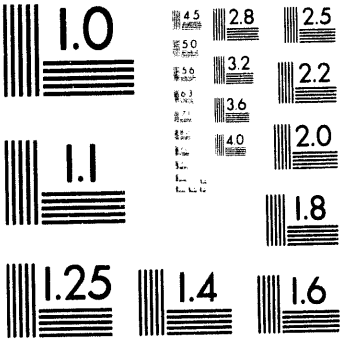
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1 of 2

LA-12646-C
Conference

UC-700
Issued: October 1993

Proceedings of the IMOG (Interagency Manufacturing Operations Group) Numerical Systems Group

62nd Meeting

February 9–10, 1993
Oak Ridge National Laboratory
Oak Ridge, Tennessee

Compiled by G. J. Maes

Los Alamos
NATIONAL LABORATORY
Los Alamos, New Mexico 87545

INTERAGENCY MANUFACTURING OPERATIONS GROUP

NUMERICAL SYSTEMS GROUP

ABSTRACT

THIS REPORT DOCUMENTS THE PROCEEDINGS OF THE 62ND MEETING OF THE IMOG NUMERICAL SYSTEMS GROUP

HELD AT

OAK RIDGE Y-12 PLANT

OAK RIDGE, TENNESSEE

FEBRUARY 9-10, 1993

IMOG / NUMERICAL SYSTEMS GROUP

62ND MEETING

CONTENTS

IMOG / NUMERICAL SYSTEMS GROUP

62ND MEETING

CONTENTS
(continued)

IMOG / NUMERICAL SYSTEMS GROUP

62ND MEETING

PARTICIPATING AGENCIES

KCD	Allied-Signal Aerospace Company Kansas City, MO
LANL	Los Alamos National Laboratory Los Alamos, NM
LLNL	Lawrence Livermore National Laboratory Livermore, Ca
PANTEX	Mason & Hanger-Silas Mason Co., Inc. Amarillo, TX
RFP	EG&G Rocky Flats, Inc. Golden, CO
SNLA	Sandia National Laboratories Albuquerque, NM
SNLL	Sandia National Laboratories Livermore, CA
Y-12	Martin Marietta Energy Systems, Inc. Oak Ridge, TN
MMSC	Martin Marietta Specialty Components, Inc. Largo, FL

IMOG

62ND MEETING

LIST OF ATTENDEES

NAME	ORGANIZATION	PHONE/FAX NUMBERS
Gene Maes *	LANL	(505)667-6567 / (505)665-5548
Dave Deck *	NDD/MMSC	(813)541-8693 / (813)541-8909
John Dunton *	SNLA	(505)844-6603 / (505)844-3343
Van Graves	Y-12	(615)576-3690 / (615)576-7649
Edwin Evans *	Pantex	(806)477-4047
Charlie R. Miller *	Allied Signal (KCD)	(816)997-4736 / (816)997-2035
Ralph J. Gladfelter **	LANL	(505)667-7501 / (505)665-3879
W. Harvey Gray	Y-12	(615)574-1476 / (615)574-3887
Dorothy W. Howell	Y-12	(615)574-1924 / (615)574-2908
Paul F. Boyer *	Y-12	(615)574-2148 / (615)574-2909
Bill Leck *	RFP	(303)566-2683
Bruce E. Affeldt *	SNL	(510)294-2293 / (510)295-1592
Ray Ford	Y-12	(615)576-4458 / (615)574-2908
Tom Bookhart	Y-12	(615)574-3139 / (615)574-5458
Colman Wright	Y-12	(615)574-1840 / (615)574-5458
Dave May	Y-12	(615)576-7239
Janie Lunsford	Y-12	(615)576-3899 / (615)574-0785
Jeniece May	Y-12	(615)574-2163

*Prime Member
**Chairman

IMOG / NUMERICAL SYSTEMS GROUP

62ND MEETING

MINUTES

CALL TO ORDER AND WELCOME

NSG Chairman, Ralph Gladfelter, called the 62nd NSG meeting to order at 8:30 a.m. on February 7, 1993.

Following Paul Boyer's host announcements, he introduced Margaret Morrow, Defense Program Manager for Y-12 Plant. Ms. Morrow gave the welcoming address to NSG members.

