and farm families.

5. Establishment of the Rural Rehabilitation Research and Training Center at the University of Montana, Missoula, by the National Institute for Disability and Rehabilitation Research. The conferences, research reports and model programs developed have expanded consumer involvement.
6. The increased sensitivity on the part of certain vendors of assistive technology to expand services into rural communities. In addition, new suppliers of assistive technology appropriate for agricultural workplaces have developed including the Round Grove Machine Company of West Lafayette, Indiana, which has become a major supplier of tractor and heavy equipment modifications.
7. The creation of the USDA-AgrAbility Project by the 1990 Farm Bill that has established programs providing assistive technology and other services to farm and ranch families in 22 states.

C. Unique Characteristics of the Agricultural Workplace

During the past thirty years, agricultural production has changed as dramatically as any segment of our society. However, the understanding level of the general public concerning how our food is produced has not kept pace. With less than 2.5 percent of the population currently living on farms and ranches, many perceptions of how farmers work — not all of which are correct — have developed. In fact, it is fair to suggest that most people today have little understanding of what actually takes place on a modern farm or ranch.

Following are characteristics that should be helpful in describing present day agricultural production to those without the benefit of being raised on a farm:

1. Agricultural workplaces are generally in rural, less populated areas. The time spent traveling for work-related activities can be a substantial part of the day. Pickup trucks and telephones are important business tools.
2. Agricultural workplaces are, in most cases, the living environment for the farm or ranch family. In other words, farm and ranch families generally live and work in the same location. Bathrooms, eating facilities, and workshops serve both vocational and avocational needs. Even some of the equipment, such as ATV's, is used for both work and recreational activities.
3. Work in agriculture takes place under all types of environmental conditions. If the farm or ranch is located in the northern parts of the United States, the workplace temperatures can range from -60°F in winter to 100°F in summer. Regardless of weather, cows, pigs and horses need to be fed and cared for. Workers are also exposed to other environmental conditions such as snow, rain, and wind and the problems these factors cause such as ice, mud and dust.
4. Agricultural production today is technology-intensive. At one point in history it took a farmer about 500 hours to manually raise an acre of corn. Today the same

acre can be produced in 4 hours. Physical strength is no longer a prerequisite for being a successful farmer or rancher. The extensive use of technology has removed much of the drudgery of farming, has greatly increased productivity and has increased the demand for good management skills. There are, however, many smaller farms and ranches that still are dependent upon a considerable amount of manual labor. Extensive use of manual labor is also still found in vegetable production operations.

5. Agriculture is big business. When a new tractor can cost \$50,000-70,000 and a combine \$100,000-150,000, the opportunities for starting a farm operation outside of a family setting have been greatly reduced. It takes major investments in capital to begin and maintain a farm or ranch operation that can support a family today. The BNG Resource Center has had contact with only a handful of individuals that were able to successfully start a farm/ranch operation following a disability. In nearly all cases the individual was involved in some aspect of the farm or ranch prior to the disability and wanted to remain active.
6. There is a broad range of people involved with agricultural production. A study of work-related disabling injuries reveals that children as young as five are sometimes injured doing farm work and more than one-third of the injuries involve those over the age of 60. It is not uncommon to find individuals over the age of 80 still making significant contributions to the farm operation, and wanting assistive technology.

Agriculture involves people with a broad diversity of intellectual skills. This can range from no formal education to advanced degrees in agricultural sciences. It can no longer be assumed that when working with farmers you are dealing with a poorly educated group of individuals. On the other hand, the illiteracy rate among migrant farm workers is generally higher and compounded by language barriers.

Those involved in agriculture also have a wide variety of cultural differences. In some states you can encounter, in the same county, a temporary farm worker from the Caribbean area, a migrant family with roots in Southeast Asia, a farm operator with a degree from the State Land Grant Institution, a hired farm hand with few reading skills, and a hobby farmer who makes his or her living as a lawyer.

7. Agricultural production involves a tremendous diversity of tasks. Task analysis has identified literally thousands of different skills that are needed in the course of a year's work on a modern farm. Some of these tasks are very simple and require little training while others demand considerable technical skills and knowledge. For example: during a three-hour milking, a dairy farmer might perform the following tasks:
 - a) Install and remove a milking machine 100 times
 - b) Inspect 100 cows for general health problems including mastitis or respiratory infections
 - c) Administer an injection of antibiotics
 - d) Reprogram an automatic feeding system
 - e) Repair a broken gate

- f) Detect a cow in need of breeding
 - g) Disassemble and sanitize milking equipment
 - h) Calculate a feed ration
 - i) Deliver a calf
8. Agricultural production remains dominated by males. Over 85 percent of the most severe injuries on farms and ranches involve males. The overwhelming majority of those served by existing rural rehabilitation programs are male. Males comprise the major portion of the workforce and have the greatest influence over management decisions.
 9. Farmers and ranchers generally work alone. Many of the tasks associated with modern agricultural production are designed so that they can be completed by one person. It is not uncommon for a farmer or rancher to work all day and have contact with only one or two other persons.
 10. Agricultural production is becoming increasingly regulated but not nearly as much as most other industries. Many workplace regulations do not apply to agriculture. And since most farms and ranches are small family-owned businesses, they will not benefit much from ADA spin-offs. This characteristic also affects, in some cases, participation in vocational rehabilitation services, Social Security programs, Worker's Compensation programs and workplace safety programs.



III. Determining the Need for Agricultural Worksite Accommodations

A. Introduction

This is the "who, why and when" in the application of assistive technology services. The "how's" and "what if's" will be addressed later. This section deals with identifying problems and needs. As mentioned earlier, the environmental context determines which device is to be used, how and where it's to be used, and who pays for it. Conducting the assessment properly and timely will provide the data needed to answer these questions. And, if the primary responsibilities for identifying, acquiring and funding the needed assistive technology lie with the person who will be using it, then we, as rural rehabilitation professionals, become a type of assistive technology ourselves by asking the right questions or bringing in the appropriate technical personnel to evaluate needs beyond our expertise. If we think of ourselves as a tool for the end-user, we can put our service roles in proper perspective and assist them to clearly identify their actual needs and not their needs as we perceive them to be. The importance of the family or other support people being involved in the assessment process cannot be stressed enough, especially in determining the levels of accommodation (covered in the following section). *Conducting Agricultural Worksite Assessments* by Field, et al., describes different types of assessment tools, provides an explanation of the questions that need to be asked and how the answers might be recorded. In this guide, only the processes and results of performing assessments will be discussed.

B. Conducting an Agricultural Worksite Assessment

1. Objectives of Worksite Assessments

Whatever type of assessment format is used, it is important to identify situational barriers and opportunities in such a manner to facilitate the selecting, financing and/or fabricating of assistive technology. Outcomes of this activity should include:

- a. A better understanding of the size and scope of the total operation and the individual's role in it, including the potential for alternative enterprises.
- b. Identification of significant workplace barriers and functional limitations that prevent completion of desired tasks.
- c. The opportunity to discuss desired worksite modifications, possible task restructuring or the assignment of certain hard-to-perform tasks to other family members or employees.
- d. The opportunity to formulate specific goals that will help the farmer or rancher to increase independence, productivity and profitability.

Points (a) and (b) are the raw data that builds an overall picture, (c) is the discussion of the data with the individual that helps to determine levels of accommodation and criteria for selecting assistive technology and (d) is the planning stage for financing, obtaining and/or fabricating the needed assistive technology.

2. *Making the Initial Contact*

The initial contact usually comes in one of three ways:

- A direct contact from a consumer seeking assistance.
- A referral from a third-party.
- A contact that you initiate upon hearing or meeting an individual who could benefit from your services.

Your response will differ with each situation and the severity of the problem the individual brings to you. The following are some possible, but not all inclusive examples:

- a. A farmer approaches your exhibit at a county fair, and asks how much does a lift for an IH 1456 tractor cost? This should key you to follow up with questions such as accessing other vehicles, what his disability may be (if it's not readily apparent), how often does he need to use that piece of equipment, does he really need to modify it or could someone else do the task and switch other duties with him, what's he willing to spend, or will he need something that could work on more than one piece of equipment. Note that you are paying attention to the problem as presented, but leading the conversation into a mini-assessment that will help the person to stop and think of other considerations he or she may not have. This could lead into scheduling a longer visit at the person's farm, discussing mobility issues in general and trying to plan for year-round (seasonal weather) problems. Or, if the person feels a need for information about their original question only, you may have to just take their name, address and phone number and forward what you can to them as a "best guess."
- b. This situation could be a phone call from a social worker at an area rehabilitation hospital, referring a client that is currently in the rehab process and suffering mild depression because he feels that his farming career is over. After getting background from the caseworker, you visit that person at the hospital (with their permission of course) seeking their personal feelings and goals that he sees as readily achievable. This not only begins to build solutions but redirects the attention of the person from their disability to their abilities. This situation is also extremely delicate as you must stay in context with known medical facts and the person's present state of rehabilitation so as not to disillusion them into thinking everything will work out quickly or perfectly. Again at this point, establishing a rapport and a problem solving relationship is more important than getting every detail of the farm operation or identifying some possible equipment modification.

- c. Another situation can begin after reading a feature article about a farmer who is already back on the farm following an injury. You contact the individual without a request from them. Whether it's via letter or phone, their first impression of you is the most important. You are invading their privacy and therefore, must be as non-threatening as possible. Opening statements of respect for their rights and wishes followed by brief explanations of why you're calling and what services you have to offer must be structured to break the ice and put them at ease. Many times you will have to convince them that you're not a salesperson; or just the opposite, that you don't have unlimited funds at your disposal to finance their rehabilitation plans. Offering an obvious solution to the problem you think you see in the article can sometimes validate your claims of wanting to help, but be careful; the solution you pose without knowing all the facts or the person's own needs can also damage your credibility by making you appear overbearing or pretentious.

3. *The On-Site Visit*

By now you've contacted the farmer to set up a time for your first visit (make every effort to be punctual). You should also have detailed directions of how to get to the farm, and an agenda in mind for what you want to accomplish.

- a. Answering the question, "Which questions to ask?"

Not knowing what questions to ask can result in giving the appearance of not knowing what you are doing and can damage credibility. Using the outline of the assessment tool as a guide, you may determine which section covers a particular task by asking the person, "Why do you do that? What does it affect? When and where do you do it?" The tried and true method of asking questions from the general to the specific will begin to break down operations into simplified tasks that can be more easily defined and worked with. The individual is the expert of his or her own farm; rely on their knowledge of just what it is they need to accomplish with each of these tasks and stick with helping them get the results they want. Our job is to adjust the method if need be, not the end product. Learning to go with the flow of the discussion is helpful if you can learn more about a particular operation. Allowing the client to "free associate" or to go off on a tangent momentarily, can often key them to include something they might not otherwise remember.

- b. Timeliness

Remember that farms are on-going operations, 24-hours a day, seven days a week. Showing up unannounced or at the wrong time can put you in a position of not seeing the specific tasks you came to evaluate or even not seeing the client at all. Don't be surprised if some critical farm operation takes precedence over your visit. Likewise, you could gain valuable data by scheduling your visit around a particular chore if it has been identified as a priority for assessment (again, the importance of the initial contact).

c. Recording client contacts

Narrative descriptions of client reactions, problems and ideas must be complete and accurate if "brain storming" types of solutions are to be developed later on. If the first visit is to be a problem solving session as well, then recording the ideas discussed can provide outlines for follow-up research or sending revised recommendations back to your client. Your surroundings can sometimes make it difficult to take notes, but the effort is worthwhile.

4. *The Need for Follow-up/Repeated Assessments*

Follow-up is one of the most important services you can provide. It ensures that ideas and discussions are turned into action and solutions. No matter who's responsible for the task, it's the evaluator's (case manager's) job to make sure it's followed up. Timing of follow-up depends upon who's doing the task, what it is, and the priority attached to it. Examples:

- a. The initial assessment points to further research of commercially available electric scooters with higher than normal amount of seat lift, allowing the user to stand and transfer more easily into the pickup, while lowering far enough to slide under tables and remain stable riding over sloping terrain. The follow-up is the responsibility of the case manager to research known contacts at scooter manufacturers and determine if something exists that meets these specifications or can be easily adapted by a dealer or manufacturer. The priority is moderately high because it is a mobility issue but not critical because the client happens to have two scooters that perform these functions separately, but inconveniently. If not workable, then the research into modifying the present scooter can be done by the client with direction from the case manager. Reason: once the client has names of possible custom fabricators and a strong knowledge of exactly what modification is needed, he can contact them directly, speeding up the time to identify and OK the vendor, negotiate a price and schedule a time for the adaptation to be performed.
- b. If the same scooter modification solution is identified, but outside funding sources are involved, such as state vocational rehabilitation, the problem is approached somewhat differently. The ideal situation is the counselor being present when the solution is first discussed; if not, then recommendations can be presented, most likely in written form, to the counselor. Upon giving his/her OK, the counselor may ask that you do the research and identify the who, what, when, where and how much, associated with the modification and supply those recommendations in writing, and order the work to be done. Or, by regulation, the counselor may have no choice but to do it alone, usually a very time-consuming process. The point is, as a case manager for the client's best interest, you must be flexible and facilitate the entire process via close and timely follow-up.
- c. If the scooter modification was not only an issue of convenience but for work functions as well, it could result in the individual being able to participate in

harvesting, buying cattle, planting or other seasonal work critical to the operation. If timeliness is an important factor, weekly follow-up by the case manager with the funding source, vendor or other agencies involved is appropriate. Timing cannot always be controlled, but should be taken into account during the planning stages of the assessment with responsibilities clearly identified between the client and the case manager.

- d. Once the work is performed, a follow-up assessment of its function is essential. This could be completed over the phone with the client or during another site visit. Again, using the criteria discussed later in this resource, evaluate its appropriateness and plan for potential problems, seasonal adjustments for usage, replacement or obsolescence. As before, scheduling this revolves around the technology and its usage. Once the originally identified needs of the client are satisfied, the case manager may initiate planned follow-up at specific short term intervals (for time periods of less than a year from first assessment). In most situations, (and for practical reasons) it should be the client's responsibility to follow up past a year of the last "everything's OK" contact.

C. Developing a Plan for Completing Agricultural Worksite Accommodations

A plan provides the user a "roadmap" to reach a desired destination, achieve a desired goal or complete a task. As the goal or task becomes more complex, the need for a plan increases. Without a plan, the risk of mistakes or failure will generally increase. A plan can be used to help motivate those involved to complete proposed activities in a timely manner. It can also be helpful in documenting progress and demonstrating to all those involved that success is obtainable if everyone works together.

There are several approaches to developing a plan for completing the necessary worksite accommodations. However, each must always involve the client in establishing the priorities and procedures that will be followed.

In some cases, the plan will be part of a more comprehensive rehabilitation plan that is developed by Vocational Rehabilitation, private service provider or other service agency. These plans will address a wide range of issues such as independent living needs, education, medical care, transportation and employment. Your services with respect to the agricultural worksite should be developed in concert with this broader plan and compliment the services provided by other providers.

In most cases, however, a comprehensive rehabilitation plan is not needed or wanted by the client. He or she may have already clarified the needs and prioritized how and when each should be met. Your role will be to help facilitate the process, to make things happen in a timely and cost effective manner. In working with the client to develop a more formal plan, insight can be provided that could result in significant changes to the client's original plans.

A formal written plan is not generally a high priority for many clients. They are generally more interested in seeing hardware and things happen than receiving a document of

proposed activities and ideas. As case loads increase, the plan, once developed, becomes an important reference tool to keep track of progress and document changes in goals. It should include the specific needs to be met, how the needs will be met and a tentative time line for completing each activity.

Remember, any plan involving people needs to be flexible to accommodate changing circumstances and goals.

D. Sample of a Completed Assessment and Follow-up Activities

1. Introduction

Arlan Bookwalter, an Indiana farmer who has had a long-term association with the BNG Outreach Program graciously agreed to allow information from his file to be included with this guide. The material selected provides an example of how the process works. It includes a copy of the assessment tool completed during the first visit, a list of the suggested modification needs that were developed for Arlan's Vocational Rehabilitation Counselor, and a summary of the case narratives that document the ongoing Outreach Program activities with Arlan.

You are encouraged to compare the list of modification needs with the case narratives and note that most of the items on the list were eventually addressed.

2. Arlan Bookwalter's Case

- a. Completed assessment tool (short version)
- b. List of modification needs
- c. Case narrative

Referral Source Ron Erdely, Methodist Hosp.

Initial Contact Date 1/5/89

AGRICULTURAL WORKSITE ASSESSMENT TOOL FOR FARMERS AND RANCHERS WITH PHYSICAL DISABILITIES

I. PERSONAL DATA

Name: Arlan Bookwalter SSN: _____

Address: 625 S. Cunning Road City: Walton

County: Cass State: IN Zip code: 46994

Spouse's name: Kay Phone: (219) 626-2090

Directions to farm/ranch: Head East on Hwy 218 into Walton, IN. Just past RR tracks is 700 E (Davis St.). Turn N/left onto that St., go past a Methodist Church to the 1st "T" intersection (625 S). Turn E/right. Go to 5th house/farm on S/right side of road. 1:15 from W.L. (55 miles)

Date of birth: 46 Sex: M Marital Status: M

Names and ages of children at home: Jeff, 18 yrs.

