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THE RETINAL FUNDUSCOPE DEMONSTRATION PROJECT

by

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TECHNOLOGY TRANSFER ?????s

1. WHAT'S THE TECHNOLOGY & COMMERCIAL VALUE?

2. WHY IS A DEMONSTRATION NEEDED?

3. HOW DID WE GET SEVEN PARTIES TO WORK TOGETHER?

RETINAL FUNDUSCOPE DEMONSTRATION PROJECT

1. WHAT'S THE TECHNOLOGY?

Life Sciences

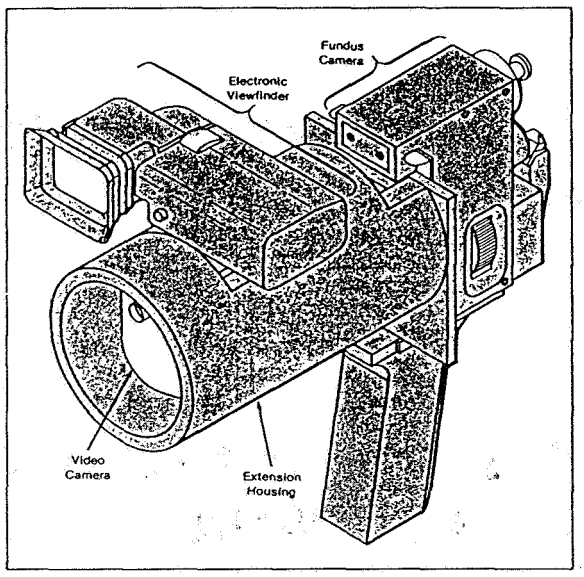
Hardware, Techniques, and Processes

Portable Video/Digital Retinal Funduscope

An inexpensive instrument can be operated with minimal training, under hospital or field conditions.

Lyndon B. Johnson Space Center, Houston, Texas

A lightweight, relatively inexpensive electronic and photographic instrument has been developed for the detection, monitoring, and objective quantification of ocular/systemic disease or physiological alterations of the retina, blood vessels, or other structures in the anterior and posterior chambers of the eye. The instrument can be operated with little training. It can function with a human or animal subject seated, recumbent, inverted, or in almost any other orientation; and in a hospital, laboratory, field, or other environment. The instrument produces video images that can be viewed directly and/or digitized for simultaneous or subsequent analysis. It can also be equipped to produce photographs and/or fitted with adaptors to produce stereoscopic or magnified images of the skin, nose, ear, throat, or mouth to detect lesions or diseases.



The **Portable Funduscope** has a modular design. The extension housing, video camera, and electronic viewfinder can be removed and replaced with a 35-mm film camera. The fundus camera can be equipped with a variety of lenses, prisms, and the like.

The instrument is an assembly of commercially available equipment, some of which has been modified slightly to make it compatible with the other equipment and the overall design. One major component is a portable fundus camera with lenses, filters, and prisms as required for various viewing configurations. The image produced by the fundus camera is either recorded on 35-mm film or sensed by a low-light-level charge-coupled-device (CCD) video camera (see figure). The other major components are an electronic viewfinder, a video monitor for viewing in real time, and a computer that digitizes the video image.

Equipment to stabilize the subject's head is included, but the instrument can be operated without such stabilization. The operator can adjust the focus on the fundus camera while viewing through an eyepiece, using either the 35-mm-film-camera attachment or looking directly at the electronic viewfinder mounted on the CCD camera. When the desired image is obtained, the camera is secured in place. Excitation and barrier filters can be inserted into the fundus camera for fluorescein angiography. The images from the CCD camera can be directly digitized by the computer for storage or transferred via telephone lines, computer networks, or satellite to remote locations.

By providing for the digital analysis of images, the instrument helps physicians to compare sequential images from a given patient to detect subtle disease progressions earlier. In addition, the acquisition of images as digital information facilitates storage, transfer, and manipulation to enhance features of interest. It also enables extensive analyses of images, including quantitative analyses of the diameters of blood vessels and the detection and monitoring of changes in retinas caused by hypertension, diabetes, atherosclerosis, vasculitis, uveitis, macular degeneration, glaucoma, and infections. The instrument can be upgraded easily as advanced sources of light, optical equipment, CCD cameras, computers, and image-analyzing computer programs become available.