MINUTES OF 62ND MEETING

The minutes of the 61st NSG meeting were accepted and approved as published.

AGENDA FOR 62ND MEETING

The 62nd meeting agenda and lunch/dinner arrangements were finalized.

NEW BUSINESS

Bruce Affeldt from SNL was nominated as Vice Chairman.

The need to revise the NSG Charter is to be discussed at the next meeting.

Participation and consolidation of NSG prime member's input to the IMOG STRATEGIC PLANNING INPUT PROCESS was discussed.

AGENDA

62ND IMOG/NSG MEETING

HOST FACILITY
MARTIN-MARIETTA ENERGY SYSTEMS
OAK RIDGE, TENNESSEE
FEBRUARY 9-10, 1993

TUESDAY, FEBRUARY 9, 1993

7:30 Pick Up Badges at Visitor Control - Assembly Station #15

8:00 Assemble in Building 9201-5 - Training Room, Room OM-10

View 12 Minute Training Film

8:30 Convene the 62st IMOG/NSG Meeting ..... Ralph Gladfelter, Chairman

Host Welcome and Introduction of Guest Speaker ..... Paul Boyer, Y-12

Y-12 Management Welcome..... Margaret K. Morrow, Y-12
(Defense Program Manager)

Host Announcements, Tours, Lunch Arrangements, etc ..... Paul Boyer, Y-12

Introduction of Members and Guests..... Ralph Gladfelter, Chairman
(Name, Agency, Position or Responsibilities)

Corrections to Minutes of 61st NSG Meeting

Revisions to Agenda for 62nd NSG Meeting

1992 NSG Annual Report to Steering Committee..... Gene Maes, LANL

10:00 Break

10:15 Training CMM Operations..... L. E. Cochran, Y-12

IBH Controls..... Edwin Evans, Pantex

Automatically Programmed Metrology Update ..... Van Graves, Y-12

TUESDAY, FEBRUARY 9, 1993
CONTINUED

11:30	Martin Marietta, Y-12 Productionizing Anvil 5000	W. Harvey Gray, Y-12
12:00	Lunch	
1:00	Roundtable Topic: "Introduction of Rapid Prototype Machine"	
	Hardware Software and Environmental Concerns	
	Elected Vice Chairman	
1:15	Accord Project	Charlie Miller
1:45	SNLA "Accord"	John Dunton, SNLA
2:00	Break	
2:10	Tool Path	J. D. May, Y-12
	Demo MFG	Janie Lunsford, Y-12
	Certify	J. V. May, Y-12
3:00	Tour M-60 Inspection Machine	Nick Zurcher, Y-12
	Dinner Arrangements	

WEDNESDAY, FEBRUARY 10, 1993

8:00 Meet in Conference Room

8:15 DNC Phase II at LANL ..... G. Maes, LANL

Roundtable Topic: "IMOG Strategic Planning Input," Charter

9:00 Roundtable Topic: "Site Activity Reports" ..... Prime Members

Brief Summary of Current and Planned Procurement Activities and/or Project Status Associated with New N/C Equipment, Graphic Workstations Generalized Post Processors, N/C Verification Packages, etc.

Spline Usage Method ..... Ralph Gladfelter, LANL

Y-12 N.C. Engineering Status..... Paul Boyer, Y-12

10:00 Break

10:15 Consolidate NSG's Strategic Planning Input to be Presented to the Annual Steering Committee Meeting. Review Revised Charter

10:30 Y-12 Mfg CAD Systems ..... R. H. Ford, Y-12

Comments from Steering Committee Member(s)..... Dave Post

Establish Next Meeting Site and Date

12:00 Adjourn

APPENDIX A

IMOG NUMERICAL SYSTEMS GROUP ANNUAL REPORT FOR 1992 PRESENTED TO IMOG STEERING COMMITTEE

Presented by:

Gene J. Maes
Los Alamos National Laboratory
Los Alamos, New Mexico

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

TECHNICAL INFORMATION RELEASE

(Instructions on back.)

