

PROJECT ADMINISTRATION DATA SHEET

ORIGINAL REVISION NO. _____

Project No. E-25-693 GTRI/~~693~~ DATE 6/22/84

Project Director: Dr. Bowlet, Book, Dickerson, and Berry School/~~1536~~ ME

Sponsor: National Science Foundation

Type Agreement: Grant No. MEA-8405772

Award Period: From 6/1/84 To 11/30/85 (Performance) 2/28/86 (Reports)

Sponsor Amount: This Change Total to Date

Estimated: \$ 37,738 \$ 37,738

Funded: \$ 37,738 \$ 37,738

Cost Sharing Amount: \$ 37,738 Cost Sharing No: E-25-321

Title: "Three Dimensional Graphics) Station for Computer Integrated manufacturing Research"

ADMINISTRATIVE DATA

OCA Contact John Boyd x4820

1) Sponsor Technical Contact:

2) Sponsor Admin/Contractual Matters:

William M Spurgeon
Production Research Program
Div. of mechanical Engineering &
Applied mechanics
National Science Foundation
(202) 357-7540 Washington, D.C.
20550

Richard B. Hastings
Monks Official
National Science Foundation
Washington, D.C. 20550
(202) 357-9626

Defense Priority Rating: n/a Military Security Classification: n/a

(or) Company/Industrial Proprietary: n/a

RESTRICTIONS

See Attached NSF Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval - Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of \$500 or 125% of approved proposal budget category.

Equipment: Title vests with GIT

COMMENTS:

* includes usual 6-month unfunded flexibility period.

COPIES TO:

Project Director
Research Administrative Network
Research Property Management
Accounting

Procurement/EES Supply Services
Research Security Services
Reports Coordinator (OCA)
Research Communications (2)

GTRI
Library
Project File
Other _____

SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 10/28/86

Project No. E-25-693 School ME

Includes Subproject No.(s) N/A

Project Director(s) Drs. Boulet, Book, Dickerson and Berry GTRC / ~~GTR~~

Sponsor National Science Foundation

Title "Three Dimensional Graphics Station for Computer Integrated Manufacturing Research"

Effective Completion Date: 11/30/85 (Performance) 2/28/86 (Reports)

Grant/Contract Closeout Actions Remaining:

- None
- Final Invoice or Final Fiscal Report
- Closing Documents
- Final Report of Inventions - Questionnaire sent to P.I.
- Govt. Property Inventory & Related Certificate
- Classified Material Certificate
- Other _____

Continues Project No. _____ Continued by Project No. _____

COPIES TO:

Project Director
 Research Administrative Network
 Research Property Management
 Accounting
 Procurement/GTRI Supply Services
 Research Security Services
 Reports Coordinator (OCA)
 Legal Services

Library
 GTRC
 Research Communications (2)
 Project File
 Other I. Newton
A. Jones
R. Embry

NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

FINAL PROJECT REPORT
NSF FORM 98A

PLEASE READ INSTRUCTIONS ON REVERSE BEFORE COMPLETING

PART I-PROJECT IDENTIFICATION INFORMATION

1. Institution and Address Georgia Institute of Technology Atlanta, GA 30332	2. NSF Program Production Research	3. NSF Award Number MEA-8405772
	4. Award Period From 6/1/84 To 11/30/85	5. Cumulative Award Amount \$37,738
6. Project Title Three Dimensional Graphics Station for Computer Integrated Manufacturing Research.		

PART II-SUMMARY OF COMPLETED PROJECT (FOR PUBLIC USE)

This project provided for the purchase of an Evans and Sutherland PS 300 color 3-D graphics system. The system has been installed in the Space Science Building in the School of Mechanical Engineering. The facility is available for any campus activity but is intended to support primarily the Computer Integrated Manufacturing Systems Program (CIMS) which is an industrially supported MS and Ph.D. educational and research program which awards approximately 100 annual certificates at the graduate level, primarily the MS. The PS 300 is tied to a VAX 11/750. The VAX hosts the analysis programs which utilize the PS 300 for graphics display, graphics processing, and interactive device data-handling. The VAX 11/750 is on the campus network so that access is provided to nearly 1000 other computers.

As a first application of the system, Mr. Gary F. Letchworth completed an MS thesis, "Computer Graphics Simulation of Two Link Flexible Manipulator Arm Motions" in April of 1986. This thesis provides (1) a useful graphics simulation to support research in control of light-weight high-speed robotics and (2) a primer in the use of the PS 300/VAX 11/750 system.

We anticipate many theses and other graduate student research uses of the system.

PART III-TECHNICAL INFORMATION (FOR PROGRAM MANAGEMENT USES)

1. ITEM (Check appropriate blocks)	NONE	ATTACHED	PREVIOUSLY FURNISHED	TO BE FURNISHED SEPARATELY TO PROGRAM	
				Check (✓)	Approx. Date
a. Abstracts of Theses		1			
b. Publication Citations					
c. Data on Scientific Collaborators					
d. Information on Inventions					
e. Technical Description of Project and Results					
f. Other (specify) MS Thesis		1			
2. Principal Investigator/Project Director Name (Typed) Wayne J. Book Stephen L. Dickerson	3. Principal Investigator/Project Director Signature			4. Date 9/11/86	

Final Project Report - Technical

**THREE DIMENSIONAL GRAPHICS STATION FOR
COMPUTER INTEGRATED MANUFACTURING RESEARCH**

NSF Grant No. MEA-8405772

This project provided for the purchase of an Evans and Sutherland PS 300 color 3-D graphics system. The system has been installed in the Space Science Building in the School of Mechanical Engineering. The facility is available for any campus activity but is intended to support primarily the Computer Integrated Manufacturing Systems Program (CIMS) which is an industrially supported MS and PhD educational and research program which awards approximately 100 annual certificates at the graduate level, primarily the MS. The PS 300 is tied to a VAX 11/750. The VAX hosts the analysis programs which utilize the PS 300 for graphics display, graphics processing, and interactive device data-handling. The VAX 11/750 is on the campus network so that access is provided to nearly 1000 other computers.

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Abstract

Computer Graphics Simulation of Two Link Flexible Arm Motions

Gary Letchworth

156 Pages

Directed by Dr. W. J. Book

Georgia Tech's Mechanical Engineering Department's Robotics and Controls Group is presently researching ways to design and control two link, two joint, lightweight, flexible manipulator arms. An Evans & Sutherland PS300 color 3-D graphics system is operated in conjunction with the Robotics VAX 11/750 computer. The purpose of this thesis is to develop the computer graphics package which will allow the PS300 to simulate flexible arm motions. The graphics software is stored on the VAX, and shipped to the PS300 when needed. The flexible arm model is built from small cube-shaped wire-frame elements. The flexible motion is composed of xyz-deflections, and axial torsion.

In order to allow the user to gain insight concerning the flexible arm's motion, the following graphics information will be displayed on the PS300: the whole arm's motion, only the flexible motion of each link, joint angle versus time graphs for each link, and flexible mode amplitudes versus time graphs for each link. The user will also be able to interactively rotate, translate, and scale the pictures of the arm and links for viewing, and will have complete control of the arm's animation.