Disability: T-10 (SCI) compression Date of injury/diagnosis: 11/15/88

Describe the cause of disability: Arlan fell into a ditch while hunting causing compression injury at T-10 (spinal column) joint.

Functional limitations as described by client and/or referral source: paraplegia, uses w/c for mobility; full use of upper extremities for transfers, work/home situations including full range of motion and no lifting restrictions. Trunk support scheduled to be removed May/June of '89.

Include exact measurements if known: (Db of hearing loss, visual acuity, lifting limits, range of motion, specific limitations on standing, sitting, transferring, carrying, walking, bending, stooping, balance, etc.)

Occupation:

☒ Full-time farmer/rancher (primary income from farm/ranch)

☐ Part-time farmer/rancher (primary income from off-farm/ranch job)

☐ Dependent of farm/ranch family

☐ Farm/ranch employee

☐ Agricultural business (type): _____

☐ Other: _____

II. GENERAL FARM/RANCH DATA

A. Type and size of operation:

☐ Dairy _____ head ☐ Hay (acres): _____
☐ Hog _____ head ☒ Grains (types and no. acres): 1300 acres corn & soybeans
☐ Beef _____ head ☐ Specialty crop(s) (type): _____
☐ Sheep _____ head ☐ Agr. business (type): _____
☐ Poultry _____ flock size ☐ Other: _____

Describe other alternative agricultural enterprises: _____

B. Summarize the farm/ranch responsibilities of the client prior to acquiring the disabling injury or diagnosis of disability:

All aspects of owner/operator: bookkeeping, marketing, purchasing,
maintenance, labor management and production.

C. List family members and co-workers who assist on the farm:

Name	Relationship	Age	Responsibilities
<u>Jeff</u>	<u>son</u>	<u>18</u>	<u>assists in maintenance & production</u>
<u>(1) temporary empl</u>			<u>summer help</u>

Additional Information

III. OVERALL FARM/RANCH ACCESSIBILITY

Terrain is generally flat with grass yards, concrete sidewalk from house to driveway; driveways are surfaced with crushed rock, as are the parking aprons to his shop. Other areas are flat, with grass or hard dirt. Access to fields is normally flat with little or no ditch to cross. Field terrain and soil varies with flat, sandy loam prevailing. Farmstead is well drained but mud and snow can still be a problem if heavy precipitation occurs. Sheds and shops are all one level.

IV. GENERAL FARM/RANCH MAINTENANCE

Arlan cannot currently access his shop because of small landing in front of door with high threshold. Inside, floor is dirt; high work bench with stationary power tools also high. Further assessment of shop/tools was not performed as all of it is currently inaccessible.

V. EQUIPMENT AND MAINTENANCE

Primary storage includes one enclosed shop at farmstead (dirt floor, one level), one rented barn (elsewhere, dirt floor, two levels) and one shed at father-in-law's (enclosed, dirt/crushed rock). Some equipment is parked outside, and shop has space to hitch/unhitch and service most equipment.

Equipment is as follows:

Tractors - International 1466, 1586 (easily adaptable), and 5488. All have cabs, radio, and a heater.

- International 560 and 1066 are without cabs.

Combines - International 1460 has a radio and heater/air conditioner.

- International 750

Implements

John Deere 7000 planter (eight row)
two 45 vibra shank field coatiers
field cultivator/finishing tool
490 disk
mulcher
four plows - (two 618 and two 616)
14 row bean cultivator
eight wide row cultivator
front mount field cultivator (with spray cart)
cultipacker
five point "V" ripper
rotary hoe

Arlan has reported no other problems (seeing, hearing, etc.) in operation of equipment beyond physical access to operators seat and controls.

VI. CROP PRODUCTION

Storage includes five steel round grain bins (ladder access only) with five stationary augers and one portable auger, plus one continuous flow grain dryer. Mr. Bookwalter is currently unable to move auger or access controls on other augers and dryer.

VII. & VIII.

Livestock and other specialty production was of no concern at this time.

IX. FARM MANAGEMENT ACTIVITIES

Mr. Bookwalter feels he will be able to continue all aspects of the farm management once independent mobility is fully realized.

X. ADDITIONAL VOCATIONAL SKILLS

Mr. Bookwalter included wood working as a craft/skill hobby, and along with fishing, wishes to pursue these modifying his boat (if possible) as well as his wood shop.

XI. ESTABLISHING PRIMARY GOALS

Mr. Bookwalter is aware of vocational rehabilitation and intends to contact the appropriate counselor for Cass County.

Arlan was provided with a variety of information including resource manuals, brochures on available lifts, literature on building ramps, names of support persons, etc. He further requested to be placed on the newsletter mailing list, receive information regarding modifications to make bathrooms accessible, and fishing resources for the physically disabled. With that information I intend to include an address for "Paraplegia News/Sport-n-Spokes." I will contact Mr. Bookwalter in three to four weeks, after he has had a chance to review the material. His son Jeff intends to return the manuals that were left with Arlan when he is at Purdue in a few weeks.

Mr. Bookwalter signed a release of information form. I intend to contact Ron Erdely regarding our visit. Mr. Erdely referred Arlan to the Breaking New Ground Outreach Program. He is a social worker at Methodist Hospital in Indianapolis.

MODIFICATION NEEDS

(2-7-89)

Mr. Bookwalter was visited on two separate occasions to share information and access his modification needs for his farming operation. Arlan incurred a level T-10 spinal cord injury compression November 15, 1988. He and his family, along with a "hired hand," farm 1300 acres of corn and soybeans. Recommendations for modifications to their farming operation are:

1. A vertical-screw lift from Simplicity Lifts, Inc. for Mr. Bookwalter's 1460 International Harvester combine.
2. A vertical-screw lift for the 1586 International Harvester tractor.
3. Hand controls for the tractor.
4. Specialized seating to absorb field vibrations on the equipment Arlan will operate.
5. Appropriate dry chemical fire extinguishers on each piece of equipment Mr. Bookwalter will operate.
6. Installation of rearview mirrors as needed on each piece of equipment for safety purposes.
7. Automatic hitching devices for wagons and other trailed implements.
8. Concrete floors and travel ways (sidewalks) for accessibility and maneuverability.
 - a. a concrete floor in the shop
 - b. a concrete work area outside the shop
 - c. sidewalks with landings for travel to and from Mr. Bookwalter's home and shop
9. A strongly-built motorized or manual wheelchair for yard/shop accessibility outside of Arlan's home.
10. FM two-way radios for communication and safety.
 - a. a base unit for the house
 - b. a hand unit for Mr. Bookwalter to carry with him
 - c. a unit to be mounted on his IH 1460 combine and his IH 1586 tractor
 - d. units to be mounted on his transportation vehicles
11. An automatic door opener to the shop.
12. Modifications to existing work benches for the purpose of making tools accessible.
13. An "A" frame tool rack for accessibility and mobility of tools.
14. A four-wheel, all terrain vehicle (ATV) for farm/field accessibility. Considerations when purchasing are:
 - a. an automatic transmission or hand controls for any foot pedals

- b. reverse capability in the shift mechanism
 - c. foot platforms or baskets to decrease the possibility of a foot slipping off when riding in rough terrain
 - d. a backrest
 - e. carrier racks, wagon attachments
 - f. helmet, goggles, gloves, and boots
15. Modifications to Arlan's van or truck to be used for farm purposes.
- a. hand controls
 - b. means to access the vehicle

Copies of this report will be sent to Ann Kniesly, Counselor at the Office of Vocational Rehabilitation in Logansport and Mr. Bookwalter.

CASE NARRATIVE

Editor's Note: Not all the narratives and telephone calls were noted in this sample. This continuing story represents many hours of farm visits and follow-up with other service providers, vendors, and media. The process is a long one, but as you can see it can and does come together. Also not included (due to space) were the many thank-you letters and scheduling contacts done by Lauri Logan, Breaking New Ground Outreach Program staff member, and Arlan to make it all happen.

Arlan Bookwalter — Case Notes

(12-13-88) Received referral phone call from Ron Erdely, ACSW of Methodist Hospital's Spinal Cord Injury Unit for Arlan Bookwalter; he's to be discharged before the holidays; will set up for farm visit after first of the year.

(1-5-89) Initial farm visit and assessment (see outline); to follow up with information (see goals).

(1-17-89) Letter to Arlan; includes names and addresses on Sportsman's Associations.

(1-26-89) Received disclosure of information to VR; will forward modifications recommendations to VRC Ann Kniesly.

(2-3-89) Farm visit follow-up

Mr. Bookwalter was visited at his home/farm by myself and Bill Field, Friday, February 3, 1989. The purpose of the visit was to complete the assessment and make modification recommendations for his operation. A summary of modifications will follow this report.

I was contacted by Ann Kniesly, Mr. Bookwalter's counselor at the Vocational Rehabilitation office in Logansport, Indiana. She sent me a copy of a newspaper clipping concerning Arlan.

(2-14-89) Letters with list to VRC and Arlan

(3-16-89) I called and spoke with Mr. Bookwalter, March 15, 1989. He said that he was getting along "pretty good."

Arlan informed me that by the first of next week (March 20, 1989), the lifts on his tractor and combine should be given the "go ahead" to be installed by Vocational Rehabilitation. Mr. Bookwalter said that they have begun modifying their bathroom. He invited me to come and see his modifications once they are complete.

I intend to contact Arlan again in about one month.

- (4-27-89) I called and spoke with Mr. Bookwalter, April 26, 1989. Arlan informed me that he has received hand controls and a vertical-screw lift for his 1586 IH tractor, hand controls and a lift for his wheelchair on his truck, and a cellular phone. Arlan is expecting to receive the Bi-Powered, Tri-Wheel chair in May and the vertical-screw lift for his 1460 IH combine in June of 1989.

Mr. Bookwalter did not have any additional needs at this time. We intend to be in touch with each other near the end of June so I can get some pictures of all of his modifications.

- (6-28-89) I spoke with Diane Deel of Simplicity Lifts, Inc., June 27, 1989. Mr. Bookwalter has also spoken with her recently. Diane and Arlan have discussed various options for entering his combine. Simplicity Lifts, Inc. will take care of the necessary adjustments.

In addition, vertical lifts manufactured in the future will be ball/screw vs. chain-driven. Apparently the ball/screw-driven lifts are more reliable and require less maintenance over a period of time. Mrs. Deel feels that the ball/screw-driven lift operates at the same speed as a chain-driven lift.

- (8-9-89) I spoke with Mr. Bookwalter on August 7, 1989.

Someone from Simplicity Lifts, Inc. made an extension on the lift for Arlan's combine which enables him to transfer more safely from the chairlift to the operator's seat.

Mr. Bookwalter is not interested in automatic hitching devices. Someone is generally around to assist with that task.

Modifications are being done to the Bookwalter's bathroom to make it more accessible and usable for Arlan. Mr. Bookwalter intends to let me know when the modifications are completed.

Arlan went on a fishing trip in Minnesota. Also, he and his wife, Kay, vacationed in South Carolina this summer.

I informed Mr. Bookwalter that Vance Hiner, WBAA News Director, is continuing to work on the story about the Outreach Program and his experience.

Arlan said that I am welcomed to visit to see the extension made to the lift on the combine; in addition to their remodeled bathroom.

- (9-29-89) I visited with Mr. Bookwalter at the Farm Progress Show on September 26, 1989. He was riding his Bi-Powered, Tri-Wheel Chair from Simplicity Lifts, Inc. Arlan spoke highly of the chair.

Repairs are continuing to be made to the lift on his combine. It should be operating well in the near future.

Mr. Bookwalter said that he intends to cement the machinery storage area perhaps sometime this fall.

The bathroom modifications are about three-quarters of the way completed.

(10-10-89) I visited Arlan at his farm on October 9, 1989.

A concrete slab was poured as a ramp to help access the Bookwalter's shop area. Arlan intends to have the machinery storage area floor cemented in addition to a work area just outside of the storage area.

Mr. Bookwalter installed a contour seat on his Bi-Powered, Tri-Wheel Chair. He feels the chair is very useful to him on his farm.

I was shown the modifications being done to the Bookwalter's bathroom. An addition was built onto their home. The bathroom, when completed, will include a roll-in shower, dressing table, toilet, sink, and roll-in closet.

Repairs were completed on the vertical lift to the I.H. 1460 combine. Arlan is able to transfer inside the cab from the chairlift to the operator's seat. Mr. Bookwalter commented that the lift moves rather slowly. I called Simplicity Lifts, Inc. about his concern. They are aware of the problem and are looking into improving the speed of their lifts in the future. A larger motor may enable the lift to operate faster than its current capacity.

Hand controls were made for the clutch, tilt steering, and brake pedals in the combine. Pictures were taken of these modifications. The controls were made at Mr. Bookwalter's shop. Cost of all the controls totaled approximately \$100. The levers are removable because they are mounted by a bolt. The "ball" grasp was purchased from an I.H. dealer for about \$10 each.

(12-27-89) I called and spoke with Mrs. Bookwalter (Kay) and their son, Jeff, on December 20, 1989.

The concrete floor to the machinery storage area was completed. They intend to use it as a shop once an electric door is installed. Vocational Rehabilitation provided some financial assistance for the concrete floor.

(2-27-90) The purpose of the visit was to see the additional modifications that have been made to Mr. Bookwalter's shop.

The most recent modifications include a concrete floor to the shop and bi-fold doors. The bi-folds doors are automatic. Vocational Rehabilitation covered the cost of these modifications.

Arlan and I updated his modifications needs list. Mr. Bookwalter does not have dry chemical fire extinguishers on his tractors; however, there is an extinguisher on his combine. Additional rearview mirrors have not been installed on his machinery. An approximately 10 foot concrete work area was laid outside the automatic door to his shop. A ramp has been laid to the back door entrance of the wood shop. Mr. Bookwalter has obtained the Freedom I wheelchair for yard/shop accessibility. Arlan has not made the necessary modifications to make his tools and workbench accessible. He intends to do this in the near future.

I was also shown the most recent modifications that were made to the Bookwalter's bathroom. Bathroom modifications include a walk-in shower, a changing table, a walk-in closet, a toilet and sink that are wheelchair accessible and the proper height. The lower cabinets of the vanity are yet to be completed.

Arlan shared with us a few ideas that he is considering making. One potential innovation is a lift in the back of a pickup truck to raise his Freedom I wheelchair into the bed. Another innovation includes a lift that would enable Arlan to transfer into a boat. The last innovation is a sliding chair in a van that would allow Mr. Bookwalter to move from the front to the rear of the vehicle.

Mr. Bookwalter, with additional help, sets up farm equipment for the Case-IH dealer in Logansport, Indiana.

Arlan continues to attend outpatient therapy at Methodist Hospital in Indianapolis on Tuesday and Thursday mornings from 9:00-10:00 a.m. He is currently working on using leg braces.

Mr. Bookwalter will contact the Outreach Program if we can be of any assistance in the future.

(7-31-90) Mr. Bookwalter has made a lift to get himself into his boat. He encouraged me to stop by to see the lift when I am in his area.

Mr. Bookwalter has purchased a 6' x 10' trailer for his Freedom I wheelchair. He has taken the Freedom I with him on vacation. Arlan and his family have traveled to Florida and Minnesota.

Mr. Bookwalter said that anytime during the day is a good time to call to arrange a visit.

(9-20-90) Farm Visit

Congressman Jim Jontz (D-IN) and David Nagle (D-IA) visited Mr. Bookwalter and were shown some of his modifications. I intend to send the Bookwalters pictures of this event.

Pictures were taken of the lift Arlan has made to get him in/out of his boat.

Mr. Bookwalter uses a commercial, covered trailer to transport his Freedom I versus a special trailer he would have built himself.

Workbench and tools have been made accessible in the machinery shop area. A wall has been added in this area as well.

(3-27-91) Farm Visit

Mr. Bookwalter's latest modifications were seen during the visit; these include workbenches in his woodworking shop raised for easier use and a tool rack. The tool rack is 6½ x 8' and contains over 100' of metal tubing. It is placed on wheels for easier maneuverability. Arlan had no idea of the cost. Pictures were taken of these modifications.

Apparently the lift to his combine looks the same, it just operates more quickly with a larger motor and different size gears.

The lift that was made for Mr. Bookwalter's boat has not yet been mounted. Arlan is considering making a vertical-screw type of lift versus the swing-arm type of lift for his boat.

Mr. Bookwalter has also not yet constructed a sliding chair for his van. He said that the chair is one of many "irons in the fire."

Fire extinguishers and rearview mirrors are mounted on Mr. Bookwalter's equipment. They intend to mount additional mirrors on his machinery in the future.

(6-6-91) Farm visit

Filming

Lauri Logan, Bill Field, and an interviewer and camera man from the USDA visited Mr. Bookwalter. Filming and interviewing took place to develop a two-three minute segment that will be broadcast nationally by USDA contacts. The filming will highlight the recent funding by USDA for programs that serve agricultural workers who have physical disabilities.

Additional Information

Concrete travelways have not yet been laid from Arlan's home to his shop.

Pictures were taken of the equipment Arlan's "hired hand" sets up for a nearby Case-IH dealer. This is a supplemental source of income for the Bookwalters.

Pictures were also taken of the lift that was mounted on the boat Mr. Bookwalter uses.

Follow-up

Mr. Bookwalter and the Outreach Program are suppose to receive copies of the final tape upon completion.