TELEPHONE 7-5013
TA-3, SM-43, ROOM NUMBER A362

This form is to be completed and submitted to OS-6, Classification Group, with copies as required of abstract or paper BEFORE any presentation or submittal for publication is made of the technical work of the Laboratory. LA-UR cover (Form 836) required on all copies of full papers. For LA-series reports, use green Form 595. **Allow three days for review.** For complete policy on publications, refer to Laboratory Manual 4.
APPROVALS: Division(s) approval REQUIRED on all submittals.

COPIES REQUIRED BY CLASSIFICATION GROUP		LA-UR/LA-CP
One of this form	Three of unclassified full paper (Cover required)	LA-CP-93-002
Two of unclassified abstract (Cover optional)	One of classified abstract/paper	

1. AUTHOR(S) (Full name and group affiliation)	2. AUTHOR(S) (Signature and date)
Gene J. Maes, WX-3	Gene J. Maes

3. Title of Article (in caps) (Spell out all symbols)
IMOG Numerical Systems Group Annual Report

4. ☒ Abstract ☐ Full Paper ☐ Other
Intended for: ☐ Journal ☐ Proceedings ☒ Meeting ☐ Talk ☐ Other
Controlled Meeting/Journal ☐ Yes ☐ No
Particulars:
IMOG STEERING COMMITTEE MEETING
LARGO, FL
December 9-10, 1992

5. List numbers of previous reports that might be useful to reviewer.

6. Research sponsored by: ☒ DOE ☐ DOD ☐ NRC ☐ Other 7. Funding agency release required ☐ Yes ☒ No COPY ATTACHED ☐ Yes ☐ No	Program Code: CW10
8. Deadline Date	Group Office Telephone: 667-6310 / Mail Stop: C930
9. Derivative Classifier's Signature: DC Hollis	Date: 12/3/92 ☐ Classified ☐ Unclassified, limited. Explain: ☒ Unclassified
10. Division(s) Signature and Date: A L Aldrich 12-4-92	

CLASSIFICATION GROUP

Date Received	DOE/NRC Category.	Group/Author Notification of Release
Reviewer	Date	☐ U ☐ C ☐ S ☐ RD ☐ FRD ☐ NSI ☐ UCNI ☐ ECI For NSI: Guide _____ Duration _____

PATENT LAW

Patent Interest ☐ Yes ☐ No	Docket Number	Patent Law Reviewer and Date
Comments:		

Abstract
Fall 1992 IMOG Steering Committee Meeting
December 9-10, 1992
Largo, Florida

Gene J. Maes
Weapons Prototype WX-3
Los Alamos National Laboratory
Los Alamos, New Mexico

DATE AND LOCATION OF MEETINGS:

The Fall (61st) meeting was held at Sandia National Laboratories, in Livermore, California on October 8,9_and 10, 1991.

FALL (61st) MEETING:

Main Areas of Information Exchange:
1. Sterolithography Systems Status at NWC
2. DNC Acquisition and Update
3. Rapid Prototyping

FUTURE MEETINGS:

The NSG subgroup plans to continue holding two meetings per year, provided funding is available. The first meeting is scheduled at Y-12 Plant, Oak Ridge Tenn., and the fall 1993 meeting is tentatively planned to be held at Pantex.

