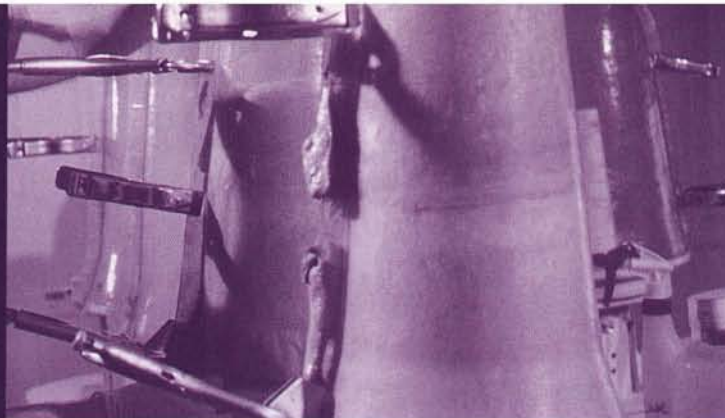


Heading a selection of
spinoffs in health and
medicine is a vision
enhancement system
derived from space
technology



Some three million Americans suffer chronic visual impairments known to ophthalmologists as "low vision," which means that they are not totally blind but retain some degree of useful vision. These disabling impairments cannot be

corrected medically, surgically or with conventional eyeglasses. They can, however, be corrected by a newly available video headset that offers people with low vision a view of their surroundings equivalent to the image on a five-foot television screen four feet distant from the viewer.

The headset is formally known as the Low Vision Enhancement System (LVES, pronounced Elvis). It will not make the blind see but for the majority of those in the low vision category it will ease such everyday activities as reading, watching TV, cleaning house, shopping, or working at jobs or hobbies.

LVES was introduced to the commercial marketplace in 1994 after almost a decade of development by a multiorganizational team that included NASA, the Wilmer Eye Institute of The Johns Hopkins Medical Institutions, the Department of Veteran Affairs, and Visionics Corporation, Minneapolis, Minnesota, which manufactures the system under license. The device was invented and patented by a trio of researchers: Dr. Robert W. Massof, director of Wilmer Eye Institute's Lions Vision Center; Dr. Thomas Raasch, also of Wilmer; and Dr. Donald O'Shea of Georgia Tech.

The Wilmer researchers, in cooperation with scientists of NASA's Stennis Space Center, used NASA technology for computer processing of satellite images, along with technology for head-mounted vision enhancement systems originally intended for space station use. The transfer of these technologies made it possible to improve the capabilities of low vision patients by appropriately enhancing and altering images to compensate for the patient's impairment.

The LVES consists of a head-mounted video display worn like goggles, a set of three video cameras, and a control unit that allows the user to select and control the cameras, and to adjust contrast and image polarity to suit the user's needs. The cameras feed the images to a computer that corrects for the particular vision problem of the user, then sends the images to the video display in the goggles.

Visionics sales literature succinctly describes the technology: "The LVES does for video images what headphones do for sound. It presents the enlarged image of a video screen to each eye in a way that creates a sense of being immersed in a video scene." The enlargement is accomplished by a patented system of optical mirrors, designed and manufactured by Polaroid Corporation, Cambridge, Massachusetts, that project the video images onto the wearer's retinas.

LVES is powered by a battery carried in a nylon belt pack along with a control unit that allows the wearer to adjust contrast and magnification. The belt pack, including the battery, weighs 2½ pounds and is about the size of a book. The headset, worn like aviator's goggles, weighs 34 ounces.

The system is used by people with a variety of low vision conditions, particularly those who have experienced loss of central vision, the part of vision normally used for reading.



Accurate alignment of the eyes is essential to LVES' proper performance. **At left**, a Visionics engineer employs a company developed technique of checking alignment with the input from two video cameras.



Shown above is the Low Vision Enhancement System (LVES) produced commercially by Visionics Corporation. The upper unit is a head-mounted video system worn like goggles; the lower item is the control unit. The system corrects for vision defects and offers visually impaired people a clear view of their surroundings.

These patients may have macular degeneration associated with aging or diabetic retinopathy, in which diabetes causes swelling and leakage of fluid in the center of the retina, the macula. The system also has benefited people who have lost peripheral or side field vision, a problem associated with glaucoma, an increase of fluid pressure inside the eye that damages the retina and optic nerve, and people suffering from retinitis pigmentosa, a progressive degeneration of the retina that results in tunnel vision and extreme sensitivity to light. Persons with optic nerve disease and congenital damage to the retina also use the LVES successfully.

The LVES development began in 1985, when Wilmer Eye Institute's Dr. Massof met with NASA officials to see if there was an emerging aerospace technology that might be adapted to low vision enhancement. Stennis Space Center and Wilmer then began development of a laboratory-based prototype system of real-time image processing. In 1992, the prototype LVES was unveiled and publicly demonstrated. Eleven centers of the Department of Veteran Affairs provided the patient population and conducted clinical trials of the system, on the basis of which final design modifications were incorporated into the headset. Visionics Corporation was founded in July 1992 to manufacture and market LVES and future improvements to the technology developed by Johns Hopkins.