Randy Pavesich is an outgoing teenager who is no stranger to assistive technology and custom seating. Now a 17-year-old attending Byron High School in Byron, Minn., he was diagnosed with congenital spastic choreoathetoid quadriplegia and received a power wheelchair at age 12. Randy loves telling jokes and making people laugh.

Randy works with a supportive team including his teachers, therapists, family, physicians and rehab technology providers whose primary goal has been to increase his independence, particularly in mobility and communication. This independence is contingent on careful attention to his needs for postural and other orthopedic support.

Courtesy Tamarack Habilitation

Randy uses an Everest & Jennings Excalibur power chair with a modified joystick. Since 1991, he has used a custom seating insert, which we refer to as a custom sitting support spinal orthosis (SSSO), with modifications for growth and to resist progression of scoliosis. A Prentke Romich Light Talker is mounted to his laptray. He accesses both the Light Talker and an Apple IIGS computer with an AbleNet Jelly Bean switch activated by his left cheek. He has a second laptray for meals or activities that warrant a larger clear surface area.

He also has an E&J Excalibur manual wheelchair that he uses with the same seating system and laptrays. He rarely uses the manual chair, which he can self-pro pel with some effort; it's mostly for places where he can't use his power chair.

Photo Mark Luinenburg

Randy **believesthatasa maturing young man, it's important for him to have more control over his environment, which his new power wheelchair and seating provide. Being able to turn his chair off and on and maneuver himself through his high school is important to his sense of independence. Randy's team includes (from left) Sherry Rovig, Tamarack Habilitation Technologies, St, Paul, Minn.; his mother, Eve; and Jeanne O'Reilly, a speech-language clinician at his high school in Byron, Minn,**

Getting to Randy

One of the challenges in addressing Randy's needs is getting to him. He lives in a rural setting near Rochester, Mum., which can be a daunting drive from St. Paul, especially in a Minnesota winter. However, after being partly funded by an outreach program by STAR, Minnesota's Tech Act project, St. Paul-based Tamarack Habilitation Technologies began mobile outreach visits to Rochester in 1991. That was when we first met Randy and started making changes to his seating system, which was a custom rectilinear unitized seating insert. That was also when the first comprehensive teamwork addressing his augmentative communication and powered mobility access began.

Randy initially operated his power chair with a U-shaped joystick handle of aluminum tubing and stabilization of his right arm via an enlarged right armrest with a forearm strap.

The Light Talker was mounted in a custom receiver that could be used either on the laptray or while Randy was using his supine stander at school. The Light Talker holder had a hinged design that allowed it to be lifted to the optimal location for Randy's visual access, or stored face down on the laptray for an improved visual field while driving his wheelchair. This face-down position also gave outstanding

protection to the device at a time when Randy was learning his driving skills. However, the configuration required assistance in raising and lowering the device. At that time, Randy had an aide who helped him at school and set up his devices.

The next refinement was relocation of the joystick to a more medial location and revamping the joystick handle to enhance Randy's driving ability. A swing-away mount for the joystick control box was incorporated to facilitate transfers andlaptray setup and removal. Because Randy had difficulty grasping a handle, the joystick controller was modified so Randy could put his cupped hand into a horizontal funnel-shaped extension. By pressing the funnel to one side or the other, he activated the controls. This method was devised through experimentation by Randy and Bill Vistead, his occupational therapist at that time.

Courtesy Tamarack Habilitation

Randy's seating and positioning team from Tamarack first met him in 1991 during an outreach program.

Growing With Randy

Randy's seating system has been modified numerous times for growth and more aggressive spine and pelvic support. His most recent assessment for a new spinal orthosis in early 1996 coincided with a need for changes to his existing communication and mobility systems. Randy's team felt that a different seating system was necessary to accommodate the changes in his growing body. Tamarack provided a custom-molded SSSO to resist further collapse of his right thoracolumbar curve while distributing those considerable supportive forces safely over a broad area. The new SSSO was recessed down and back within the wheelchair frame to obtain a safer (i.e., more dynamically stable) center of gravity, better environmental access and improved appearance

The team focused on more independence and control for Randy by designing a system to provide unassisted access to his communication device.

His occupational therapist, Aya Hasdai, and teacher, Karen Light, recommended changes in the joystick position and design, along with a modification to the control switches for the wheelchair to give Randy safer and smoother control of his wheelchair. Since he could not access the standard on/off switch of his wheelchair, the switch was adapted to give him this additional level of independence. In addition, Randy had difficulty selecting either the high/low toggle switch or the on/off switch until a shield was installed between the two.

On-the-Road Designs

The distance between the home team and Tamarack necessitated some aspects of the design. After discussions about joystick-handle configurations, the team decided to work on a surface that Aya could reshape, if needed.

It seemed likely that a domed oval about 3 inches long with a high-friction surface would give Randy "good purchase" on the handle, or the ability to control it, without having to grasp it. The handle needed to be light so it wouldn't overpower the spring at the base of the shaft, so a piece of 6# density polyethylene foam was shaped and a slip-on cover of high-tack Spenco shoe matting and Rubatex was provided. The ethafoam handle was notched and bolted to a lightweight stainless steel base that attached to the joystick shaft with a collar and set screw. This allowed easy adjustment or removal of the handle.

The old system of moderating some of Randy's overflow motion with an enlarged armpad and forearm strap was discontinued and the joystick was repositioned at a higher level, in what seems to be a "sweet spot" for him. With practice, he continues to improve his control.

To activate a toggle switch, Randy would have to flex or extend his fingers to brush across the switch. To improve his access to the on/off switch, it was extended with a "high-tech" piece of plastic pen tubing. Aya further noted Randy's hand

Randy's improved mobility allows him to participate in a favorite activity of teenagers—cruising the mall.

