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7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES): Dr David Senseman, University of Texas at San Antonio, San Antonio, TX 78285 8. PERFORMING ORGANIZATION REPORT NUMBER: AFOSR-TR-90 0683

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13. ABSTRACT (Maximum 200 words): This equipment grant provided funds to purchase a Silicon Graphics workstation for optical recording of brain activity. The system is being used by scientists at the University of Texas and the USAF School of Aerospace Medicine to examine brain electrical activity related to aerospace environmental stresses. *Key words: purchase, Logistics, contracts, guarantee, price, etc.* DTIC ELECTE JUN 27 1990

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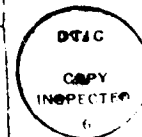
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**FINAL REPORT: AFOSR-89-0118**

- 1. PROJECT TITLE:** MULTI-USER FACILITY FOR HIGH PERFORMANCE OPTICAL RECORDING OF BRAIN ACTIVITY (DURIP)
- 2. GRANTEE:** THE UNIVERSITY OF TEXAS AT SAN ANTONIO
- 3. PRINCIPAL INVESTIGATOR:** DR DAVID M. SENSEMAN
- 4. ADMINISTRATIVE OFFICE:** AFOSR/PKD, BUILDING 410 BOLLING AFB DC 20332
- 5. SPONSORING SCIENTIFIC OFFICE:** AFOSR/NL, BUILDING 410, BOLLING AFB DC
- 6. PROGRAM MANAGER:** WILLIAM O. BERRY

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**EQUIPMENT PURCHASED:**

In the original proposal funds were requested to purchase a SUN Microsystems 4/260C color graphics workstation with a 60 MByte tape backup unit, 280 Mbyte SMD hard disk drive and a TAAC-1 image processor/graphics board. Total acquisition cost per unit (including a 30% University discount) for the SUN system was quoted at \$44,823.

Following submission of this proposal to AFOSR, we continued to monitor new product offerings in the volatile workstation market by major systems vendors (i.e. Digital Equipment Corp (DEC), Hewlett-Packard, Pixar, SUN Microsystems and Silicon Graphics Inc). At the time the award made, we determined that the workstation system most suitable for our research needs was the Silicon Graphics Inc. (SGI) model 4D/50GT. This system has substantially better 3-D graphics resolution and performance than the SUN 4/260C workstation originally selected.

Details of the SGI 4D/50GT workstation purchased with the DURIP funds are as follows:

Silicon Graphics model 4D/50GT with:

- MIPS 32-bit Risc CPU (8 MHz)
- 8 MBytes memory
- 170 MByte hard disk (SCSI Interface)
- 60 MByte tape drive (SCSI Interface)
- 19" (dia) color graphics monitor (1280 x 1024 pixels)
- NTSC Genlock board
- Ethernet port
- IRIX (Unix System V) operating system
- Graphics Development software

AFOSR Funds (DURIP)	=	\$ 45,000.00
UTSA Contribution	=	<u>7,119.02</u>
Total Acquisition Cost	=	\$ 52,119.02

## **RESEARCH:**

We have successfully completed our first task in the integration of the new workstation into our experimental system, i.e., the porting of existing software code to the SGI workstation for the display of our experimental data. The number of man hours to complete this task was estimated to be approximately 6 man months which is about the time it has taken to complete the initial port. We are quite please with our choice of the Silicon Graphics workstation over the offering from SUN Microsystems.

Attached (Fig.1) is a color photograph of three graphical user interfaces (GUI's) that we have developed to facilitate qualitative and quantitative analysis of our optically recorded brain electrical information. We decided that the additional effort needed to program these GUI's (compared to a simpler text-based menu selection scheme) would yield greater productivity and allow us to fully utilize (exploit?) the relatively large number of unskilled laborers (i.e. undergraduate students) available at this University.

Starting 1 JUN 90, we will formally begin a colaborative research effort with Dr. G. Andrew Mickley, Lt.Col., USAFSAM/RZP/536-3582 which will use optical recording techniques (and the SGI workstation) to study the functionality of neural connections between brain grafts and hippocampal tissue in rats with radiation-induced loss of granule cells. This work is being funded, in part, by the AFOSR RIP program with myself serving as a summer fellow.

We are still hopeful that we Dr. Michael Rea at Brooks AFB will be able to provide us will tissue samples so that we can use our optical recording techniques to study the spread of evoked electrical activity from the optical nerve into the suprachiasmatic nucleus and adjoining structures.