1992 Annual Steering Committee

IMOG
NUMERICAL SYSTEMS GROUP
ANNUAL REPORT FOR
1992
PRESENTED TO
IMOG STEERING COMMITTEE

Gene J Maes
NC/Process Coordinator
Alternate Chairmen

PREPARED FOR SUBMISSION TO 1992 MEETING OF
IMOG
STEERING COMMITTEE

Martin Marietta Specialty Components Inc.
Largo, Florida
December 9-10, 1992

NSG MEETING AND ATTENDEES

FALL MEETING IN 1991

At
Sandia National Laboratories
Livermore, Califromia

October 8-10, 1992

9 - NSG Members
14 - Participants
8 - Agencies Represented

NO MEETING IN 1992

IMOG / NUMERICAL SYSTEM GROUP

61ST MEETING

LIST OF ATTENDEES

ATTENDEES	FACILITY	POSITION/TITLE	FTS NO.
Bruce Affeldt *	SNLL	Mfg. Tech. Support	234-2293
Judy Tejada	SNLL	Technical Applications	294-1275
Larry Wyrick *	KCD	IS Section Supervisor	997-4740
Edwin Evans *	PANTEX	Sr. Engineer	477-4047
Gene J. Maes *	LANL	Process Coordinator	843-6567
Scott W. Green *	LLNL	Computer Scientist	543-9836
Edwin Wyman	LLNL	Guest (Retired)	NA
Kenneth R. Hernandez	LLNL	Machinist/Programmer	543-7187
John Dunton *	SNLA	NC Engineer	844-6603
Paul Boyer *	Y-12	Dept. Head NC Engineering	624-2148
Van B. Graves *	Y-12	Development Engineer	626-3690
Leroy Mellecker *	RF	NC Applications Manager	345-2775
Rick Wayne	SNLL	Dir. of Comp. & Sys. Research	
Pete Witze	SNLL		

* NSG Prime Member
** Steering Committee Representative

IMOG / NUMERICAL SYSTEMS GROUP

61ST MEETING

PARTICIPATING AGENCIES

KCD	Allied-Signal Aerospace Company Kansas City, MO
LANL	Los Alamos National Laboratory Los Alamos, NM
LLNL	Lawrence Livermore National Laboratory Livermore, CA
PANTEX	Mason & Hanger-Silas Mason Co., Inc. Amarillo, TX
RFP	EG&G Rocky Flats, Inc. Golden, CO
SNLA	Sandia National Laboratories Albuquerque, NM
SNLL	Sandia National Laboratories Livermore, CA
Y-12	Martin Marietta Energy Systems Inc. Oak Ridge, TN

IMOG / NUMERICAL SYSTEMS GROUP

61ST MEETING

MINUTES

CALL TO ORDER AND WELCOME

NSG Chairman, Leroy O. Mellecker, called the 61st NSG meeting to order at 8:30 a.m. on October 8, 1991.

Following Bruce Affeldt's host announcements, he introduced Rick Wayne, Director of Component & System Research at SNLL. Mr. Wayne gave the welcoming address to NSG members.

MINUTES OF 60TH MEETING

The minutes of the 60th NSG meeting were accepted and approved as published.

AGENDA FOR 61ST MEETING

The 61st meeting agenda and lunch/dinner arrangements were finalized.

NEW BUSINESS

Dave Deck's resignation as Vice Chairman was announced.

Ralph Gladfelter from LASL was nominated to be his replacement. Since Ralph was not able to attend this meeting, acceptance had to be deferred until both Ralph and his management could be contacted.

Ed Wyman retired from LLNL, and Scott Green will take his place as prime member.

The need to revise the NSG Charter is to be discussed at the next meeting. (See Appendix Q)

Participation and consolidation of NSG prime member's input to the IMOG STRATEGIC PLANNING INPUT PROCESS was discussed. (See Appendix S)

61ST IMOG/NSG MEETING AGENDA

SANDIA NATIONAL LABORATORIES, LIVERMORE
LIVERMORE, CA
OCTOBER 8-10, 1991

TUESDAY, OCTOBER 8, 1991

7:30 **Pick up Badges at Visitor Control - Building 911**

8:00 **Assemble in Building 910 - Conference Room 201**

8:30 **Convene the 61st IMOG/NSG Meeting** ..... Leroy Mellecker, Chairman

Host Welcome and Introduction of Guest Speaker ..... Bruce Affeldt, SNLL

SNLL Management Welcome ..... Rick Wayne, SNLL
(Director of Component & Systems Research at SNLL)

Host Announcements, Tours, Lunch Arrangements, etc. ..... Bruce Affeldt, SNLL

Introduction of Members and Guests. ..... Leroy Mellecker, Chairman
(Name, Agency, Position or Responsibilities)

Corrections to Minutes of 60th NSG Meeting

Revisions to Agenda for 61st NSG Meeting

1990 NSG Annual Report to Steering Committee. ..... Leroy Mellecker, EG&G RF

10:00 **Break**

10:15 **N/C Measures of Performance** ..... Paul Boyer, Y-12

Advanced N/C Project ..... Larry Wyrick, KCD
(Presentation and 32 minute video)

Update on the DNC System at LANL ..... Ralph Gladfelter, LANL

12:00 **Lunch**

TUESDAY, OCTOBER 8, 1991
(continued)

1:00 **Roundtable Topic: "The Necessity of a Solid Modeler in the N/C Environment"**

What type of solid modeler based system is best suited for N/C tool path generation? Should the solid modeler for N/C be different than that used for mechanical design?