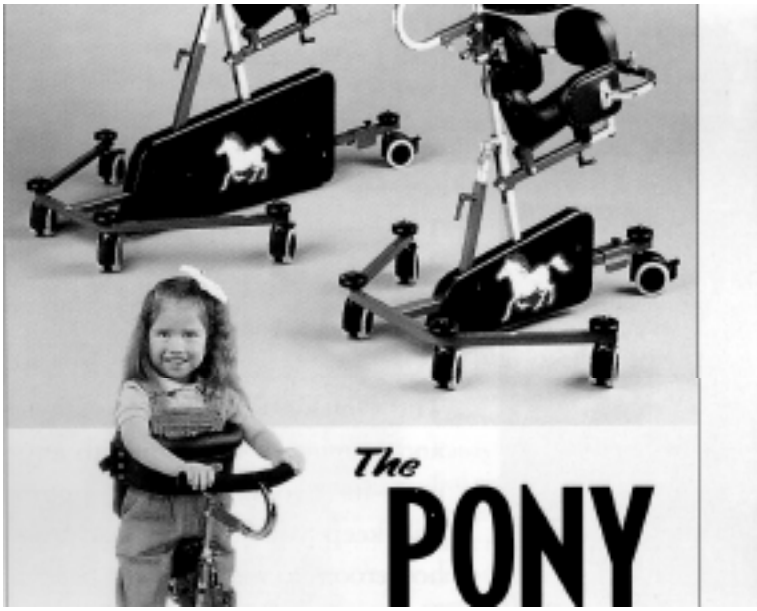
position when he tried to activate the switch and added a"T" that allow even better access. Since that last modification, Randy's mother, Eve, learned about an extension truck drivers use for their toggle switches and was able to purchase the item at a local truck stop. It has replaced the pen tubing and T-shaped addition.

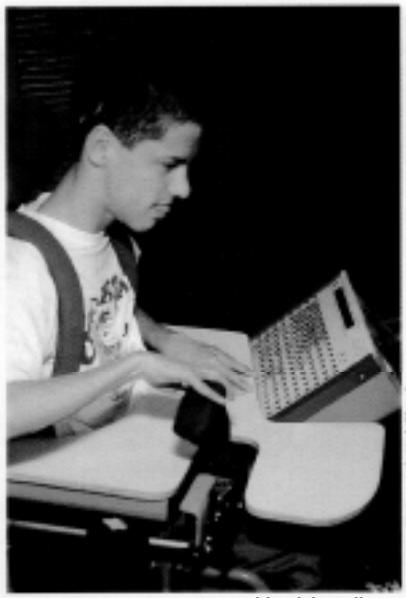
During this visit, Aya and Karen asked if Randy's Light Talker could be recessed into the tray surface with enough clear visual field for him to drive safely and still see his device well. Randy's growth spurts not only advanced him through many seating modifications, but also gave him the height needed for the Light Talker to clear his thighs when recessed, and the perspective to view his surroundings over the laptray and device.

Because the team wasn't sure of the angle that would be best for Randy's viewing, the device was mounted on hinges and a support bracket that allowed incremental angle adjustment. The cost of the mounting system was moderated by incorporating major portions of the existing support and utilizing drop-hook seating hardware. The laptray was reinforced with stainless steel bar stock welded to the drop-hook hardware to support the Light Talker.

The old chin-switch mounting was prone to going out of adjustment-a common problem with designs that rely on clamping to round tubing. A new mounting system was

cated with square tubing and incremental adjustment holes to bolt the switch in place. The entire switch mount is easily removable from a receiver bracket on Randy's new head support. Because Randy's had more consistency of position in his new SSSO, meaning he would be in the same position each time he was in his power chair, placement of the switch was much easier. We knew that each time he was in his chair, his chin would be at the same height, so the switches would not require daily adjustment-another example of the interconnected nature of seating and positioning and environmental access.




Courtesy Tamarack Habilitation

Randy enjoys having access to his Liaht Talker while traveling through his school's halls. To encourage interaction, increase stability and make it easier for Randy to see while moving, the Liaht Talker has been lowered and set deep into his tray. Randy particularly enjoys sharing jokes with his teachers and friends. One of his favorite jokes is: Why do Eskimos wash their clothes inside? Because it's too cold out-Tide! He also uses his Light Talker to write short stories and write down his thoughts, ideas and dreams.

Randy's equipment was funded by a combination of private insurance and Minnesota Medical Assistance. The cost of the new custom equipment and modifications, not including the seating, was $1,350. His new SSSO, including custom modifications to the footrests and recessed platforms for both manual and power wheelchairs, was $4,300. The evaluation was performed for free during Tamarack's monthly mobile outreach. The orocess took about four months, from evaluation to final fitting.

After several years of modifications to accommodate for Randy's changing size and abilities, we think we've finally got it! Indoors, especially in his fully accessible house, Randy is functionally independent. He also enjoys the outdoors around his family's country home. His mother reports greatly improved maneuvering skills with the new system and increased confidence as he continues to refine his proficiency. He receives regular mobility training emphasizing crowded areas.

Randy's improved mobility allows him to participate in a favorite activity of teenagers-cruising the mall. His friends have one complaint about his increased communication, however. They want Randy to remember where he stores the punch lines for his jokes!

Sherry Rovig works in the Seating and Adaptive Equipment Department of Tamarack Habilitation Technologies, St. Paul, Minn. Aya Hasdai, OTR, works for the Zumbro Education District, a multipurpose cooperative of seven member school districts, in Byron, Minn. She has worked with children with special needs for 11 years.

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