3. Summary and Discussion

Arlan's case history demonstrates how the assessment tool and case narratives can be used to help identify and prioritize problems, and monitor progress towards developing viable solutions. It also points out the need for flexibility. As a better understanding of the client and his or her operation develops, after several contacts, there will be a need to revise the list of needs and goals such as which problem needs the greatest attention or what is a reasonable length of time to expect needed modifications to be accomplished. For example, some of the issues addressed in Arlan's case that influenced the decisions made included:

- a. With his son and existing employee as a ready labor resource, Arlan could initially concentrate on his recovery and less on the farm operation. This source of assistance was also factored in when exploring changes in the distribution of labor. (In operations without similar labor resources, anxiety over getting the work done can be harmful to the rehabilitation process.)
- b. Since there was no livestock to deal with, Arlan could focus on crop (corn and soybean) production which required less physical activity and was more highly mechanized.
- c. Arlan's farm was nearly all flat which provided more options for mobility aids.
- d. Because of Arlan's involvement in the machinery set-up business, accessibility to the farm shop became a high priority. Issues such as a high threshold, electric door, and concrete floor became more important.
- e. Access to grain storage became a long-term goal with present needs being met by hired help.
- f. Woodworking and craft/recreation activities were identified for later adaptations.
- g. A re-assessment occurred approximately one year into the process which resulted in dropping the idea for a modified ATV in favor of finding a way to transport the Freedom I power chair. Other modifications reconsidered were the installation of fire extinguishers on all equipment, improved communications, roll-around tool rack, lowered work benches, and extra mirrors on equipment. Some of these took much longer to accomplish than originally planned.
- h. Appropriately, one of the last things done was the fitting of Arlan's fishing boat with a homemade lift.

E. Using A Team Approach

In developing effective and cost efficient solutions for complex worksite accommodations, two or three heads are usually better than one. Other professionals such as rehabilitation engineers, occupational therapists, and individuals with special technical skills can provide rapid feedback on goals, ideas and possible solutions. It would be ideal that each client be visited by an interdisciplinary team of specialists to complete an assessment and

develop a set of solutions. However, because of cost, lack of such personnel in most rural communities and scheduling problems, such a team approach is difficult if not impossible in many cases to carry out. Because of the restraints to the use of a team approach, it should be generally left to cases that are complex or where numerous modifications are needed.

The following provides some tips on using a team approach.

1. *Role of Case Manager*

The primary role of the case manager is to help the client reach his or her goals to the fullest extent possible. This is accomplished through facilitating the assessment, documenting progress, intervention and advocacy when necessary, maintaining communication with all the involved participants, and being a frequent source of encouragement.

2. *Who to involve*

Your initial contact with the person is usually the only data you have to identify whom to bring along for the assessment. If voc-rehab is involved, the counselor is a valuable team member and may wish to be included. But normally scheduling is so tight, most clients must go to them. This obviously defeats the purpose of making a farm visit. If your project is fortunate enough to employ a rehabilitation engineer, he or she can sometimes generate good solutions to be thought through or nip bad ones before time is wasted on them. The same applies for occupational therapists and physical therapists. The referral source may be invited, if the representative is someone who has intimate knowledge of the situation and is OK'd by the client. This could be friends, family, hired help, social workers, clergy, or extension agents. Some situations can call for driving evaluators, interpreters, communication aids specialists, fabrication specialists, computer specialists, etc. In many instances, the assessment will be performed by the case manager working alone with the client, setting goals for rehabilitation and bringing in consultants/specialists as specific needs are identified.

3. *When to involve them*

Many times the objective of the task (whether it's selecting livestock, setting the threshing functions of a combine or calibrating seed placement for a planter in different soil conditions) is so subjective it may be difficult for even the client to put into words exactly what outcome is desired. Having team members available for on the spot demonstrations of the desired activities can be a great advantage in determining specific needs. This involves timing visits during critical farm operations: calving season, harvest time, milking time, etc. Again, difficult, but not impossible and the "hands-on" experience can be very productive.

4. *Client's rights and desires*

Client's rights and desires are always first and foremost. It's very easy to intimidate someone who is new to the rehabilitation process (i.e., almost all of the people

we are here to provide services for) into feeling they have little knowledge of what it is they need. The case manager's job as a team member is to ensure that the client's rehabilitation needs outweigh the needs of schedules, funding sources, vendors and other service providers. This team approach is valuable only so far as it serves the client's needs. If the individual says no to a certain piece of assistive technology, or insists that their spouse will not have to work in the containment building, or that their child is too young to take over certain tasks, then respect their reasonings and look for other options. They probably have access to much more information about their own particular farm tasks and resources than could ever be determined in an assessment.

5. Case Example

Discussion of Arlan Bookwalter's case, as an example, can demonstrate the success of the team approach:

- Networking to receive a referral from an outside agency (Methodist Hospital);
- Identifying needs (assessment by BNG together with Arlan and medical referral information from Methodist Hospital);
- The client contacting outside resources for funding (Voc-Rehab);
- Effectively utilizing outside funding, counseling Arlan on his disability and how to get the most out of potential social services (Voc-Rehab and BNG staff);
- Bringing together assistive technology vendors, clients and funding sources (Round Ground Machine, Co., Voc-Rehab and BNG staff)
- Support of family and employees (Arlan's wife, son and hired help working together, splitting job duties and finding an alternative enterprise: farm equipment assembly for year-round employment and income).

IV. Selecting the Appropriate Level of Accommodation Using a Solution Hierarchy

A. Introduction

You have probably heard the saying: "There is usually more than one way to skin a cat" (apologies to the cat lovers). This idea holds true when attempting to identify accommodations for agricultural worksites. Because of the diversity of factors involved, no set of rules can be applied consistently to developing an effective solution in every situation. What works for one farmer might not for another. However, there is a logical, orderly process that can be used in solving assistive technology problems that experience suggests reduces the amount of time, energy and money invested. The purpose of this section is to present a solution hierarchy that addresses the various levels of accommodation and limits possible solutions.

B. Defining the Problem

Have you ever noticed how quick we usually are to offer solutions to problems that we haven't taken the time to investigate or understand? Usually before any complex problem can be solved, a considerable amount of attention needs to be given to defining and understanding the problem. More is gained from spending time on assessing the problem than working on quick solutions that often fail or are rejected by the user. For example, a farmer with a leg amputation might consider on a specific day that his most significant problem is climbing and entering his grain bin to check grain quality. If you focus only on the act of climbing the bin, you will probably overlook other solutions such as electronic in-bin monitors that practically eliminate the need for bin entry.

When seeking a solution for an agricultural worksite accommodation problem, take the time to carefully investigate the problem. Consider questions such as:

1. Why does the task need to be done?
2. Who needs to complete the task?
3. What other alternatives exist?
4. Where does the task need to be done?
5. Where does the task fit into the rest of the operation?
6. When does the task need to be done?
7. How often does the task need to be done?
8. How does the task need to be done?

C. Assessing Abilities and Resources

In addition to defining the problem, time should be spent assessing the person's abilities and resources that could be used to overcome a particular barrier. Resources might include: other family members or employees who could assist in performing a difficult task; readily available tools and equipment; service contracts to repair equipment; and financial resources. Completing an inventory of abilities and resources is part of the work-site assessment discussed in Chapter III.

D. Solution Hierarchy and Levels of Accommodation

Once you have a good understanding of the problem and the resources at your disposal, the process of developing a solution can begin. As mentioned earlier, there is no set of rules that result in a solution every time but rather a solution hierarchy that enables you to narrow in on potential solutions.

Some refer to the solution process as one consisting of four levels:

- Solving the problem without purchasing additional equipment or making modifications.
- Using commercially available items.
- Modifying commercially available products.
- Designing or fabricating a device or modification.

In the following overview of a suggested solution hierarchy, six steps are presented in overcoming agricultural workplace barriers. Each is posed as a question that can result in a possible solution to the problem.

1. *Can the task be eliminated?*

In some cases, the best solution might be to eliminate the troublesome task. When a disability occurs and future plans are being made, consideration should be given to which activities are essential and which can be eliminated. Other personal goals should also be considered. For example, a farmer who experiences a back injury that impairs his/her ability to handle baled hay might consider getting out of the hay business. A farmer who develops a severe respiratory problem might use this point in time to decide to sell the hogs and increase crop production.

2. *Can the task be accomplished by someone else?*

In many farm operations, job restructuring is not possible because the bulk of the labor is provided by only one or two individuals. However, in operations where other family members or employees are involved, consideration should be given to re-assigning job responsibilities to more effectively accommodate a person's abilities following a disability.

This approach has special value when it comes to tasks that are too expensive to modify or ones that would pose special hazards to the person if he or she were to continue performing them.

Examples might include a farmer who becomes visually impaired and turns over the field work to another family member and takes on more of the farm management responsibilities. In some cases, farmers have taken on more of the domestic and child-rearing responsibilities following a disability while the wife has become more active in the farm operation.

3. *Is there an alternative way to perform the task using existing capabilities and resources?*

If the individual decides that he or she wants to continue performing a specific task, there might be ways to do so using existing capabilities and resources. This might include:

- a. Using other physical means to complete the desired task. For example, a farmer who is a bilateral arm amputee, might be able to drive the tractor using his feet. Another farmer with a bad back could make several trips to carry feed rather than one. With patience and practice many tasks can be performed by alternative methods.
- b. Using existing tools, equipment and facilities to complete desired tasks. It is not always necessary to purchase or fabricate specialized assistive technology. With a careful assessment of existing resources on many modern farms and ranches, possible solutions could be readily available. A farmer who develops a mobility impairment could utilize an existing golf cart, ATV, snowmobile or garden tractor to increase access to remote areas of the farm. Skid steer loaders, found on many farms, have been used to complete a wide variety of chores for those with mobility impairments or insufficient strength.

4. *Is there a commercially available product that will enable the person to complete the desired task?*

There are literally thousands of commercially available products that could be used by agricultural producers to complete essential tasks. A description of the more commonly used devices can be found in Volume II of "Agricultural Tools, Equipment, Machinery and Buildings for Farmers and Ranchers with Physical Disabilities." Other sources of information regarding applicable labor saving devices and assistive technology include:

- a. ABLEDATA (Assistive technology database)
- b. Farm magazines (Farm Show, Successful Farming, Farm Journal, Progressive Farmer, Prairie Farmer)
- c. Hardware stores
- d. Tool catalogues
- e. Specialty catalogues

See Chapter V for sources of additional ideas on locating commercially available products.

5. *Can a commercially available product be modified so that it can be used to complete the desired task?*

Experience has shown that commercially available products can often be modified to enable a person with a disability to complete a desired task. Often these modifications are simple and can be completed with minimal expense. This approach allows, in many cases, a familiar tool or piece of equipment to become the assistive device increasing the likelihood of acceptance. The following are examples of this type of accommodation.

- a. Adding an additional step to the existing approach to a combine or tractor for an individual with a mobility impairment. Addition of a non-slip surface on the steps of a combine or tractor is also a simple approach to improving the safety of mounting and dismounting.
- b. Adding extensions to the hydraulic control levers on a tractor or combine for someone with a reaching or grasping limitation.
- c. Installation of foot guards on an ATV to reduce the potential for contact with the wheels and to support the legs.
- d. Padding of handtools and powertools to reduce impact injuries to the hands and improve grip.
- e. Modifying a tool with a custom-made grip for an individual with a hand injury.

6. *Can a device or modification be designed and fabricated that will allow the user to complete the desired task?*

This approach is generally the most time-consuming and expensive and should only be used as a last resort. It often requires several cycles of trial and error to achieve a usable device or modification. One of the primary disadvantages of this approach is the long lead time often required to get a finished product into the hands of the consumer.

There are, however, many examples of devices that have been locally fabricated, at very low cost, and have served the needs of the users quite well. These have usually been the product of a local craftsman who was both a creative designer and skilled fabricator.

Examples of custom made assistive technology include:

- a. Tractor or combine lift for someone with a mobility impairment.
- b. Twelve (12)-volt electric lift to raise and lower a wheelchair in and out of a truck bed for storage.
- c. Pig jig for holding baby pigs for administering health care.
- d. One-handed staple starter for individuals with an arm amputation needing to fix fence.

V. Sources of Information on Assistive Technology Appropriate for Agricultural Workplaces

A. Introduction

Once you have determined the need for assistive technology and the appropriate levels of accommodations, where can you go — what resource can you investigate — to locate potential solutions to assist in the design, fabrication, or procurement of the desired technology?

This chapter will list a variety of resources under the headings of People, Places and Things, but the lists are not exhaustive. The number of resources available to you are truly limited only by your imagination because assistive technology solutions are found in nearly every occupation. By using creative problem-solving (see Chapter VII), you may discover, for example, that *American Fruitgrower* magazine advertises assistive technology appropriate for a farmer with a disability who operates a fruit orchard as an alternative enterprise. The point is, make use of the list of resources provided here, but use your imagination to identify further resources that are not listed. Remember that appropriate assistive technology can sometimes be found in uncommon places.

B. People

1. *Person who has the need*

Having to deal with a problem for a length of time will often provide keen insight into how that problem should or could be solved. Ask the individual if he/she has an idea for a solution. Solutions developed or identified by the potential user will more likely be successful.

2. *Farm family*

Check with other members of the client's family, including nearby relatives, to see if they have any special skills that could contribute to an appropriate solution. In some cases, they only need to be asked and the response will be overwhelming. Don't assume that family members know what the needs are.

3. *Neighbors and friends*

An excellent source of solutions are the client's neighbors and friends, especially those who farm or provide skilled services in the community. In some cases these individuals can not only provide creative ideas but also are capable of fabricating many types of assistive technology.

4. *Consumers using technology*

This category would include consumers who have purchased and are using a commercial product being considered as a solution and other farmers/ranchers who have built solutions similar to a device being considered for fabrication.

5. *Rehab professionals*

- speech pathologists
- prosthetists/orthotists
- physical/occupational therapists
- rehabilitation engineers

6. *Agricultural engineers*

Agricultural engineers have an excellent understanding of agricultural worksites, equipment and processes. Because of the diverse nature of agriculture, these engineers also have experience with designing one-of-a-kind solutions unique to agriculture. In many states, the Land Grant Institution has an agricultural engineering department that can be a source of engineering expertise. In some cases these services can be obtained at no cost through Extension agricultural engineers. Agricultural engineering departments could also assist through the use of student design projects to develop needed solutions.

In addition, there are many agricultural engineers who provide consulting services for a fee. For further information contact:

American Society of Agricultural Engineers
2950 Niles Road
St. Joseph, MI 49085
(616) 429-0300

7. *Cooperative Extension Service*

Each county in the United States has a county Extension office that is staffed with specialists in various aspects of agriculture. These professionals can be an excellent resource in developing solutions to agricultural worksite barriers. Most have not had any formal training in the field of rehabilitation but are familiar with agriculture and are experienced with addressing unique problems. Involving them in a team to address specific assistive technology problems could prove very beneficial.

8. *Other professionals*

- carpenters
- electricians
- machinists
- welders
- shoe makers
- engineers
- cabinet makers
- auto mechanics

9. *Members of service clubs or church groups*

C. Places

1. Dealerships

- a. Durable medical equipment — dealers carry products such as outdoor mobility aids and independent living aids, for example.
- b. Automobile or ATV/Motorcycle — may have experience installing hand controls or making special accommodations.
- c. Farm machinery — can offer expertise in a variety of areas including modification of equipment and sale of laborsaving devices.

2. Libraries

It is sometimes easy to forget that libraries are full of resources, just waiting to be accessed.

- a. Occupation-specific magazines — it seems there is a magazine for every interest, and a significant percentage of them contain at least some advertisements for or reviews of related technology (e.g. — *Successful Farming* or *American Fruitgrower*).
- b. U.S. patent abstracts — can be searched to locate commercial products of which you are unaware, or to provide direction for creating a new solution. (A list of patent depository libraries is included at the end of this chapter.)
- c. Reference librarians — have command of a vast assortment of resources and expertise to help guide you in the correct direction.

3. U.S.D.A. AgrAbility Programs

The USDA AgrAbility Program now has active projects in 22 states that are charged with providing technical assistance to farm and ranch families impacted by disability. Personnel involved with each project are able to make site visits and become involved with the rehabilitation team. Each is well equipped with resources and expertise to assist with identifying, selecting and implementing appropriate assistive technology. See Section XII for information on making contact with the closest AgrAbility Project.

4. Not-For-Profit Agencies

There are many fine institutions, foundations, and organizations providing assistance to persons with particular disability types while others provide assistance to persons with a wider range of disabilities. Too numerous to mention here, agencies serving individuals with disabilities may be listed in resources assembled by your state's Governor's Committee on the Disabled and others. Three examples of agencies follow.

- a. American Foundation for the Blind's (AFB) National Technology Center — available are evaluation reports of technology for persons with visual impairments or blindness, reference lists of companies that sell various forms of assistive technology, access to the AFB's Careers and Technology Information Bank (CTIB) database, access to a resource specialist who can answer questions, information on financial assistance programs for purchasing technology, and a comprehensive listing of all manufacturers/distributors of products for blind and visually impaired persons. (1-212-620-2080).
- b. Technology to Assist Persons with Disabilities — is a national information system that provides free information about resources in your state (1-800-922-9234, Ext. 301 or in South Carolina, 1-800-922-1107).
- c. Gallaudet Research Institute — publishes reports relating to assistive technology for deaf and hard of hearing people, including *Devices for Deaf and Severely Hard of Hearing People: An Annotated Bibliography* and *Specialized Audio, Visual, and Tactile Alerting Devices for Deaf and Hard of Hearing People*. Gallaudet Research Institute, Gallaudet University, 800 Florida Avenue, N.E., Washington, DC 20002.