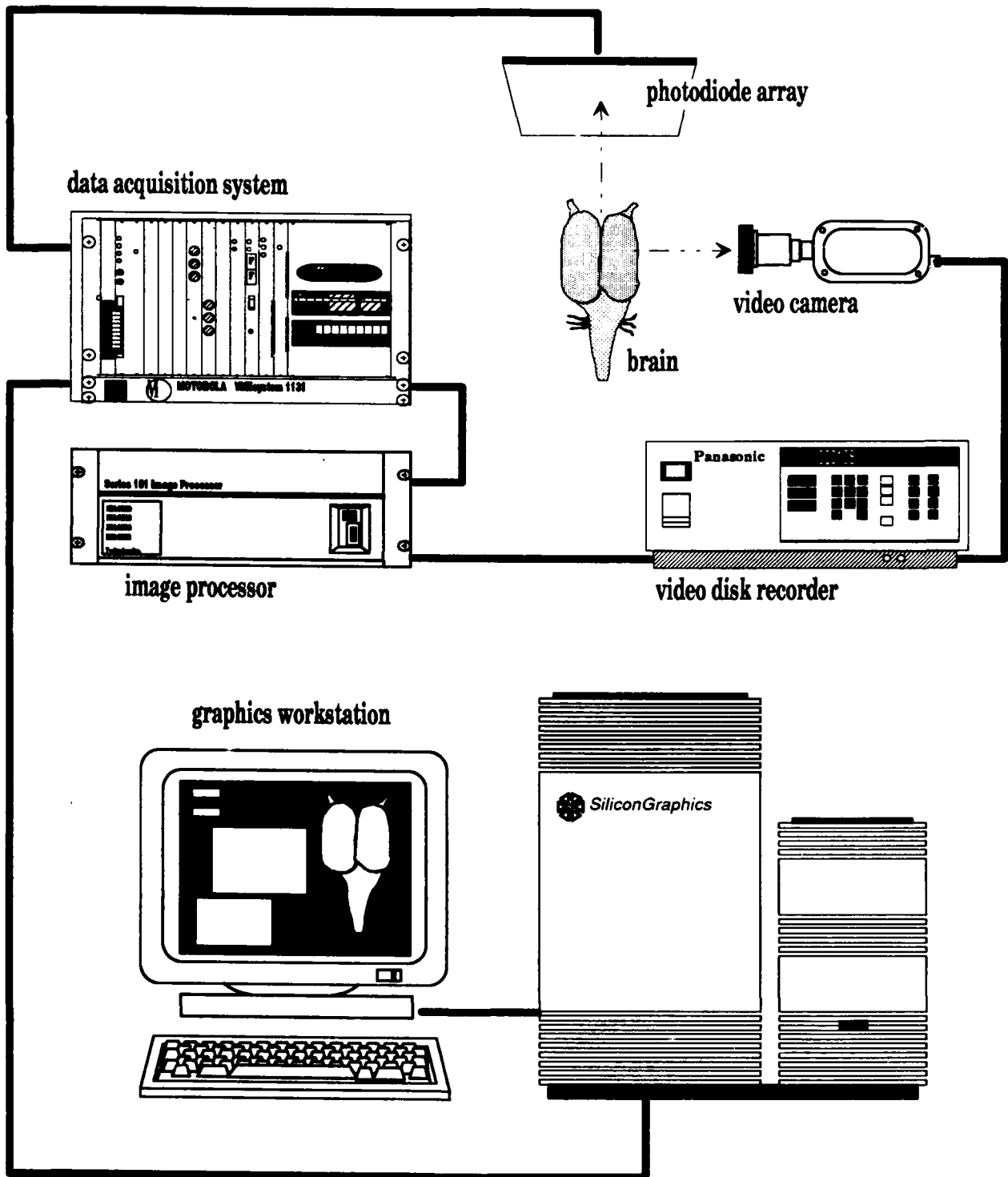
Final, we have made formal arrangements with Lt. Col. Robert M. Cartlege also at Brooks AFB (USAFSAM/RZV) to perform a pilot experiment to demonstrate the feasibility of using optical recording techniques to study information processing in the normal and laser-damaged mammalian (rabbit) retina. These initial experiments will carried-out in colaboration with Dr. Randy Glickman at the UT Health Science Center at San Antonio (UTHSCSA) would has extensive research experience with the isolated rabbit eye-cup preparation.

I have also enclosed copies of a research paper delivered this summer at a NATO Conference (Göttingen, FGR) and an abstract that has been submitted to the Society for Neuroscience. Two other research manuscripts are currently in preparation -- copies of these papers will be forwarded to your office as soon as they are accepted for publication.