This work was done by Gerald R. Taylor of **Johnson Space Center**; *Richard Meehan of the University of Colorado; and Norwood Hunter, Michael Caputo, and C. Robert Gibson of Krug International. For further information, Circle 37 on the TSP Request Card.*

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Johnson Space Center [see page 16]. Refer to MSC-21675.

1. WHAT'S THE TECHNOLOGY & COMMERCIAL VALUE?

- **Funduscope Aids Detection of Disease** or Physiological Alteration of the Retina, Blood Vessels or Other Structures of the Eye as well as the Skin, Nose, Ear, Throat, and Mouth

- Remote Diagnosis **Allows More Specialists to Participate** Resulting in:
  -Faster and More Complete Diagnosis
  -Fewer Rescheduled Visits
  -Access to Specialists Otherwise Not Available
  -Improved Health Care Delivery

- Remote Consultations will **Reduce Physician Overhead Costs and Travel Time by $132,000,000 Per Year** (A.D. Little, 1992)

- **Continuing Medical Education Faster**, More Effectively and **More Efficiently Saving $100,000,000 Annually** in Conference and Travel Expenses

2. WHY IS A DEMONSTRATION NEEDED?

1. **Field Test** Portable Funduscope by Health Care Providers

2. **Assess** SatelliteTelemedicine **Cost/Benefit** of Using the Portable Funduscope

3. **Assess** Commercial **Market Potential** of Portable Funduscope

4. **Assess Cost/Benefit** of Health Care Staff **Continueing Education** via Satellite Videoconferencing

3. HOW DID WE GET SEVEN PARTIES TO WORK TOGETHER?

- *NASA Headquarters* ($350,000): Demonstration Project Funds to Reduce Commercial Risk

- ***Johnson Space Center***: Protocols and Results with NASA Telemedicine Projects

- ***KRUG Life Sciences***: Funduscope Availability & Training ($4,500 in-kind)

- ***Scott & White Memorial Hospital*** ($95,000 & $400,000 in-kind): Funduscope Evaluation for Telemedicine & Health Care Telelearning

- ***James Rumsey Technical Institute*** ($361,800 plus $50,000 in-kind) sponsored by the West Virginia Dept. of Education and the Appalachian Regional Commission: VoTech Skills Training

- ***SpaceTech*** ($85,000 in-kind): Network Integration, Operation & Expansion

- ***MCTTC*** ($40,000 in-kind) : Project Management & Funduscope Market Assessment for Commercialization

3. HOW DID WE GET SEVEN PARTIES TO WORK TOGETHER?

JOINT-SPONSORED DEMONSTRATION AGREEMENT

1. PREAMBLE
2. DEFINITIONS
3. PARTIES & KEY PERSONNEL
4. ATTACHMENTS
5. TERM OF AGREEMENT
6. PURPOSE OF AGREEMENT
7. STATEMENT OF WORK
8 TASKS & DELIVERABLES
9. FUNDING & IN-KIND CONTRIBUTIONS
10. PROJECT MANAGEMENT
11. RIGHTS TO INTELLECTUAL PROPERTY
12. RIGHTS TO PHYSICAL PROPERTY
13. RIGHTS TO PUBLICATION
14. TRANSPONDER TIME ALLOCATION
15. INSURANCE & LIABILITY
16. DISPUTES
17. TERMINATION
18. NASA PROVISIONS
19. EXPANSION OF DEMONSTRATION PROJECT
20. GENERAL PROVISIONS

RETINAL FUNDUSCOPE DEMONSTRATION PROJECT

EXPECTED RESULTS

1994-95: Demo Expansion to Include Additional Medical Centers & Technologies

1995-97: Commercialization of Portable Retinal Funduscope by KRUG & Distribution Partner

1996-98: Commercialization of Portable Funduscope with Attachments for Ear, Nose, Throat, Mouth and Skin

1995-99: Telemedicine Becomes Established Medical Practice