5. Businesses

- a. Hardware and building supply stores — carry an assortment of fabrication materials, fasteners, adhesives, lubricants, and just plain neat gizmos that are time savers and laborsavers.
- b. Farm supply stores — also carry commercially available laborsaving devices and equipment.
- c. Industrial supply companies — can answer questions about fabrication materials and whether commercial equipment is available to meet a certain application.
- d. Lumber yards and factories — may have scrap material which they will donate or sell at a low cost.
- e. Other businesses — art stores, department stores, hobby shops, electronic stores, and specialty gift stores carry unique devices that can sometimes be used in making worksite adaptations.
- f. American Automobile Association (AAA) — can provide information on where to purchase hand controls and modified vans.

6. Farm Building Plan Service

The Farm Building Plan Service is an organization of extension and research agricultural engineers from the 12 states of the north central region, plus representatives of the USDA. The Service provides a wide range of publications related to the needs of agriculture. Some of these have relevance to the needs of farmers/ranchers with disabilities. For a catalogue contact the member university closest to you.

MIDWEST PLAN SERVICE MEMBER UNIVERSITIES

Univ of Illinois
Agr Engr Dept
1304 W Pennsylvania Ave
Urbana IL 61801
(217) 333-7964
FAX (217) 244-0323

Ext Agr Engr
Kansas State Univ
Seaton Hall Rm 237
Manhattan KS 66506
(913) 532-5813
FAX (913) 532-6944

Agr Engr Plan Serv
Univ of Missouri
205 Ag Eng Bldg
Columbia MO 65211
(314) 882-2731
FAX (314) 884-5650

Ext Agr Engr
Ohio State Univ
590 Woody Hayes Dr
Columbus OH 43210
(614) 292-6007
FAX (614) 292-9448

Farm Bldg Plan Service
Purdue University
1146 Ag Engr Bldg
W Lafayette IN 47907-1146
(317) 494-1173
FAX (317) 496-1115

Plan Service Secretary
Michigan State Univ
Agr Engr Dept
217 Farrall Hall
E Lansing MI 48824-1323
(517) 353-3297
FAX (517) 353-8982

Agr Engr Plan Service
Univ of Nebraska
219A LW Chase Hall
Lincoln NE 68483-0727
(402) 472-1646

MWPS Secretary
South Dakota State Univ
Box 2120, Agr Engineering
Brookings SD 57007
(605) 688-5667
FAX (605) 688-4917

Agr Engr Ext
Iowa State Univ
207 Davidson Hall
Ames IA 50011-3080
(515) 294-6361
FAX (515) 294-9973

Ext Agr Engr
Univ of Minnesota
1390 Eckles Avenue
201 Agr Engr Bldg
St Paul MN 55108
(612) 625-9733

Ext Agr Engineering
Box 5626
North Dakota State Univ
Fargo ND 58105
(701) 231-7238
FAX (701) 231-1008

MWPS Secretary
Agr Engr Dept
460 Henry Mall
Univ of Wisconsin
Madison WI 53706
(608) 262-3311
FAX (608) 262-1228

Send Iowa orders to:
Publications Distribution
Iowa State University
Ames IA 50011-3171
(515) 294-1343
FAX (515) 294-2945

7. National Aeronautics and Space Administration (NASA)

NASA Technology Utilization Offices are places to go for ideas and information on ways to utilize and transfer the technology of NASA to everyday situations. Technology transfer experts can help you apply innovations developed by NASA at ten separate offices located throughout the U.S. To locate the office nearest you, or for more information about the services NASA has to offer, contact: Walter Heiland, NASA Center for Aerospace Information, Technology Utilization Office, 800 Elkridge Landing Road, Linthicum Heights, Maryland 21090-2934, (410) 859-5300, Ext. 244.

8. Farm Shows and Ag Days

Held all across North America every year, these shows — whether large or small — frequently have new, unique, or innovative devices on exhibit.

D. Things**1. Written resources**

- a. *Agricultural Tools, Equipment, Machinery & Buildings for Farmers & Ranchers with Physical Disabilities, Volumes 1 and 2*, published by the Breaking New Ground Resource Center at Purdue University, West Lafayette, IN. Volumes are organized according to function: lifts, hand controls, commercial accessories, etc.

- b. *Farm and Home Modifications Designed and Used by Saskatchewan Farmers with Physical Disabilities*, published by The Handicapped Farmers Program of the Saskatchewan Abilities Council, (306) 374-4448, organized by disability.
- c. Newsletters — Several provide coverage of information and events of interest to rural residents with disabilities, and the first two each frequently contains an article describing a rural assistive technology solution.
 - *Breaking New Ground*, published by the Breaking New Ground Resource Center at Purdue University, West Lafayette, IN, (317) 494-5088.
 - *HANDI FARMER*, published by the Handicapped Farmers Program of the Saskatchewan Abilities Council, Saskatoon, Saskatchewan, Canada, (306) 374-4448.
 - *The Rural Exchange*, published by RTC-Rural at the University of Montana, Missoula, MT, (406) 243-5467.
- d. Catalogs
 - Farm supply catalogs — Carry various laborsaving solutions. *Modern Farm*, which carries such items as a one-handed nail starter, a modified shovel and several other laborsaving solutions. Other farm supply catalogs include *Nasco Farm & Ranch*, 1-800-558-9595; *General Tractor Farm & Family Center*, New Parts, 1-800-247-0126, Used Parts, 1-800-247-0128, General Information, 1-800-247-7508.
 - Industrial supply catalogs — Many of these catalogs carry information on laborsaving tools and fabrication materials. For example: *Northern Hydraulics*, 1-800-533-5545; *Sears Power & Hand Tools*, 1-800-377-7414; *Grainger Industrial & Commercial Equipment & Supplies*, 1-800-225-5994; and the *Thomas Register*, 212-629-2100 (listing of industrial products and services).
 - Recreational catalogs — Farmers and ranchers can enjoy many recreational activities (at those rare times when they're not working) with help from some recreational assistive technology. Examples include: *Access to Recreation*, 1-800-634-4351.
 - Other resources — *Fred Sammons* which carries Poly Lock, Poly Form and independent living aids, 1-800-323-5547.
- e. Disability resource manuals

There are several available. One with which we are familiar is:

- *The 1996 Complete Directory for People with Disabilities*, Leslie Mackenzie, Editor. GreyHouse Publishing, Lakeville, CT, (203) 435-0868, \$110.00. Seventeen chapters in four major groupings: institutions, products, media, and programs. The "Products" section includes: assistive devices, clothing, and computers, plus major catalogs listed for each area. A chapter on recreation has its own list of assistive devices.

f. Professional journals

There are a multitude. A few of them are:

- *Journal of Visual Impairment and Blindness* frequently reviews technology relevant to its readers.
- *Rehabilitation Gazette* published an extensive list of resources of many types in the January 1992 issue. Headings include: Aging, Catalogs, Computer-Related, Directories, Employment, Periodicals, Publications, Sports and Recreation, Technology, Videos, and more.
- *TeamRehab Report* in each issue has a section on new products.

g. Other periodicals

- Disability-related: Again, there are many available including: *Paraplegia News*, *Accent on Living*, *Sports 'N Spokes*.
- Farming-related: There are several publications that carry articles and information on agricultural worksite adaptations and laborsaving technologies. Examples of these include *Farm Show*, which is published bimonthly, contact: Farm Show, Box 1029, Lakeville, MN, 55044, (612) 469-5572; and the following magazines published monthly which include: *Progressive Farmer*, *Farm Journal*, *Successful Farming*, and many more.

h. Technology publications

- *Trace Resource Book: Assistive Technologies for Communication, Control, and Computer Access*, Trace R&D Center, University of Wisconsin, Madison, WI, (608) 263-2309.

A self-described "comprehensive guide to software, hardware, and augmentative communication equipment." Includes Telecommunication Devices for the Deaf (TDDs).

- *The Wichita Rehabilitation Engineering Center Tech Brief*, The Cerebral Palsy Research Foundation of Kansas, Wichita, KS, (316) 688-1888.

Published irregularly since 1976, each issue contains 10 to 25 descriptions of custom-designed and fabricated solutions. Solutions are typically simple, cost-effective, and practical ways to perform a certain job task. One- to two-page descriptions provide background, problem, and solution and are accompanied by at least one sketch or drawing of the solution.

- *The Assistive Technology Sourcebook*, Alexandra Enders and Marian Hall, Editors. RESNA Press, Washington, DC, (202) 857-1199.

This book describes itself as a "doorway to assistive technology resources." It includes a chapter on information-seeking strategies, and lists available resources for each chapter topic, including: Technology at Home, Technology at Work, Technology for Education and Children, Recreation and Leisure Technology, and many others.

- Resource list at end of this binder

2. *Databases*

- Job Accommodation Network (JAN) — A service of the President's Committee on Employment of People with Disabilities, JAN brings together information from many sources about practical ways of making accommodations for employees with disabilities. (1-800-JAN-7234 in U.S.; 1-800-JAN-CANA in Canada)
- ABLEDATA — A database of more than 16,000 commercially available products for persons with disabilities. (1-800-346-2742) The electronic database is also available on compact disk.
- National Rehabilitation Information Center (NARIC) — provides information on a wide range of disability-related topics. (1-800-346-2742)
- Careers and Technology Information Bank (CTIB) — A service of the American Foundation for the Blind, the CTIB contains information compiled from interviews with more than 1400 blind and visually impaired individuals who use assistive technology at home, at school, and at work; participants provide feedback on the products they use, their employment or school (experience and the training they received. Individuals can request a database search for persons who use a particular assistive technology and then speak with them about that technology. (1-212-502-7600)
- A Breaking New Ground database in development provides an electronic version of the Volume 2 resource manual. In addition, it provides a support system that will guide a professional and a farmer in making decisions about assistive technology issues that may need to be addressed before the latter returns to farming or ranching.

INDEX OF PATENT DEPOSITORY LIBRARIES BY STATE

State	Patent Depository Library
Alabama	Auburn University — Auburn University Libraries Birmingham — Birmingham Public Library
Alaska	Anchorage — Z.J. Loussac Public Library
Arizona	Tempe — Noble Library, Arizona State University
Arkansas	Little Rock — Arkansas State Library
California	Los Angeles — Los Angeles Public Library Sacramento — California State Library San Diego — San Diego Public Library Sunnyvale — Sunnyvale Patent Clearinghouse
Colorado	Denver — Denver Public Library
Connecticut	New Haven — Science Park Library
Delaware	Newark — University of Delaware Library
District of Columbia	Washington — Howard University Undergraduate Library
Florida	Fort Lauderdale — Broward County Main Library Miami — Miami-Dade Public Library Orlando — University of Central Florida Libraries Tampa — University of South Florida Library
Georgia	Atlanta — Price Gilbert Memorial Library, Georgia Institute of Technology
Hawaii	Honolulu — Hawaii State Library
Idaho	Moscow — University of Idaho Library
Illinois	Chicago — Chicago Public Library Springfield — Illinois State Library
Indiana	Indianapolis — Indianapolis-Marion County Public Library
Iowa	Des Moines — State Library of Iowa
Kansas	Wichita — Wichita State University
Kentucky	Louisville — Louisville Free Public Library
Louisiana	Baton Rouge — Troy H. Middleton Library, Louisiana State University
Maryland	College Park — Engineering and Physical Sciences Library, University of Maryland
Massachusetts	Amherst — Physical Sciences Library, University of Massachusetts Boston — Boston Public Library
Michigan	Ann Arbor — Engineering Transportation Library, University of Michigan Detroit — Detroit Public Library
Minnesota	Minneapolis — Minneapolis Public Library and Information Center

This list was obtained through the Marion County Public Library.

State	Patent Depository Library
Mississippi	Jackson — Mississippi Library Commission
Missouri	Kansas City — Linda Hall Library St. Louis — St. Louis Public Library
Montana	Butte — Montana College of Mineral Science and Technology Library
Nebraska	Lincoln — Engineering Library, University of Nebraska-Lincoln
Nevada	Reno — University of Nevada-Reno Library
New Hampshire	Durham — University of New Hampshire Library
New Jersey	Newark — Newark Public Library Piscataway — Library of Science and Medicine at Rutgers University
New Mexico	Albuquerque — Centennial Science and Engineering Library, University of New Mexico
New York	Albany — New York State Library Buffalo — Buffalo and Erie County Public Library New York — New York Public Library at 43rd Street
North Carolina	Raleigh — D.H. Hill Library, North Carolina State University
North Dakota	Grand Forks — University of North Dakota
Ohio	Cincinnati — Public Library of Cincinnati and Hamilton County Cleveland — Cleveland Public Library Columbus — Ohio State University Libraries Toledo — Toledo/Lucas County Public Library
Oklahoma	Stillwater — Oklahoma State University Library
Oregon	Salem — Oregon State Library
Pennsylvania	Philadelphia — The Free Library of Philadelphia Pittsburgh — Carnegie Library of Pittsburgh University Park — Pattee Library, Pennsylvania State University
Rhode Island	Providence — Providence Public Library
South Carolina	Charleston — Medical University of South Carolina Library
Tennessee	Memphis — Memphis & Shelby County Public Library & Information Center Nashville — Vanderbilt University Library
Texas	Austin — McKinney Engineering Library, University of Texas at Austin College Station — Sterling C. Evans Library, Texas A&M University Dallas — Dallas Public Library Houston — The Fondren Library, Rice University
Utah	Salt Lake City — Marriott Library, University of Utah
Virginia	Richmond — Virginia Commonwealth University Library
Washington	Seattle — Engineering Library, University of Washington
Wisconsin	Madison — Kurt F. Wendt Library, University of Wisconsin-Madison Milwaukee — Milwaukee Public Library

VI. Criteria for Selecting Assistive Technology Appropriate for Agricultural Workplaces

A. Introduction

As new types of assistive technology are developed and reach the marketplace, and as individuals with disabilities become more able to take charge of developing their own solutions to accomplishing desired tasks, rural rehabilitation service providers will be called upon to help select the most appropriate devices or modifications. Furthermore, service providers will be asked to assist in evaluating the various alternatives and making specific recommendations concerning their application in various situations. Since there is a lack of uniformly accepted criteria, the evaluations and choices made are often more subjective in nature and will often be limited by the experiences of the professional and alternatives available.

There are efforts underway to develop objective means of evaluating assistive technology such as powered wheelchairs, van lifts and other widely used products. It is unlikely, however, that these strategies will impact many of the types of assistive technology used by farmers and ranchers for the foreseeable future. This section is designed to provide you with an overview of the primary characteristics of assistive technology used in the agricultural workplace and how these characteristics can be evaluated.

B. Characteristics of Appropriate Assistive Technology

To be considered appropriate, rural assistive technology should have the following characteristics:

1. The technology should function as expected.

The single most important characteristic of any type of assistive technology is its ability to function at the level expected by the user. In other words: Does it work? Does it meet the need? Does it perform under the anticipated conditions? Appropriate assistive technology works.

Most assistive technology is abandoned because it does not work.

Generally, function is the easiest characteristic of assistive technology to confirm. It either works, or it doesn't. In some cases, however, function might be dependent upon the perception of the user and the adequacy of the training provided.

A device that works but is placed in the hands of a consumer who is not properly trained can result in rejection or even injury.

Beauty, form, safety, cost or tradition often have little to do with the user's view of how well an assistive device or modification works. A frequent comment concerning a homemade device is: "It might not be pretty but it works!" High cost does not automatically mean the selected technology will function as expected or do the job more effectively.

2. The technology needs to be cost effective.

Regardless of how great the need might be, in most "real life" situations, economic resources are limited. Unfortunately, the quality of assistive technology services and the quality of the technology itself are often dependent upon how deep a pocket the consumer has to draw from.

Appropriate assistive technology is affordable for the consumer and should result in benefits commensurate with the costs. In some cases, the cost of the assistive technology is so great that it would be more "appropriate" to explore alternative ways to accomplish the desired task.

As a professional you need to believe that everyone deserves the best, but in actual practice you will see consumers receiving significantly different levels of service and quality of technology. This can be extremely frustrating for both the consumer and the professional.

With respect to new technology that is extremely expensive and has a greater risk of failure, cost effectiveness is not as important during the development stages. As the concept becomes more widely accepted and sales increase, the cost generally decreases.

3. The technology should be safe.

Appropriate assistive technology is safe. Devices, practices and modifications that expose the user to increased physical risks are not appropriate and need to be avoided.

Even if a particular consumer is willing to accept the higher risk of a selected technology, the professional rehabilitation engineer, technician, or counselor exposes himself to considerable personal liability by prescribing an unsafe technology. In some cases, such a recommendation may violate his/her professional code of ethics.

Risk is relative. What might be unsafe for one individual could be appropriate for another depending upon physical capabilities, training, and use of safety measures. There are circumstances where specialized training, guarding and supervision can convert an unsafe technology into a safe one for specific applications.

As in the airline industry, special attention should be focused on those circumstances where there is little or no room for error — the kind where you can only make the mistake once.

4. The technology should be acceptable to the consumer.

Technology that functions, is cost effective, and is safe but is rejected or eventually abandoned by the consumer is not appropriate technology. Only the user can tell you whether the shoe fits.

