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The Portable Dynamic Fundus Instrument: Uses in Telemedicine and Research

Norwood Hunter
Michael Caputo
KRUG Life Sciences Inc.
Houston, TX

Roger Billica
Gerald Taylor
NASA Johnson Space Center
Houston, TX

C. Robert Gibson
F. Keith Manuel
St. John Eye Associates
Nassau Bay, TX

Thomas Mader
Madigan Army Medical Center
Tacoma, WA

Richard Meehan
University of Colorado
Denver, CO

For years ophthalmic photographs have been used to track the progression of many ocular diseases such as macular degeneration and glaucoma as well as the ocular manifestations of diabetes, hypertension, and hypoxia. In 1987 a project was initiated at the Johnson Space Center (JSC) to develop a means of monitoring retinal vascular caliber and intracranial pressure during space flight.

To conduct telemedicine during space flight operations, retinal images would require real-time transmission from space. Film-based images would not be useful during in-flight operations. Video technology is beneficial in flight because the images may be acquired, recorded, and transmitted to the ground for rapid computer digital image processing and analysis. The computer analysis techniques developed for this project detected vessel caliber changes as small as 3%.

In the field of telemedicine, the Portable Dynamic Fundus Instrument demonstrates the concept and utility of a small, self-contained video funduscope. It was used to record retinal images during the Gulf War and to transmit retinal images from the Space Shuttle Columbia during STS-50. There are plans to utilize this device to provide a mobile ophthalmic screening service in rural Texas. In the fall of 1993 a medical team in Boulder, Colorado, will transmit real-time images of the retina during a normal ocular examination and during fluorescein angiography to a medical team at JSC for remote consultation and diagnosis.

The research applications of this device include the capability of operating in remote locations or small, confined test areas. There has been interest shown in utilizing retinal imaging during high-G centrifuge tests, high-altitude chamber tests, and aircraft flight tests. A new design plan has been developed to incorporate the video instrumentation into a face-mounted goggle. This design would eliminate head restraint devices, thus allowing full maneuverability to the subjects. Further development of software programs will broaden the application of the Portable Dynamic Fundus Instrument in telemedicine and medical research.