1:30 **Utilization of CAD/CAM Systems for N/C** ..... Prime Members
(Current Status, Problems, Benefits, Future Plans, etc.)

SNLA ..... John Dunton, SNLA
[(Basic overview of "Accord" - CAD/CAM/CAE Joint Project between Sandia National Laboratories and Allied-Signal (KCD)]

Martin Marietta, Y-12 ..... Paul Boyer, Y-12
(Evaluation status of ProEngineer)

CAD Systems Evaluation at LASL ..... Ralph Gladfelter, LANL

2:00 **Break**

2:15 CATIA Implementation at Rocky Flats ..... Leroy Mellecker, EG&G RF

ComputerVision at SNL, Livermore ..... Bruce Affeldt, SNLL

ICEM/DDN at KCD ..... Larry Wyrick, KCD

UNIGRAPHICS at LLNL ..... Scott Green, LLNL

3:00 ANVIL Turning Tasks ..... Paul Boyer, Y-12

3:30 **Acquisition of a Generalized Postprocessor** ..... Edwin Evans, PANTEX

4:00 AMP/AIM ..... Van Graves, Y-12

Dinner Arrangements

WEDNESDAY, OCTOBER 9, 1991

8:00 **Meet in Conference Room**

8:30 **Site Tours**
(Arrangements have been made to tour Sandia's CAD/CAM and Shop Areas)

9:30 **Roundtable Topic: "Alternative to the Wilson-Fowler Spline"**

(Preliminary review of spline comparisons
of different systems) ..... Ralph Gladfelter, LASL

10:00 **Break**

10:15 **Instrumentation on Spark Ignition Engine Research** ..... Pete Witze, SNLL

ES&H Issues for Stereolithography ..... Judy Tejada, SNLL

Stereolithography Apparatus (SLA) ..... Larry Wyrick, KCD
(Presentation and 15 Minute Video)

Current Status of Stereolithography at SNLA ..... John Dunton, SNLA

12:00 **Lunch**

1:00 **Acquisition of a DNC System for Pantex** ..... Edwin Evans, PANTEX

Status Report on DNC System at LANL ..... Gene Maes, LANL

Roundtable Topic: "The Current/Future Impact of Tiger Team and I&E Security Requirements on NC Operations"

2:00 **Break**

2:15 **Roundtable Topic: "IMOG Strategic Planning Input"**

Come prepared to discuss NSG's Strategic Planning Input
to be presented to the Annual Steering Committee Meeting
at GEND November 20 and 21, 1991.

3:00 **Business Planning Session:**

- Review of NSG Charter
- Frequency of NSG Meetings
- Management's Perception/Support of IMOG
- IMOG/NSG Benefits (Tangible and Intangible)
- Direction/Theme of Future NSG Agendas
- Nomination of new Vice-Chairman

Numerical Systems

Subgroup Member	Y-12	SNLL	SNL
A. Business Drivers	1. One CAD/CAM system for weapons design needed 2. Part programming system independent of CAD system needed	1. Improve quality 2. Reduce duplication of effort 3. Reduce cost of NC prog. /Mfg. 4. Contacts with other DOE agencies	1. Reduce time required for process planning/part programming 2. Improve present techniques for special equip. 3. Increase quality-using verification techniques
B. Process Development Objectives	1. Mfg. methods standards material removal and cert. 2. Real time simulation/ verification systems for NC tool paths 3. Develop turning system user friendly/productive	1. Maintain compatibility Wilson/Fowler spline 2. Standardize Stereolithography operations 3. Make use of other Labs equipment	1. Part programming from model database 2. Integrated system for probe programming 3. Realistic solid model verification capability
C. MFG or Lab Key Process Operational Problems	1. Comprehensive computerized process planning system needed 2. Comprehensive planning system needed 3. Common focal point for all development and automation activities needed	1. Standard test for spline	1. Solid modeling 2. Auto-process planning 3. NC Verification
D. Subgroup Member Focus or Interest	1. Planning and scheduling with little cost 2. Prioritize procurement of NC SW/HW needed 3. Common postprocessor within NWC to permit sharing of data	1. Postprocessors 2. Spline data 3. Mfg. capabilities 4. Stereolithography	1. Incompatible CAD databases 2. Inefficient/incomplete CAD/CAM, NC programming methods 3. Limited automated process planning capabilities