Assistive technology that is abandoned or rejected is not necessarily bad or poorly designed but is often not compatible with a specific individual. The same technology that is unacceptable to one individual might be considered indispensable to someone else.

The level of consumer acceptability can also be dependent upon factors such as consumer involvement in the design process, consumer training and follow-up maintenance and service. It appears, from experience, that the more the consumer is involved with the selection and implementation process, the greater the potential for acceptance of the technology.

5. *The technology should be readily available.*

Assistive technology that is still in the development stage, found only at some research center, other state or available in only limited quantities is not appropriate. Appropriate assistive technology should be readily available to the consumer. It should not be the exclusive domain of the rich and famous.

Promoting technology that is not yet available or tested is cruel, especially if it is presented as a viable solution that would work "if only we could get it."

Many types of assistive technology are readily available that would have application in farm and rural settings but remain unused because consumers and professionals are not aware of its existence.

6. *The technology should be serviceable.*

In many cases a piece of broken assistive technology is worse than none, especially if the consumer has become dependent upon it.

Appropriate assistive technology should generally be serviceable within the consumer's community. Providing a rural consumer with an assistive device that can only be serviced by two rocket scientists 2,000 miles away, who volunteered their services to develop it, will eventually be frustrating and costly to the consumer.

As the dependency upon the technology increases, the need for being able to service it locally increases.

For rural consumers who are considerable distances from rehabilitation services and facilities, the serviceability of a technology can significantly reduce the "appropriate" options. However, consideration should be given to other sources of service. If a rural farm equipment dealership technician is able to troubleshoot and service sophisticated new farm equipment, they should be able to service many types of new assistive technology. You may also find that this type of service is also less expensive.

7. *The technology should be durable.*

The conditions in rural settings; especially agricultural workplaces, can be especially harsh. Appropriate assistive technology should be able to withstand the heat, cold, dirt, snow, rain, dust and manure that will often be present.

Devices and modifications used by farmers and ranchers should be constructed to endure hard use and it should be assumed that this group of consumers will find other applications that will severely test the durability of the device.

8. *The technology should be adaptable.*

Appropriate assistive technology should be flexible enough to accommodate the various circumstances under which it will be used. If both disabled and able bodied users are expected to utilize the device or modified equipment, it should accommodate the needs of both.

As new technology is developed or changes occur in the equipment or facilities being modified, the assistive technology should be adaptable to avoid the need for a complete change.

C. Evaluation of Assistive Technology

At present there are no techniques to objectively evaluate whether a particular type of assistive technology would be appropriate for a specific rural or agricultural worksite application. Neither are there efforts being made to evaluate commercially available or homemade devices and modifications to determine their value in rural or agricultural worksite environments. The numerous variables involved, many of which are very subjective, will make developing such an evaluation process very difficult.

Based on the eight characteristics previously described, a simple evaluation approach might utilize the following form.

Evaluation Criteria		Score					
		Low		----->		High	
		0	1	2	3	4	5
1.	Function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2.	Cost Effectiveness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3.	Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4.	Acceptability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5.	Availability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6.	Serviceability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7.	Durability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8.	Adaptability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Using this tool, a score of 0 to 5 would be given to each of the eight evaluation criteria. A score of 0 on a given criteria, such as Function would mean that the technology simply does not work. A score of 5 on a criteria, such as Acceptability would indicate that the consumer found the technology very acceptable and useful.

D. Summary

Evaluation often proves to be an expensive and time consuming activity. However, prescribing assistive technology to consumers without taking the time to evaluate can result in frustration, failure and wasted resources. Furthermore, it can lead to a string or succession of problems as new consumers are encouraged to adopt technology or practices that have not worked for previous users.

Investing in the evaluation process can prove to be a good investment with many positive returns.



VII. Developing Creative Solutions to Agricultural Workplace Barriers

Rehabilitation specialists are routinely called upon to prescribe, provide, design, build and even maintain assistive technology. In your job you have probably been confronted with needs and situations that require technical solutions even though you may have little or no formal technical training or experience in solving these kinds of problems. This chapter explores some strategies that can be used in developing solutions to assistive technology problems and presents a framework for creative and efficient problem solving. The bibliography at the end of this chapter lists some publications that discuss issues related to creativity and methods to enhance and exploit individual creativity. Perhaps you can put some of these tools in your personal toolbox and use them to better meet the needs of your clients.

A. Creativity

All people are creative. We are creative in different ways and have different levels of creative energy. Creativity cannot be taught. What can be taught are strategies and methods that can help us exploit our natural creativity and apply our unique talents to solving problems. How many of us have read articles that purport to measure creativity by solving brain teasers? For example: without lifting your pencil, connect all 9 dots in a 3x3 square array with 4 (or 3, or 2, or 1!) straight lines. Exercises like this may be fun (for some of us) but they tend to test analytical skills (left-brain function) rather than creative potential. Individual creativity seems to depend on the relative abilities of and communication between the left and right sides of our brain. According to Raudsepp (1) the right part of the brain processes information in a holistic manner, accenting visual/spatial skills. People with a right-brain bias are intuitive types who use metaphors and analogies in solving problems. They are apt to visualize solutions in toto, then work out the details later. On the other hand, the left part of the brain processes information in a linear manner, favoring verbal/logical skills. People with a left-brain bias (this includes most engineers) are rational types who use analysis as their principal method for solving problems. They tend to "think problems through" as a means for uncovering solutions. The more complete the mix between left and right-brain abilities, the greater the potential for creativity.

Creativity can be defined in a variety of ways: the ability to relate previously unrelated things; the ability to synthesize new combinations of ideas and concepts into useful forms; or an intuitive mixing of previous experiences into patterns and combinations that are new and unique. Creativity goes beyond simply generating ideas. It requires that ideas also be implemented and the result be something new. Hence, creativity produces change and both are associated with uncertainty and risk (2). Because of this, our ability to be creative, innovative or clever may be hindered, thereby preventing us from realizing our maximum creative potential.

B. The Process of Design

The definitions of creativity presented above imply the existence of a process that one can follow, either knowingly or unknowingly, when solving problems. Engineers generally adhere to a formal "design process" that begins with recognizing a need and deciding to do something about it. The process ends with plans or a device for satisfying the need. Whether we realize it or not, we often use some version of the engineering design process when solving everyday problems. For example, in the supermarket we compare two cuts of meat or two brands of cereal on the basis of personal need, product quality, price, value, etc. and then decide which items best meet our requirements. This process is no different from what an engineer does in solving a problem using analysis (price per pound), evaluation (nutritional need, convenience), optimization (minimum waste, value) and decision making (I'll take the Cocoa Puffs, please). Steps in the problem solving or design process include:

- recognizing or identifying a need
- defining the problem
- gathering information that can be used to solve the problem
- developing specifications
- conceptualizing, analyzing and refining alternatives
- evaluating alternatives
- testing the device
- documenting the design, development and operation of the device
- delivering the final product

This comprehensive problem solving template is quite general and provides a framework for logically working through problems. It is not unique to engineering and can be modified and applied to a host of technical and nontechnical problems. The following example of the design of a seat for a walker illustrates how the steps in the design process are applied.

1. Need

A 9-year-old girl with cerebral palsy wants a portable seat that attaches to her walker. She recognized that from time to time she tires when walking and it would be handy to have a seat in her walker in which to rest. The need statements are generally short and somewhat vague; they simply state the objectives of the design and any necessary limits. Design a seat for a walker. The objective is to design a seat; the limit is to design a seat for a walker. In this case, and for most assistive technology problems, needs are generally obvious and easy to identify.

2. Problem Definition

Once the need has been identified, it is expanded into a problem definition. In developing problem definitions, it is often helpful to think in terms of what has to happen in order to meet the stated need. For this problem, the seat should be

attached somehow to the walker and should not interfere with normal use of the walker. The seat must be safe and not add much weight to the walker. The resulting problem definition might then be:

Design a seat for a walker that is easy to operate for a young girl with cerebral palsy, is lightweight and inexpensive, and folds out of the way when not in use.

Any additional features desired in the seat or other constraints that would affect the design would also be included in the problem definition.

3. *Information Gathering*

In developing a solution, it is important to learn as much as possible about the problem: what commercial or do-it-yourself designs have already been developed, advantages and disadvantages of previous designs, what new technologies or materials might we want to consider, etc. Information gathering can be time consuming but is an essential part of the process. It may lead to an existing solution, or to a solution to a related problem that can be easily adapted for this need. None of us has time to reinvent wheels! Quantitative descriptions of the user's abilities and resources may also be essential pieces of information for designing or selecting assistive technology.

4. *Specifications*

Design specifications allow us to judge the quality of and compare solutions we develop. Specifications are closely related to the problem definition but are quantitative rather than vague descriptions. Whereas the problem definition required the seat to be lightweight and inexpensive, the specifications should state maximum weight and maximum cost. For example, we might require the device to weigh less than 1.5 lb and cost less than \$10 for materials.

5. *Conceptualizing*

Developing design alternatives, or ideation, is the mental process of producing ideas in order to solve a problem. At this stage in the design process we hope to stimulate our imagination to the peak of our creative potential and generate a multitude of concepts and ideas that will solve the problem at hand (3). Some techniques to enhance ideation are presented in Section C below. The solutions that we generate may be practical, clever, silly, expensive, simple, complex, etc. The objective is to initially produce a large number of possible solutions and then, using the problem definition and design specifications, reduce the list to the most promising alternatives that can satisfy the given constraints.

6. *Evaluating and Testing*

Up to this point, we've relied on our creative energy, detective skills and time to solve the problem. It now becomes necessary to invest material and financial resources to refine, evaluate and test the most viable alternatives and then select the best one for final development or fabrication. Good solutions are effective, simple,

easily and quickly completed, require low maintenance, and satisfy the client. Remember that off-the shelf items or simple modifications to existing devices may provide the least expensive and quickest solution to your problem. Generating a unique, custom-made solution from scratch is generally the most costly, time consuming and risky approach to solving an assistive technology problem.

7. Documentation

Documentation for a design project might include notes, sketches, manufacturer's data, memos, reports and operating manuals. Complex problems and lengthy solutions demand more thorough documentation. A design journal or notebook should be used on a regular basis to document all information relevant to the project. Important decisions should be explained in detail.

The design process is a comprehensive and general template that provides a framework for logically working through problems. It is not unique to engineering and can be modified and applied to a host of technical and nontechnical problems. By adhering to the process we increase our chances of understanding the true problem and producing a good solution.

C. Creative Problem Solving: Overcoming Barriers to Conceptualization

Very few people like to solve problems. When confronted with a problem, most of us pick the first or easiest solution that comes to mind. Sometimes we turn our back on the problem and pick no solution at all. A better strategy in solving problems, and one that we can all adopt, is to select the most attractive solution from a list of many possible solutions or concepts (4). This Section deals with generating ideas (conceptualization) and some of the barriers that we may encounter in this process.

Creativity in problem solving isn't so much a trait or talent as it is a conscious process. The ability to conceptualize, to generate ideas and concepts, requires an open and energetic mind and a dedicated effort. Learning to conceptualize is no different from learning to play the piano. You can read about how to play, listen to people talk about piano playing or listen to someone play but you can't become a virtuoso until you do it and practice it yourself. It is the same with conceptualizing; it must be done consciously and routinely until you are comfortable and proficient. Jim Adams, in his delightfully readable book *Conceptual Blockbusting* (4), presents some of the barriers that can prevent us from conceptualizing and techniques that we can use to overcome these barriers. If we are aware of these blocks, they can be eliminated or compensated for thereby increasing our creativity and productivity in problem solving.

Conceptual blocks prevent problem solvers from either correctly perceiving or conceiving solutions to problems and include perceptual, cultural, environmental, emotional and intellectual blocks. Some examples of these blocks (drawn liberally from Adams (4)) are given below.

- stereotyping
- seeing what you expect to see
- being controlled by preconceptions

- inability to isolate the problem
 - too much or too little information
 - misleading information
 - information out of context
- over or under-constraining the problem
- inability to see the problem from various viewpoints
 - architect vs. homeowner
 - rehab specialist vs. consumer
- cultural taboos
- tradition preferable to change
- problem-solving is serious business
 - humor not allowed
- fear of failure
- fear of taking risks
- being criticized
- making a fool of yourself
- fondness for order
- inability to incubate
- lack of cooperation, trust, support
- distractions and interruptions
- using incorrect language
 - visual vs. verbal vs. mathematical

Creativity and change are risky and these conceptual blocks are attempts to protect us from the unknown. When heading into the unknown, anything can happen including failure. It is important, when trying to solve problems, to recognize these blocks and the limits they impose on our creativity. It takes courage and confidence to pursue new directions. Although increasing creativity and change lead us into increased risk, they also can lead to rewards such as satisfaction or recognition. These rewards provide the compensation for possible losses connected with leaving an equilibrium state for one with more unknowns (2).

Overpowering conceptual blocks requires a conscious effort to force thoughts that would not otherwise occur. One of the most important capabilities in a creative person is a questioning attitude. If you accept the status quo without question, you will have no need to innovate. You will not be able to see needs and problems, and problem sensitivity is one of the more important qualities of the creative person. Once the problem is sensed, the questioning attitude must be used continually to ensure a creative solution. A creative person should have a healthy skepticism about existing answers, techniques and approaches (4).

Engineers and other professional problem solvers are expected to formulate ideas and seek alternative solutions on demand. Demand ideation is not impulsive or inspirational. It does not wait for the proverbial light bulb to turn on or on being struck by a bolt of lightning to solve problems. Several different demand ideation techniques are available to help limber your mind, increase your flexibility in problem solving and stimulate your

imagination to generate a multitude of solutions. Two especially useful techniques rely on making lists: using trigger-words and brainstorming. Other techniques are described in detail in references (2)-(4).

1. Using Trigger-words (from reference (3))

The trigger-word is simply the verb in the problem or needs statement. A list is made of the various actions that can produce the trigger-word. This then creates a new batch of ideas for ways to solve the problem. For example, if the problem is to move an object from point A to point B, we make a list of all the actions corresponding to the verb MOVE. This list may include:

push	glide	float	pull	slide
sling	shove	tumble	throw	roll
lift	swing	fly	drop	whirl
leap	drag	kick	run	slip

Now we rephrase the problem using one of these actions: How can we PUSH the object from A to B? How can we FLOAT it? How can we FLY it? PULL it? Each alternative verb produces different ways to solve the problem. PUSH recalls a bulldozer, a hydraulic ram or a group of people doing the pushing. PULL recalls a team of horses, a cable and winch, etc. The trigger-word is a methodical method for increasing the scope of idea stimulation by forcing a variety of ways to conceive the nature of the problem. The purpose is to generate as many solutions as possible without regard to their practicality or feasibility.

2. Brainstorming

Brainstorming is a useful and powerful group ideation technique that can produce a large quantity of ideas. Brainstorming has four rules:

- no evaluation of any kind is permitted
- participants are encouraged to think of the wildest ideas possible
- generate as many ideas as possible
- participants build upon or modify the ideas of others

The success of brainstorming depends on the compounding effect of each person in the group responding to the ideas expressed by others (3). Brainstorming relies on spontaneity and is stimulating and playful provided no one attempts to judge or evaluate the ideas of others. Any single idea that comes forth in a brainstorming session has its faults. The important thing is that it is an idea whether good, bad or ridiculous. Its only value may be that it triggers another possibility that triggers another that eventually leads to a totally unique and valuable solution (3).

As with any skill, conceptualization requires practice and feedback for improvement. There are no sure-fire methods to use or guaranteed results from following a particular process. Each problem is different and each problem-solver will respond differently. The best technique is the one that works best for you. The real issue is:

how do we relax our ego and become good, creative problem solvers? We go out and do it and we practice it and we learn from that!

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VIII. Reducing the Risks of Farming/Ranching With a Physical Disability

A. Introduction

The agricultural workplace is considered by the National Safety Council as one of America's most dangerous places to work. Consistently, agricultural production reports one of the highest work-related fatality and disabling injury rates. Injury prevention cannot be ignored when a farmer or rancher returns to work with a disability. The purpose of this section is to point out some of the risks associated with farming with a disability and the hazards that should be considered when implementing assistive technology in the agricultural workplace.

B. Background

1. Agricultural production has been traditionally highly labor intensive, male oriented, and tolerant of high levels of risk.
2. Farm and ranch families have traditionally been more tolerant of high injury rates than many other industries.
3. Safety in agricultural production has generally been a low priority and is currently, for the most part, unregulated by state or federal safety regulations.
4. Little attention has been given to the role of persons with a disability in agricultural production even though they make up a sizable percentage of the agricultural workforce.

C. Risks Associated with Farming with a Physical Disability

There have been no published studies to determine the safety record of farmers with physical disabilities and the impact physical disabilities might have on the frequency and severity of injury. Only recently has emphasis begun to be focused on those attempting to farm with physical disabilities; thus, little has been done to identify the potential health and safety risks that physically disabled farmers face.

Preliminary studies conducted by The Iowa Easter Seal FaRM Program of 100 farmers with physical disabilities have found that approximately 50 percent of the injuries/illnesses that this group reported were farm-work related. In 75 percent of the cases the primary disability was believed to be a contributing factor.

Several areas of potential risk have been identified which should be considered to ensure the health and safety of those farming or ranching with a physical disability. They are as follows:

1. Potential Risks To Those Providing Assistance

Physically impaired farm operators must often rely upon other people such as family members, neighbors, and hired hands to complete essential farm-related jobs.