### **Figure 1. Experimental Apparatus**

Major functional subsystems of the experimental apparatus to be used in the proposed research are illustrated semi-diagrammatically. Major equipment items used for multiple-site optical recording include a 464-element silicon photodiode array, and a 512-channel data acquisition system based on a Motorola VMEsystem 1147 supermicrocomputer system (25MHz MC68030 CPU, 8 MBytes RAM, 340 MByte SMD disk drive). For image capture and processing, a Hammamatsu C2400 video camera systems records a high-resolution (512 x 512 pixels), monochrome (8 bit) image of the preparation at the end of an experiment onto a Panasonic video disk recorder for archival storage. A VMEbus-based image processor (Imaging Technologies Series 150) is used to digitized and enhance the image between being written as a data file on the data acquisition system. Image and data files are transferred, in batch, over a 9600 baud line to a Silicon Graphics workstation (model 4D/80GT) for display and analysis using various display modes and options.

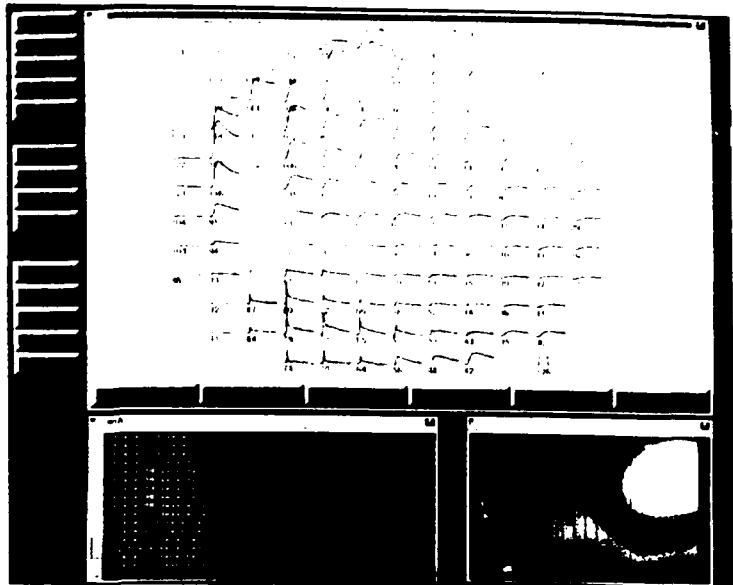
Figure 1



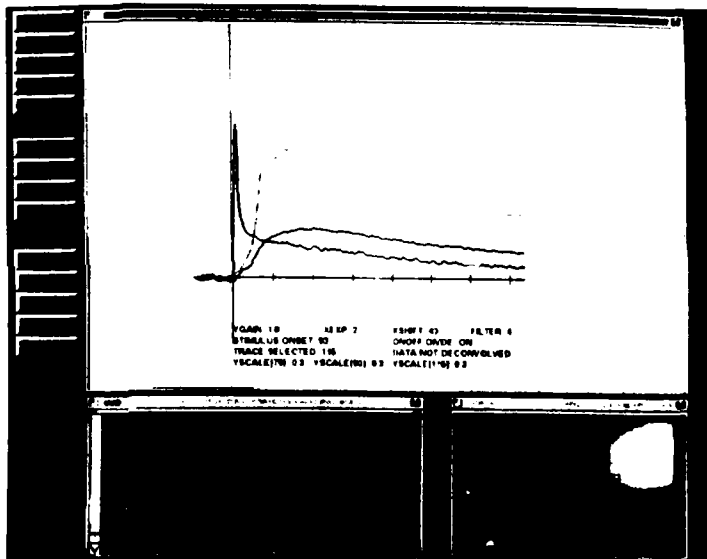
### Figure 3. Graphical User Interfaces (GUI's)

Color photographs taken directly of the screen of our Silicon Graphics workstation show the 3 main graphical user interfaces for data display and analysis. 'Radio buttons' at upper left of the screen can be 'pushed' by mouse-click to activate the different display modes (page display, examine, pam display) or manipulate diode array and image data files (e.g. read a new file, subtract one file form another, invert traces, etc.). The texport window at the lower left of the screen emulates an ASCII terminal which allows complex commands (e.g. file names) to be entered via the keyboard. Pop-up, roll-over menus, are used primarily to set various display 'flags' (e.g. norm/invert traces, figure/nonfigure mode). Three such menus are visible in the lower right corner of the large data window in the PAM display. An image of the preparation showing the recording locations of the various detector elements is present at all times during data analysis in the lower right window. In the examine mode, colored squares, matching the colored traces are used to mark the anatomical recording site of each selected trace.

PAGE  
DISPLAY



EXAMINE



PAM  
DISPLAY