Having others to complete certain tasks, especially around machinery, often creates unique hazards to both the disabled operator and the helper. For example, one farmer, who is paralyzed from the waist down, relies upon his young son to operate a front-end skid-loader to lift him, in the bucket, up to the tractor's operator seat. Other problems develop when young or inexperienced family members are expected to hitchup implements or make repairs to farm machinery under the direction of the disabled operator.

2. *Risks Due To Visual Impairment*

Visual impairments that reduce acuity, color differentiation, depth perception, or night vision can all result in unsafe operation of equipment and risks to the operator and bystanders.

In one case, a farmer's sight had completely diminished over a period of several years. During the last few years, before he went blind, his vision was significantly impaired but he continued to operate farm equipment regularly. The risks involved in this particular case are obvious.

In other cases, farm operators who are color blind may experience problems when attempting to operate machinery where the controls are color coded or where color differentiation is required to complete a task. Impaired vision under low light levels can create hazards, both when operating equipment and when inside poorly lit buildings where the potential of falls is present.

3. *Potential of Fires in Equipment and Buildings*

Fire is a major threat to anyone who has physical impairments which restrict their mobility. Compound these problems with the difficulty of quickly evacuating a burning combine or livestock building, and serious risks are created.

There are many situations involving physically impaired farmers operating combines and other self-propelled equipment where rapid evacuation in the event of a fire would be difficult. In some cases, if the combine or tractor were to catch on fire, the operator would be virtually helpless to extinguish the fire, call for help, or evacuate the machine. Even if the operator was able to evacuate the machine, the lack of mobility might still expose him to flammable crop residue.

Since the threat of fire is always present in an agricultural workplace, several possible solutions or partial solutions are suggested. These include:

- Ensuring that each self-propelled machine operated by physically disabled individuals be equipped with radio communication to other workers.
- Mounting portable fire extinguishers at strategic locations around each building and on each machine with which a physically disabled person will be working.
- Installing fire detection and extinguishing systems that activate automatically or from the operator's station.

- Investing more time in fire prevention activities to reduce the risk of fire. Keeping the machine clean, inspecting for hot bearings and slipping belts, and following proper refueling procedures are key fire prevention activities.

4. *Exposure to Excessive Machine Vibration and Movement*

Modern farm tractors and combines are designed to substantially reduce operator exposure to high levels of vibration. This is accomplished through the use of larger tires, operator cabs or platforms that are isolated from the chassis and ergonomically designed seating. Older equipment or some equipment that is operated for long periods of time can, however, result in excessive exposure to machine vibration and motion. This is generally caused by machine characteristics and rough terrain. There is a growing body of literature that indicates that long-term exposure to certain levels of vibration can be harmful.

Even though most of the evidence points to machine vibration as harmful, there has been feedback from some equipment operators, especially those with spinal cord injuries, that there may be some possible benefits to limited machine operations. Several have reported that they have felt physically better after getting back on the tractor or combine and that the exposure enables them to sleep better. Others have also commented that they have had fewer problems with pressure sores during the summer months when operating equipment.

In addition to the psychologically therapeutic effects the operation of farm equipment might provide, other positive observations include the increased blood flow due to the vibration and the reduction of skin pressure due to the fluid bouncing action of operating large equipment in the field. Regardless, many wives have commented that both their husbands' physical and mental condition improved when they were able to get "back on the tractor."

Operators with low back disorders are especially vulnerable to added injury if exposed to excessive operator station vibration. The additional shock and load to the components of the back can lead to more rapid breakdown of the discs and irreversible damage to the lumbar spine. Other side effects include vision problems, impaired coordination or balance, fatigue, headaches and insomnia.

Another potential hazard is injury caused by repeated contact with operator station fixtures caused by the uncontrolled body motion of individuals with paralyzed limbs. This "bumping" leads to bruises and open wounds which in some cases go unnoticed due to the lack of skin sensitivity. Padding is an important protective measure.

5. *Respiratory Hazards*

Agricultural workplaces expose workers to a variety of airborne hazards. These include toxic gases such as those found in silos and manure pits and airborne particulates such as grain dust, dried manure, molds and soil. Individuals with a hypersensitivity to this material can be severely stressed when working and can become extremely ill. With repeated exposures, some individuals exhibit more severe

symptoms. In some cases there may be no alternative except to avoid the irritating agent.

Farmers with spinal cord damage may also have reduced respiratory capacity and, thus, may require special filtration systems or air conditioning to work comfortably.

The application of agricultural chemicals may also present a respiratory hazard for farmers who, because of a physical impairment, would be unable to quickly evacuate the application area should a chemical spill occur.

6. *Temperature Extremes*

Farm and ranch work goes on regardless of the weather. This means that farmers and ranchers are potentially exposed to both extreme cold and heat. Both can present serious safety problems if not attended to.

Paralyzed limbs are susceptible to frost bite and require extra protection. This might include thermal underwear or heated tractor cabs. Heated socks and hand warmers are other possibilities.

Farmers with spinal cord injuries often require air conditioned tractor and combine cabs to work in the heat of summer. Their reduced ability to sweat requires a cooler work environment, plenty of fluids and frequent rest breaks.

7. *Hazards Resulting from Impaired Hearing*

A hearing impairment may make it difficult or even impossible for a farmer to detect machine failure, such as a noisy bearing or loose chain. Likewise, a hearing impaired farmer would experience difficulty determining if the tractor or machine was functioning normally, or at all.

Hearing impaired farmers may also fail to correctly comprehend instructions or commands from fellow farmworkers. Failure to completely understand fellow workers, in some circumstances, can result in mishaps. One farmer who has practically no hearing, was nearly injured when he stepped in front of an oncoming tractor that he didn't hear approaching.

8. *Length of Work Day*

Farmers and ranchers traditionally work long days, and this characteristic does not necessarily change following a disability. Interviews with spinal cord injured farmers indicate that even this group tends to put in lots of hours. At this time, it is not known what adverse effects might result from extremely long periods of exposure to certain farm-related job such as machine operation.

Some possible side effects include the increased possibility of pressure sores, bladder infection, bruises and general fatigue. There does not appear to be a common pattern for the onset of any of these problems, but they should not be ignored.

For example, all farmers are susceptible to fatigue and a farmer with a severe disability even more so. Efforts to compensate one set of muscles with another, such as working with only one leg or arm, can wear a person down much quicker. Once tired, the risk of injury or illness increases.

D. Hazards Associated with Assistive Technology in the Agricultural Workplace

Any technology has associated with it potential hazards. Assistive technology is no exception. The following section provides a brief overview of hazards that could be present as the result of introducing assistive technology into the agricultural workplace.

1. *Modified Agricultural Equipment*

The BNG Resource Center has had contact with hundreds of farmers who have made changes in their farm operation to accommodate a physical disability. The most frequent modifications have been to farm equipment including trucks, tractors and combines. These changes have, in many cases, been designed and constructed locally without regard to established engineering standards or safe design principles. Since farm equipment is modified infrequently, compared to vehicles used for highway or industrial use, there are no applicable standards to follow. Consequently, it is not too rare to find modifications that expose the user to normally unacceptable levels of risk. This is especially true with respect to manlifts and hand controls. The following are brief summaries of concerns associated with these two areas:

a. Lifts

Manlifts used to raise an individual with restricted mobility up to the operator's station of the tractor or combine vary widely in design and operation. Several of the concepts expose the operator to considerable risk. In one case, a tractor mounted boom was used with a chain hoist and body sling to raise the paraplegic operator over the top of the tractor and then down onto the seat. A fall from such a height would have resulted in serious injury. In another case, a lift was constructed of galvanized water pipe which lacked the strength needed to prevent deformity in the structure's underloading. Numerous examples of serious pinch points, exposed chains, improperly selected components, and questionable electrical wiring have also been observed.

In some cases, lifting devices were mounted to the tractor by attaching part of the structure to the tractor chassis and part to the cab. In each instance the cab was designed to "float" on the chassis by means of rubber isolation blocks. By joining the cab and chassis together with the rigid frame of the lift assembly, sound was readily transmitted into the cab from the tractor's drive train and stress was placed on the lift as the cab floated on the rubber mounts, when the tractor traveled over rough ground.

b. **Hand Controls**

Hand controls vary considerably from one modified unit to the next. On some, the hand operated clutch or brake lever is pulled toward the operator to engage or disengage the clutch or brakes while on others, it is pushed away from the operator. In some cases, the brake levers are designed to be moved forward to utilize the forward momentum of the operator, during deceleration, to apply additional force to the brake levers while the clutch lever was moved toward the operator to follow the Society of Automotive Engineering Code for Operator Controls on Agricultural Equipment; (SAE J841e.)

Several cases have been encountered where so many controls were hand operated that the operator was forced to allow the tractor to "self-steer" during row end maneuvers or other complex machine tasks. In flat fields this may not present a problem but on steep hillsides or near embankments, unsafe conditions would develop.

Hydraulic or electric actuated controls can present a problem if not designed and installed properly. In some cases small hydraulic or electric actuators were installed on brake or clutch pedals and controlled remotely. These units often lacked a sense of feel or did not allow adequate control. Jumpy starts and the inability to brake quickly presented special problems to other workers.

Injuries have also been reported when contact has been made with controls because of spasticity or vibration. To avoid this possibility, controls should be padded or located to avoid contact. Restraining belts are another possibility but should only be provided in consultation with an occupational or physical therapist.

2. ***Modified Farm Buildings and Facilities***

Modifications to farm or ranch buildings should take into consideration other potential users. For example, ramps that are constructed where ice and snow accumulate on them can become a fall hazard for other users. Remote switches on equipment such as barn cleaners, augers, and grain unloading equipment should have lock-out capabilities to avoid their being started while someone is working on or near the equipment.

E. Injury Prevention Tips

1. ***Upper extremity limitations*** — There are often risks of further injury because of: decreased padding or scar tissue around the stump that may not tolerate bumping; prosthetic entanglements; overuse of opposite extremity; and susceptibility to frost-bite. Injury prevention measures include:
 - a. For finger and hand injuries with decreased tissue or padding around bony prominence, use a custom-made padded glove to prevent skin damage.

- b. Pocket hand-warmers can be used to prevent frostbite for finger and hand injuries that have reduced circulation.
 - c. One-handed nail starters might be considered to reduce finger injuries when starting nails.
 - d. Do not rely on a terminal device when grasping an overhead rung on a ladder or for climbing.
 - e. Be careful when working around livestock so that the terminal device does not get caught on chains, collars, ropes, halters, or other materials attached to livestock. Care should also be taken when completing other tasks where the prosthesis could become entangled.
 - f. When using an upper-extremity prosthetic device with an internal elbow lock, one should be cautious in lifting and carrying objects that exceed the strength of the elbow lock. Consult with a prosthetist on appropriate weight that could be carried. An external elbow lock made out of durable material such as stainless steel might be considered for performing tasks that require heavier lifting and carrying. Keep in mind that a heavy-duty external elbow lock will add more weight to the prosthesis.
 - g. Do not work on electrical equipment with the terminal device of a prosthesis. This is to avoid electrical shock.
 - h. To prevent frostbite to the stump of a below-elbow amputation, following are some tips that might help: Add additional stump socks to provide more insulation. Obtain stump socks that lift perspiration away from the skin. Tube socks can be added to the outside of the socket to provide more insulation. Frequent breaks should be considered to ensure adequate warmth for the stump. A muff might also be used to keep the stump warm while performing tasks in which the arm is not needed.
 - i. Use one-handed tools and other labor-saving devices that could help prevent additional injuries to the affected limb as well as potential injuries to the good extremity.
 - j. For bilateral arm amputations, additional steps made of non-slip material, wider steps, and hand-holds could be added to farm machinery to make mounting and dismounting safer to compensate for decreased balance and grasping ability.
2. ***Lower Extremity Impairments*** — Some of the same hazards associated with an upper extremity impairment can be present for someone with a lower extremity impairment such as an amputation. In addition, there appears to be a greater risk of falling. Some important injury prevention measures are as follows:
- a. To prevent potential falls, fatigue and further deteriorations, outdoor mobility aids should be considered when maneuvering around rough rural terrain. These aids include: manual, electric, electric/gasoline-powered wheelchairs,

all-terrain vehicles, golf carts, and lawn mowers. Foot guards and modifications to controls for all-terrain vehicle and lawn mowers should be considered for individuals who lack sensation and control in lower extremity.

- b. Special cane tips for snow, ice, and loose gravel should be considered.
 - c. When mounting and dismounting a tractor, one should start out with the dominant leg and avoid jumping.
 - d. Farm machinery could be adapted to accommodate lost abilities in mounting and dismounting through the addition of a manlift, non-slip steps, wider steps, additional steps, and hand-holds.
 - e. Controls in tractors should be adapted to accommodate for lost strength or function of extremity.
 - f. Direct contact with livestock should be avoided if possible or approached with extreme caution because of the unpredictable nature of livestock. Worksite accommodations to eliminate direct contact might be considered. These accommodations include fence line feeders, automated feed systems, using round bales, and raised decks for hogs.
 - g. Labor-saving devices such as automatic gate openers and automatic hitching devices will help in reducing further degeneration of impaired extremity.
 - h. For individuals who have experienced hip replacements, tasks that require bending 90 degrees or more from the hip should be avoided. An all-terrain vehicle that has a bench seat may be more appropriate for hip replacements than an all-terrain vehicle that requires one to straddle the machine.
 - i. Walking through rough fields or fields that have high vegetation can cause potential falls or entanglements that could cause twisting of a joint. Follow the wheel tread marks that have been made by farm equipment or create a smoother path for safer ambulation.
 - j. Several improvements have been made to lower-extremity prosthetic devices to enhance comfort, reduce skin breakdown, save energy, and improve safety. These improvements include a "NSNA" (Normal Shape, Normal Alignment) socket for above-knee amputees; flex-foot; and hydraulic knee. Consult with a prosthetist to determine if any of these technologies would be appropriate for a specific application.
 - k. To reduce fatigue and further deterioration of affected extremity when performing tasks that require standing for long periods of time, a sit-stand chair or stool might be useful to relieve pressure without interfering with the task.
3. **Back Injuries** — Individuals with back injuries often experience limitations in a variety of activities including: lifting, standing, carrying, pulling, climbing, bending, kneeling and walking. The extent of these limitations is generally influenced by the level and severity of the injury. Farmers and ranchers with back injuries should

attempt to identify their functional limitations and then determine the tasks that should be avoided due to their potential of causing further injury. Because back injuries are not often evident, the individual may attempt to perform a hazardous task or be asked by someone else to complete a task resulting in injury or further deterioration of their condition.

The following are safety tips that might reduce the risk for those with back injuries:

- a. Avoid unnecessary lifting by using appropriate assistive technology or labor saving devices. For example use a shop hoist to move tractor tires or heavy parts rather than manhandling them.
- b. When lifting use the basic rules of lifting.
 - If the object is too heavy, get help or use a lifting aid.
 - Bend at your knees, not your waist. Keep your back straight.
 - Keep the object (bale of hay) being lifted close to your body.
 - Use your leg muscles, not your back.
- c. Wear appropriate footwear when working. Cowboy boots may look nice but in some applications can aggravate back injuries.
- d. Push on loads rather than pulling. You can push twice the weight you can pull with less strain on your back. For example pushing a feed cart is better than pulling it.
- e. Adjust tractor, combine and truck seats so that knees are level with hips. Sit straight and adjust seat so controls can be reached without stretching.
- f. Don't stand in one position too long. When working at a work bench, use a box to raise one foot or when milking in a parlor change your position frequently. Combination sit/stand stools are available for use when performing tasks that require standing for long periods.
- g. In equipment used frequently, use the best seating possible. Features such as cushions, adjustable lumbar support, adjustable arm rests, swivel bases and proper placement in relationship to controls should be considered. The use of mirrors can reduce the stress caused by frequent turning to view trailing operations.
- h. Devices such as automatic hitching aids, automatic gate openers, and remote controls on equipment can reduce the frequency of mounting and dismounting from the tractor.
- i. Use extra steps on tractors and combines to reduce excessive stretching to reach the first step.

- j. Direct contact with livestock should be avoided due to their unpredictable behavior. Job restructuring or modifications to livestock handling facilities should be explored. Possibilities include: fenceline feeding, confined feeding, service contract for animal health care needs and contracting to have livestock transported.
 - k. Watch your weight, get adequate rest on a good mattress, get plenty of exercise and use good posture. Being overweight or not maintaining adequate muscle strength can lead to or intensify back injuries. Fatigue and stress can also contribute to back problems.
4. **Spinal Cord Injuries** — Some of the most serious hazards observed with respect to farming or ranching with a disability have been associated with individuals who have spinal cord injuries. The lack of mobility in some circumstances and the techniques used to overcome workplace barriers can present levels of risk that could be considered by many as being unacceptable. The following are suggested injury prevention measures that should be considered.
- a. To prevent excessive bruising, scraping, or cuts to lower extremities when mounting or dismounting from a tractor, a manlift is recommended. In addition, some tractors may require the installation of an overhead grab-bar to assist in transferring from the manlift to the tractor seat. Assistance from another person might be required and is generally encouraged.
 - b. Seat belts or restraining devices should be considered when operating a manlift, especially if the individual experiences spasticity in the lower extremities.
 - c. Hand controls should be installed in farm machinery to accommodate the lost function in the lower extremities.
 - d. Two-way communication devices should be installed on every vehicle to be operated in cases of emergency and for saving time. These devices could include: FM/business band radio, cellular phone, and a push-button alarm system.
 - e. To prevent potential skin breakdown while operating farm machinery, various wheelchair cushions can be used. Modifications can also be made to the tractor seat to provide better upper body stability through the use of ergonomically designed or custom made cushions. A seat belt should also be worn for safety and stability.
 - f. A fire extinguisher should be available within reach on all equipment to be operated.
 - g. Rollover protective structures and cabs are recommended on all tractors to be operated.

- h. For tractors without a cab, special care should be taken to prevent sunburn and heat stroke during the summer by installing an overhead canopy, drinking lots of fluids, or performing field work during times in which there is less exposure to heat (i.e., early mornings, evenings, or nighttime).
- i. During winter months, warm clothing should be worn to protect against exposure or frostbite due to decreased circulation. Quilted material wrapped around lower extremities, leg-warmers, modified "Snug Sacks," Alaskan mukluks, or other materials can be used to keep legs and feet warm. Downhill ski shops are a source for good ideas.
- j. When welding, a leather welding apron that covers both legs, feet, lap, and wheelchair should be used. A custom made apron might be needed. Caution should be taken when handling hot objects. Leather shoes should also be worn.
- k. Outdoor mobility aids such as all-terrain vehicles should be modified with foot guards to prevent feet from inadvertently slipping off and getting caught under the wheels as well as control modifications. In addition, special caution and care should be taken to avoid contact with the muffler.
- l. When working with large livestock, direct contact should be avoided. Restructure these tasks so they could be performed by another person. Also explore the use of labor-saving worksite modifications including fence line feeders, automated feed systems, automatic gate openers, raised decks and other livestock holding equipment.
- m. Dust, mold, dander from livestock and other respiratory irritants should be avoided, especially for spinal cord injuries resulting in decreased function of respiratory systems. There is a concern that individuals with higher-level spinal cord injuries and several years of working in livestock handling facilities could be more susceptible to pneumonia.
- n. Other labor-saving technologies such as automatic hitching devices and bin level indicators should be considered as well as job restructuring of those tasks that are difficult or hazardous to perform.

F. Sources of Safety Information

The safety and health of the person being served always needs to be a priority. It is too late to deal with the problem after an injury has occurred. Before any recommendations are made to enable a person to continue completing a farm or ranch-related task, consideration should be given to the potential risks involved.

There are several sources of information relating to agricultural safety and health hazards. The following are a few examples.

1. Rural Health and Safety Resource Directories

Many Extension Safety Leaders and safety organizations across the country have published resource directories of safety information available in their states. For example, the Indiana Rural Safety and Health Council regularly publishes a directory listing hundreds of films, videos, publications, and other resources available in Indiana. For more information on obtaining a safety resource directory for your state, contact your local office of the Cooperative Extension Service, or the state Extension Safety Leader at your Land Grant Institution. For a copy of the *Indiana Rural Health and Safety Resource Directory*, write:

Indiana Rural Safety and Health Council
Purdue University
1146 Agricultural and Biological Engineering Building
West Lafayette, IN 47907-1146

2. Audiovisual Materials

High quality audiovisual materials can be very effective in vividly reinforcing a particular safety message in a very short amount of time. In the past few years, a large number of excellent videos on various farm safety topics have been produced and are available for purchase or rent. The following sampling of videos are available from the Instructional Media Center at Purdue University (317-494-6742). Similar products are likely available in most states.

Agricultural Injuries and Children.* 38:00 minutes, JSCA

Dr. William E. Field, Purdue University, discusses children and agricultural injuries and the importance of protecting agriculture's greatest resource, our children. Includes ideas for protecting farm children from farm hazards.
(Producer: New York Center for Agricultural Medicine)

***Agricultural Tractor Safety.* 24:00 minutes, JSCA**

Explains that tractor accidents are the leading cause of death for farm and ranch workers and that most of these accidents can be prevented. Shows mannequins being crushed and mangled in accidents while making a strong case for rollover protective structures, seat belts, PTO shields, and prohibiting extra riders.
(Producer: Purdue University)

***ATV Safety on the Farm.* 17:00 minutes, JSCA**

Offers a concise overview of ATV safety basics for both farm operators and their employees. Although the video focuses on farming activities, the information is beneficial to anyone using ATV's for utility operations. Driving procedures and personal protective equipment are discussed in detail.
(Producer: The Ohio State University)

*Videos are generally classified for age groups according to the following scale:

E = Elementary J = Junior High S = Senior High C = College A = Adult

***Dairy Safety, It's No Accident.* 28:00 minutes, JSCA**

This film discusses a variety of safety concerns relating to dairy farming, including animal handling techniques and the hazards of various types of milking parlors. Also the proper handling and storage of dairy chemicals are stressed.
(Producer: California Polytechnic State University)

***Driveline Safety...and You.* 24:00 minutes, JSCA**

Orion Samuelson discusses accident prevention when using agricultural equipment drivelines. The video also advises the viewer how to use and maintain a driveline properly and points out correct operating procedures for one to follow.
(Producer: American Driveline Manufacturers Association)

***Farm and Ranch Electrical Safety.* 19:00 minutes, SCA**

The risk of electric shock is an ever-present hazard in modern agriculture. Radio personality Wey Simpson explains how to properly handle irrigation equipment, how to safely wire and ground electrical systems, and what to do when the worst happens.
(Producer: University of Idaho)

***Farm and Ranch Equipment Safety.* 19:00 minutes, JSCA**

Bob Tallman, voice of "The American Farmer" radio program, narrates the program and discusses many important safety considerations for farm and ranch equipment. Emergency medical personnel discuss accident situations they have experienced involving equipment, and they offer advice on accident prevention.
(Producer: University of Idaho)

***Farm Chemical Safety Is in Your Hands.* 12:30 minutes, SCA.**

The National Agricultural Chemical Association produced this film which is an excellent training tool for a wide range of audiences. The importance of proper chemical mixing and handling are stressed. Concepts such as toxicity and risk are discussed in detail. The proper personal protective equipment for chemical handling, including gloves, goggles, and more, is described.
(Producer: National Agricultural Chemical Association)

***For the Rest of Your Life.* 16:00 minutes, SCA.**

Instructs on the precautions to be used when handling anhydrous ammonia as a fertilizer. Reports on the agricultural uses of anhydrous ammonia, why it can be dangerous, what accidents can happen, and how to prevent eye injuries or permanent eye damage when using anhydrous ammonia.
(Producer: Iowa State University)

John Deere Consolidated Safety Video. 87:00 minutes, SCA.

Contains eleven segments on such farm safety topics as safety attitudes, bypass starting, safety and labels, lawn mowers, combines, tractors, and others.
(Producer: Deere & Company)

Kids Talk Farm Safety Stuff. 7:00 minutes, EJ.

This short film has a group of young farm children describing various hazards on the farm. Animals, farm machinery, ponds, and other potential hazards are described by the kids. This film is an excellent way of introducing farm safety concepts to children.
(Producer: Farm Safety 4 Just Kids)

Sawdust. 18:00 minutes, EJA.

Covers a wide variety of hazards encountered by youngsters in both town and country. Topics covered include highway and playground safety, as well as farm hazards such as tractors and flowing grain.
(Producer: Indiana Rural Safety and Health Council)

Tractor Accidents — It's Not Gonna Happen to Me. 24:00 minutes, SCA.

Deals exclusively and thoroughly with tractor safety with respect to four areas: pre-operation safety, tractor transportation safety, operation safety, and emergency response procedures. Provides in-depth information about roll-overs. Comes with video teaching guide and student activities.
(Producer: California Polytechnic State University)

Tractor Safety is No Accident. 17:00 minutes, JSCA.

Covers a broad range of subjects including inspecting the machine before operation, safe operating procedures, and the importance of shutting down the engine before attempting to make repairs.
(Producer: J.I. Case Company)

3. Publications

Publications exist on almost every conceivable topic related to farm safety. Brochures, bulletins, posters, and technical papers are available through your state Extension Service, organizations like the National Safety Council and Farm Safety 4 Just Kids, agricultural equipment manufacturers, agricultural organizations, and federal agencies, including the National Institute for Occupational Safety and Health (NIOSH) and the Consumer Product Safety Commission. A few phone calls can generate more material than you can efficiently use. Be careful not to overwhelm consumers with printed material. A few key pieces that effectively address your objectives will have more impact than a bushel of unrelated items. Be prepared to pay for multiple copies of most material. In many cases, sponsors may be willing to cover the costs of selected items.

3.1 Leaders Materials

Careful Country Teacher's Kit

A comprehensive educational resource designed to help teachers, parents, and others teach injury prevention principles to rural and farm children. The Teacher's Kit is structured around the 24-page Careful Country Farm Safety Coloring and Activity Book, which uses animal characters and "parent alerts" to depict the primary health and safety hazards to farm children. The kit includes lesson plan, fact sheet, camera-ready handouts, and an 18-minute video entitled Sawdust.

Available from:

Indiana Rural Safety and Health Council
Purdue University
1146 Agricultural and Biological Engineering Building
West Lafayette, IN 47907-1146

Teaming Up — A Farm Safety Walkabout For Kids

A resource designed for organizing a farm safety "walkabout" for farm families. Includes suggested motivation techniques and activities designed for children.

Available from:

Farm Safety 4 Just Kids
P.O. Box 458
Earlham, IA 50072-0458

Farm and Ranch Safety Management Instructor's Guide

Assists teachers in planning agricultural lessons.

Available from:

Local John Deere dealer, or
Hobar Publications
1234 Tillar Lane
St. Paul, MN 55112

***First on the Scene.* 46 pages.**

This manual provides appropriate first response procedures for the first person on the scene of a farm accident. Designed for the farm family, the manual uses simple flowcharts to direct the actions of the first responder.

Available from:

Farm Building Plan Service
Purdue University
1146 Agricultural and Biological Engineering Building
West Lafayette, IN 47907-1146

3.2 Handouts

Most county Extension offices have access to safety-related brochures and pamphlets which are suitable as handouts for farm safety workshops.

In Indiana, for example, the following titles are available:

Beware of Flowing Grain Dangers.
Beware of Machine Hazards.
Beware of On-Farm Manure Storage Hazards.
Chain Saw Safety.
Dressing Up the Farm Family.
Protecting Your Hearing.
Safety with Farm Tractors.
Using Anhydrous Ammonia Safely.
Using Grain Harvesting Equipment Safely.
Using Hay and Forage Harvesting Equipment Safely.

4. Sources of Additional Information

The following listing is merely a sample of the organizations and information sources you may wish to contact while planning your safety workshop.

4.1 Child Safety

Farm Safety 4 Just Kids
P.O. Box 458
Earlham, IA 50072-0458
Tel. (515) 758-2827

Rural Indiana Safer Kids Project
Purdue University
1146 Agricultural and Biological Engineering Building
West Lafayette, IN 47907-1146
Tel. (317) 494-5013
Fax (317) 496-1115

The National SAFE KIDS Campaign
Children's National Medical Center
111 Michigan Avenue, NW
Washington, D.C. 20010-2970
Tel. (202) 884-4993

Children's Safety Network
Rural Injury Prevention Resource Center
National Farm Medicine Center
1000 North Oak Avenue
Marshfield, WI 54449
Tel. (715) 389-4999
Fax (715) 389-4950

4.2 Electricity

Local utility company
Local rural electric management company (REMC)

4.3 Farm Safety

Agricultural Division
National Safety Council
1121 Spring Lake Dr.
Itasca, IL 60143-3201
Tel. (708)285-1121

4.4 Fire Prevention

Local fire department

National Fire Protection Association
1 Batterymarch Park
Quincy, MA 02269

4.5 General Safety

State affiliate of the National Society to Prevent Blindness

State affiliate of the National Safety Council

U.S. Consumer Product Safety Commission
230 Dearborn Street, Room 2945
Chicago, IL 60604
Tel. (312)353-8260

4.6 Health

American Heart Association

American Lung Association

American Red Cross

Arthritis Foundation

State Department of Health

State Food & Drug Administration

State Mental Health Association

State Poison Center

4.7 Outdoor Recreation Safety

State Department of Natural Resources

4.8 Traffic

State Department of Traffic Safety

State Police

State Sheriff's Association

IX. Strategies for Financing Assistive Technology

For a number of reasons, financing assistive technology has not been a major concern raised by those who have contacted the existing rural rehabilitation service delivery programs such as the BNG Resource Center. Of the thousands of calls and letters that have been received, only a handful have requested direct financial assistance. Some of the most obvious reasons include:

1. Farm and ranch families generally have a strong sense of economic independence. There is usually a hesitancy to accept financial assistance for themselves or when there are conditions attached. Even though many farmers and ranchers accept government farm program support, such assistance is often viewed as compensation for helping to maintain the present "cheap food policy" rather than a handout. In some cases a family may be willing to go without rather than become entangled in some bureaucratic program.
2. Farmers and ranchers have more technical skills than most of the population and frequently do their own repairs, maintenance and fabrication work. Many farms have well-equipped workshops that allow for easy fabrication of many needed devices and modifications.
3. Farmers and ranchers do not perceive the Land Grant Institution or Extension Service, in which the BNG Resource Center is located, as a source of financial assistance. Rural people come to the Land Grant School or local Extension Office for ideas and strategies that help them live better more productively and more profitably.

Funding, however, becomes a major barrier when the family's income is low, farm/ranch operation marginal, or the needed assistive technology expensive. The following sections provide brief summaries of some of the more typical sources of funds to purchase the needed technology. In some cases, two or more of these will have to be tapped to obtain the level of funding needed.

A. Personal Resources

If considered numerically, most of the agricultural workplace modifications that have been documented have been designed, fabricated and financed by the disabled person or a member of his or her family. This approach is often taken without regard for other legitimate sources of support and has generally proven to be the fastest and most cost effective strategy. Though not proven, there is evidence to suggest that the acceptance rate of the technology is also higher than other means. Farms have been visited where literally thousands of dollars of modifications have been made without any input from a rehabilitation engineer or assistive technology specialist. In most cases the costs for the technology are written off as part of the operating expenses of the farm or ranch.

B. Private Insurance

Most farmers and ranchers carry some insurance that will provide for some of the costs associated with a disability. However, as many as a third, do not.

A careful review of all insurance policies should be undertaken to determine the level and scope of the coverage.

C. Community Resources

It is characteristic of many rural communities to come to the aid of residents who experience a catastrophic need. Where cash is in short supply, the assistance is provided as a service such as harvesting a crop, rebuilding a barn or providing transportation. Some examples of providing assistive technology in this fashion are as follows:

- a. Donation from a local service organization of a pickup truck that was modified for a farmer who experienced a spinal cord injury.
- b. Donation of a set of hand controls and wheelchair lift for an individual's van.
- c. Workday at a farm to install concrete walkways and shop floor to improve accessibility.
- d. Fabrication of a set of hand controls.
- e. Donation of a two-way communication system to improve the safety of a farmer working in the field.
- f. Construction of a deck and ramps on an older farm home.

D. Private Funding Sources

Every state has not-for-profit organizations that provide assistance to persons with disabilities. This usually comes in the form of direct payment to the vendor involved or service provider. In most cases, the resources of these groups are considerably less than the demand. Consequently, few cover the entire cost but rather make a partial payment towards the needed service or technology.

All not-for-profit organizations that obtain funding through public appeals are required to be registered. A call to the Governor's Committee on the Disabled or the Secretary of State's Office should give you access to a list of organizations that could be approached. It may be necessary to assemble a proposal that breaks down the need into more manageable pieces and approach several of the organizations with each being requested to fund a part of the need.

E. Public Sources of Funds

A number of state agencies have been established by the legislatures of each state to address the needs of those impacted by disabilities. Some serve a specific population such as the blind, hearing impaired, or those unemployed because of disabilities, while others attempt to act as "safety nets."

Access to public agencies that serve the disabled is usually through a local or regional office that attempts to tie many of the services together. None are perfect, they tend to work slow, often seem insensitive and appear to have a never-ending set of rules and guidelines for compliance. These agencies, however, were established to provide needed services and should be utilized.

Every state is different in the way they address the needs of the disabled, but each generally has agencies such as the following:

1. Vocational Rehabilitation Agency
2. State Worker's Compensation Fund
3. Commission for the Blind/Deaf
4. Medicaid/Medicare

In addition, federal agencies such as the Veteran's Administration, which provides specialized medical and rehabilitation services to veterans, should be tapped if the farmer is eligible.

Another public agency that might be helpful in rural communities is the Farmers Home Administration (FmHA). FmHA provides rural housing loans to buy, build, improve, repair or rehabilitate rural homes. In some cases they have provided loans to improve the accessibility of older farm homes. Check the phone book for information on contacting your nearest FmHA office or other governmental agencies.



X. Community Based Resources for Fabricating Assistive Technology

A. Local Fabricating Resources

1. Custom fabricators
2. Local craftsmen
3. Farm implement dealers
4. Local volunteer groups (Volunteers for Medical Engineering*, for example)

B. Ingenuity Networks

An ingenuity network is a group of individuals with various skills, abilities, talents, and creativity that can be utilized to help individuals with disabilities solve unique problem tasks through various levels of accommodation. The types of solutions that ingenuity networks can develop include: providing alternative ideas for completing a task using existing resources and physical abilities; locating commercially-available technologies; modifications to equipment or buildings; and designing and fabricating of new solutions. Almost everyone has some skill or ability that can be useful in solving a unique problem task.

The development of ingenuity networks has become more popular in recent years because of limited financial resources available to solve problems and the push toward consumer responsive, empowerment and community-based approaches that teach people how to solve their own problems. The importance of helping each other during difficult times is not new to people who live in rural areas who have been dependent upon their family, friends, and neighbors during times of crisis.

The benefits of an ingenuity network are extensive including the development of better solutions through the input of people with various expertise (remember, three heads are better than one); the cost-effective nature of involving volunteers; and the local grassroots approach to problem-solving.

This paper will discuss and demonstrate ideas for developing an ingenuity network that can be utilized when solving difficult problems; methods of identifying, recruiting, and coordinating of volunteers; and potential disadvantages when using an ingenuity network.

* Volunteers for Medical Engineering, Inc. (VME) is a non-profit organization that utilizes volunteers with engineering or technology backgrounds to work under the direction of medical professionals to find engineering solutions to medical problems. To find VME volunteers in your area contact: Volunteers for Medical Engineering, c/o UMBC/TEC, 5202 Westland Blvd., Baltimore, Maryland 21227.

Activities of an Ingenuity Network

Everyone has some type of skill, ability, talent or creativity that can be used in solving a specific problem. These individuals can be categorized by the nature of their skill, geographic location, and the type(s) of activities that they are willing to participate in. There are four primary types of volunteers in an ingenuity network. They include:

1. **Idea Generators:** Many people enjoy sitting around the table brainstorming possible ideas related to solving a particular problem. People who might be considered as idea generators include: design engineers, blacksmiths, farmers, consumers who use assistive technology, machinists, interior decorators, woodworkers, artists, inventors, and people who simply enjoy a brainstorming session over a cup of coffee. Some of the best ideas have been suggested this way.
2. **Procurement Specialists:** These specialists are often called "scroungers" because of their creative and uncanny ability to obtain needed resources. These are people who have expertise in locating materials, people, places, and funding to help solve a problem task. Procurement specialists/scroungers may be people who are collectors, salesperson, and garage sale hunters. They often can view what may be considered junk as real treasures that can be used various ways. Farmers can be excellent procurement specialists since many have learned that surviving is making the best out of what you have. Antique collectors, scrap iron businesses, and people who run junk yards are excellent resources for obtaining needed materials, items and parts. Procurement specialists who are able to identify and locate commercially-available products are often not afraid to ask for items or materials to be donated. They don't seem to take it personally if someone says no. They may be good at convincing people of the benefits of donating an item or their time for a good cause. Not only are procurement specialists good at finding actual items, they may know of people who can be contacted to assist or places to go to find a unique item. In addition, they may be willing to make the contacts and do the legwork to obtain a needed resource since they're often good at motivating people to become involved or simply opening the door for other people to make the needed contacts.
3. **Designers:** These people often have the technical skills needed to design an adaptation or an actual product. Designers could include: architects, extension agents, contractors, engineers, and occupational therapists.
4. **Fabricators:** When an item needs to be built, or a product needs to be modified, skilled fabricators are essential. Examples of fabricators might include: blacksmiths, shoemakers, plumbers, farmers, auto mechanics, electricians, concrete workers, artists, tailors, seamstresses, etc. Fabricators may need blueprints, designs, and detailed instructions on how to build a device or make necessary modifications.

Developing an Ingenuity Network

The first step in developing an ingenuity network is to identify people who might be interested in helping solve unique problems. The following are methods for identifying people with needed skills, abilities, talents, and creativity.

1. The local media can be contacted and encouraged to carry articles or news stories about the need for volunteers to help out with specific projects.
2. During awareness presentations to community organizations, potential volunteers can be solicited or encouraged to participate in an ingenuity network.
3. Contacts with community organizations, service clubs, churches, associations, and trade organizations. Many of these organizations are interested in doing service projects. Examples of types of organizations include: the Telephone Pioneers, the Carpenter's Union, the Plumber's Union, the Physical Therapy or Occupational Therapy Associations, the Concrete Associations, Kiwanis Clubs, Jaycees, Optimist Clubs, Knights of Columbus, Boy Scouts, Girl Scouts, 4-H, Extension Service, Future Farmers of America, and the Machinists Union, just to name a few.
4. Senior citizens and retirees are another source of volunteers with various expertise. Contacts with companies that offer early retirement for employees during economic difficulties can be very productive. These companies are often interested in providing their early retirees with opportunities to keep them active and involved in their communities. Churches, senior citizen centers, Green Thumb, and other organizations that serve senior citizens are also excellent resources to contact.
5. Placing posters in hobby shops, coffee shops, grocery stores, laundromats, and other places of business can help identify creative people.
6. Word of mouth has always been one of the best methods of learning who in the community has the skills and abilities that might be needed.
7. Consumers of assistive technology are often very useful in an ingenuity network. These individuals not only understand the difficulties associated with a particular problem task, but are also interested in helping others to achieve their maximum independence. Furthermore, consumers are often forced to be creative in coming up with solutions to overcome difficult barriers.

Managing an Ingenuity Network

Managing an ingenuity network can vary depending upon how the network will be used. An informal ingenuity network that is used on an "as needed basis" is often used by smaller organizations. The names and expertise of the various volunteers are often stored in the minds of the staff to be recalled when a problem arises. The disadvantages to this approach is that other staff members are not aware of potential resource people who could assist with solving a unique problem. In addition one might not remember a potential volunteer who has not been used for a while.

A more formalized method of managing and coordinating an ingenuity network might include the following:

1. Develop a postcard system that records individual names, addresses, phone numbers, and the types of activities that they would be willing to participate in.
2. Resources can be categorized by the following activities: idea generating; procuring needed people, places, and materials; designing, or fabricating solutions.
3. A computerized system or a card catalog could be used for updating and maintaining an active list of resource people.
4. Although the majority of people listed in an ingenuity network may be volunteers, it is important not to rule out resource people who request pay for their services. Specialized and creative people are often invaluable in an ingenuity network.
5. Keep track of the types of activities that volunteers have participated in. These activities and projects can be documented on the back of an index card or included in a computerized system.
6. Send an information flyer to all people in the ingenuity network. This flyer should include ideas on ways that they can assist in helping to solve a problem task and the benefits of participating in an ingenuity network.
7. Recognize volunteer participation through organizational newsletters and conducting volunteer appreciation events.

Potential Problems

Although ingenuity networks can be an excellent resource in solving unique problems in an effective and cost-efficient manner, there can be some difficulties or shortcomings such as:

1. Time: For some simple projects, it may take too much time to organize people in the network to become involved. It may be more cost-efficient to simply hire someone with the needed skills. In addition, many individuals in the ingenuity network work full-time jobs and are only willing to work on a particular project when they have time. This is fine as long as the problem task does not need to be solved right away. It could be difficult for those problems that need to be solved right away.
2. Coordination: Yes, three heads are better than one, but sometimes trying to coordinate three or more people to come together to help with a particular task can be challenging.
3. Errors: If the problem task is not clearly defined, then errors are more likely to occur when developing a solution. In addition, many individuals who participate in any ingenuity network lack the understanding of the physical limitations associated with a specific disability. As a result, the solution may not be effective.

4. Lack of interest: If volunteers are not used enough, they may lack interest and choose to find something else to participate in. In addition, service providers may forget the level of expertise available within the ingenuity network and therefore under-use this valuable resource.

Coping with Potential Liability

No one is immune from potential liability exposure in anything they do. However, various Good Samaritan laws in individual states have not held volunteers liable for providing services at no cost to their neighbors. It is recommended that one check the laws within one's state related to this matter.

Some volunteers in ingenuity networks have their own waiver of liability form. This form is signed by the consumer who receives assistance or services from the volunteer of the ingenuity network. Some of these volunteers have consulted an attorney in developing the liability waiver form.

Organizations that recruit and use volunteers often have liability insurance that covers volunteers associated with their organization. It is advisable to consult with an insurance company regarding this matter.



XI. Strategies for Delivering Assistive Technology Services in Rural Settings

A. Introduction

This chapter's goal is to make you aware of and familiar with three strategies being used by programs and institutions to deliver assistive technology services in rural settings:

1. Central Fabrication Facility
2. Mobile Fabrication Vehicle
3. Assistive Technology Demonstration Vehicle

The first two strategies involve direct fabrication of solutions for the persons being served, while the remaining strategy provides services via a van that carries commercially available assistive technology. For each of the three strategies presented, a brief discussion of the strategy is followed by a listing of some of the advantages and disadvantages associated with that strategy. Where possible, programs that are employing a particular strategy are named to allow readers to contact those programs for further information regarding implementation of that strategy.

All have benefits and drawbacks and no one strategy can be described as "best" for all situations or for all programs. Each strategy has unique advantages and disadvantages that will make it a more or less appropriate choice under given circumstances.

B. Strategies

1. *Central Fabrication Facility*

If a program intends to fabricate custom solutions then it must almost certainly create or have access to a central fabrication facility where a large proportion of the fabrication will take place.

Any other arrangement could cause both inefficient use of time and/or a reduction in the size and quality of solutions capable of being fabricated. For example, a program choosing to rely solely on machine shops local to a client being served would have no control over what type or size of machine tools are available or whether the machinist is skilled or unskilled.

One major drawback of a central fabrication facility is the cost of purchasing tools and equipment to establish it. According to one source, the cost of tools and equipment could range from \$15,000 if buying used equipment, to \$25,000 if new equipment was purchased "carefully," to as much as \$60,000 for a well-equipped facility with new equipment. These estimates do not include materials.

Advantage

- Can make use of large, bulky equipment.
- Can make use of specialty machines, because space is less a concern.

- Specialty equipment can make specialty items.
- Higher precision tools can be used.

Disadvantage

- Problem not usually "at hand" for machinist to investigate.
- Rely heavily on design and measurements taken "in the field."
- Can't easily make changes in design as item is being fabricated.
- Relatively slow turn-around time because of travel necessity.
- Specialty equipment requires operators skilled in use of that equipment.
- Inventory costs can be quite large.

Example:

Rehabilitation Technology Centers
6862 Hillside Court
Indianapolis, IN 46250
Contact: Mark Russel, Director
(317) 845-3408

2. *Mobile Fabrication Vehicle*

The idea of using a mobile fabrication vehicle, or mobile shop, to deliver assistive technology services is gaining popularity among programs serving rural clients. One benefit provided by a mobile shop is the potential to greatly reduce the time spent in assessing, designing, and fabricating a solution when compared with a central fabrication facility. With only a central facility, each step of (1) assessment, (2) initial solution, and (3) modification requires a farm visit. In certain circumstances, this can all be accomplished in one day with a mobile fabrication vehicle. This reduces not only time delay, but also travel costs and staff time.

However, because of the great distances found in the rural areas in which these vehicles operate, there is concern that the operating expenses of the vehicle can make some trips prohibitively expensive. Services provided through a fabrication vehicle may or may not be cost-effective depending upon:

- travel distance
- numbers of individuals served in a location
- available services within local communities
- number and complexity of needed accommodations

For example, it may be cost-effective to design and fabricate worksite adaptations for individuals who reside within an 80-mile radius and whose adaptations can be made in two hours or less. It may be too costly, however, to travel 200 miles to design and construct a ramp requiring two days to build when, with technical assistance provided, local community volunteers or vendors could construct the ramp themselves. A meeting of rehabilitation professionals in Kansas (CPR-Kansas, 1991) concluded that a mobile fabrication vehicle is used most effectively when the design and fabrication of solutions can be accomplished in a day or less.

An example of a mobile fabrication vehicle is the unit being operated by The Easter Seal Society of Iowa's FaRM Program. This "mobile shop" consists of a commercial van with a two-foot raised roof to allow fabrication in a standing position. The shop is equipped with a MIG welder, oxygen-acetylene torch, 220 arc welder, power saws, post hole digger, hand tools, portable work bench, and assorted fabrication material. The approximate cost of the unit in 1989 was \$38,000.

Advantage

- Problem is at hand and available for immediate inspection.
- Can easily make changes in design as item is being fabricated.
- Item can be "tried out" by client and reworked immediately if necessary (no lag time).
- Travel time from farm to central facility is eliminated.
- Necessity of return visits to farm may be eliminated.

Disadvantage

- Solutions limited to fabrication methods and materials carried in the vehicle.
- Requires driver/technologist willing to spend many hours traveling and nights away.
- Inventory costs
- Not cost-effective for fabricating all types of assistive technology.
- Difficulty in obtaining on-going funding.

Examples:

Farm Family Rehabilitation Management
(FaRM) Program
P.O. Box 4002
Des Moines, IA 50333
Contact: Project Director
(515) 289-1933

Cerebral Palsy Research
Foundation of Kansas, Inc.
P.O. Box 8217
Wichita, KS 67208
Contact: Leonard Anderson, V.P.
(316) 688-1888

3. *Assistive Technology Demonstration Vehicle*

This strategy for delivering services to people in rural areas does not involve direct fabrication of solutions. An assistive technology demonstration vehicle instead provides contact with solutions that are commercially available. A demonstration vehicle carries actual examples of assistive technology of interest to rural residents with physical disabilities, as well as catalogs of various manufacturers and sales companies. The intent is to let people examine cost-effective solutions that are commercially available. Farmers may be spared either the time or expense, or both, of developing their own solution when an effective, reasonably-priced solution already exists and is being sold. The only thing lacking, frequently, is the awareness that such an item exists or knowledge of where to go to buy it.

Delivering services via a demonstration vehicle may be appropriate for programs that, because of liability or other issues, are prevented from providing fabrication services.

Initial vehicle costs can range from \$20,000 to \$40,000 depending upon the types of van modifications requested, such as: custom cabinets, wheelchair lift, automatic door openers, hand controls, power driver's seat. Inventory costs also can be high if items such as wheelchairs and three-wheeled scooters are purchased to carry in the vehicle.

Advantage

- Can fill two roles: one as service provider and one as public awareness.
- Service provision:
 1. Convenient — take directly to home.
 2. Hands-on — people can see before deciding to buy.
 3. Exposure to items that might not have been seen before [e.g. — sport wheelchair, swing lift].
 4. If a commercially available product is reasonably priced as compared to the cost to construct a solution, the farmer will save time and/or money.
 5. Can provide design consultation on-site.

- Public Awareness:

1. Public, both disabled and non-disabled, made aware of the abilities and needs of farmers with physical disabilities.
2. New contacts can be generated.
3. A simple way to transport displays for shows, and items make great displays to attract interest.

Disadvantage

- Individual solution may not be provided by a commercial item.
- Maintenance and gasoline costs.
- Still may not have in van an item that a farmer wishes to see.

Example:

Breaking New Ground Outreach Program
Purdue University
1146 Agricultural Engineering Department
West Lafayette, IN 47907-1146
Contact: Cindy Ade, Coordinator
(317) 494-5954

REFERENCES

The Wichita Rehabilitation Engineering Center Tech Brief, The Cerebral Palsy Research Foundation of Kansas, Wichita, KS.

WORKSHEETS

The following two worksheets can be used for discussion purposes in presentations that you may give on assistive technology. You may also find them useful as you and your clients identify, select, and implement appropriate assistive technology.



10-1-11
10-1-11



Discussion Questions

Delivery of Assistive Technology Services to Rural/Farm Residents

1. What is meant by the term assistive technology?
2. How many rural/farm residents are there who could benefit from the appropriate application of assistive technology? Is the percentage of the rural population with physical disabilities more or less than would be found in an urban setting?
3. What are the most common causes and types of physical disabilities found in rural areas? Do they differ from those found in urban settings?
4. How does rural assistive technology differ from other types of assistive technology?
5. What are the barriers to the effective and timely delivery of assistive technology services in rural areas?
6. What are the basic characteristics of appropriate rural assistive technology?
7. Is assistive technology currently used in rural and farm settings carefully evaluated prior to use by consumers?
8. Is the issue of secondary injuries a valid concern for the provider of rural assistive technology, especially when farmers are involved?

9. What tools are currently available to assess the need for assistive technology in an agricultural workplace?

10. How is most assistive technology currently used by rural/farm residents currently designed and fabricated?

11. Who are the primary rehabilitation service providers in rural areas?

12. Who are the potential (non-traditional) resource people in many rural communities who could contribute to meeting assistive technology needs?

13. What are the potential (non-traditional) sources of funding in rural communities to cover the cost of needed assistive technology?

14. What are the opportunities for alternative or supplemental sources of income for a person with a disability living in a rural area?

15. If you were contacted today by a farmer with a need for an assistive device to perform an essential farm chore, whom would you contact?

16. What impact will ADA have on the delivery of assistive technology services to rural/farm residents?

EVALUATING ASSISTIVE TECHNOLOGY

Activity Sheet

1. Assistive Technology: _____

2. Scoring

Evaluation Criteria	Score					
	Low					High
	0	1	2	3	4	5
a. Function	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
b. Cost Effectiveness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
c. Safety	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
d. Acceptability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
e. Availability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
f. Serviceability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
g. Durability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
h. Adaptability	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

3. Identify two primary reasons that make the technology appropriate.

- a) _____

- b) _____

4. Identify two reasons why the technology is inappropriate.

- a) _____

- b) _____

1. The first of these is the fact that the
the United States is a country of immigrants.
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10. The tenth of these is the fact that the
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The United States is a country of immigrants.

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