Numerical Systems

Subgroup Member	LANL	LLNL	KCD
A. Business Drivers	1. Reduce material waste 2. Develop probing programs 3. Standardize NC Controls	1. Integrate CAD/CAM/CAE 2. Minimize HW/SW, costs maintenance 3. Diversify customer base to avoid over reliance on traditional customers	1. Improve quality of NC programs 2. Decrease flow time to produce NC programs 3. Provide capability to support new technologies (FMS, off-line CMM support, machining probing)
B. Process Development Objectives	1. Use solid modeling for part programs 2. Integrate DNC system 3. Real time scheduler	1. CALS/EDI/EC 2. Computer-aided Inspection	1. Advance NC capability, utilizing CAM-I concepts 2. Methodology/capability for supporting on-machine probing by a more automated method 3. Flexible Manufacturing System implementation and production start-up
C. MFG or Lab Key Process Operational Problems	1. One CAD for drawings and one for NC 2. Outdated equipment	1. Wilson-Fowler support 2. Postprocessor maint. and development in multi CAD/CAM system environment 3. Lab wide integration	1. Incorporation of changes introduced on the shop floor 2. Move to less manpower intensive method of postprocessors such as generalized post 3. Graphical support for NC tool path generation by commercial CAD/CAM/CAE systems
D. Subgroup Member Focus or Interest	1. New NC controls 2. In house DNC System 3. New equpment verification	1. Parametric modeling 2. Applications in Mfg. 3. PDES	1. On-machine probing, methods techniques, support software, and standards 2. Next generation CAD/CAM/CAE systems based on solid modelers 3. Continuous improvement or TQM ideas for NC manufacturing support

IMOG / NSG

TANGIBLE BENEFITS:

	Potential Savings
o Sharing of a postprocessor for a 4-axis lathe by KCD to Y-12	$10,000
o As a direct result of a live demonstration of Vericut software at a NSG meeting, KCD and other sites did not buy more expensive, less efficient tool path verification systems they were evaluating.	$10,000/site
o Transfer of APT part programs from Rocky Flats to Y-12 for the machining of Uranium components.	$500 - $1,000/ part program

IMOG / NSG

INTANGIBLE BENEFITS:

- Sharing of Information:
  - Minutes
  - Meetings and Tours
  - Telephone and FAX
  - Directory of Contacts
- Improvements as a Result of Roundtables:
  - Software Quality Assurance
  - Controls for programs at the shop floor
  - DNC data transfer and verification
  - CNC selection and use of options
- Sharing and Exchange of Software:
  - Postprocessors
  - Graphic Programming Techniques
  - NC Software Maintenance Systems
- Sharing of Resumes and Personnel Availability:

Advantages for Continuing IMOG/Subgroup

In spite of the changing missions within the NWC, Numerical Control is still a viable resource whose expertise is and will be required today and in the future to support the reduced NWC weapon workload. To lose this valuable Nation Resource within the NWC and the exchange and sharing of successes, failures, and resources would be a crime at least in my mind.

I certainly hope the Steering Committee is aware that the changing NWC mission has severely affected most NC Organizations within The NWC complex proportional to the effect on touch labor. They all have become smaller, however, the talent within them that helped win the cold war is still there, and is still a force that is ready to address the part programming requirements that a new mission to the table. To allow the IMOG Numerical Systems Subgroup to wither and die would be a Travesty

Paul Boyer
Y-12 Plant

IMOG/NSG

FUTURE MEETINGS

February, 1993
Y-12 Plant
Oak Ridge, Tennessee

Fall 1993 Meeting

October, 1993
Pantex Plant
Amarillo, Texas

Administrative Changes

Membership should remain the same, Retirements?
A new Vice Chairman to be nominated

LOS ALAMOS

WX-3 -- WEAPONS PROTOTYPE GJM 12-9-92

CHARTER
FOR
THE IMOG NUMERICAL SYSTEMS GROUP

Purpose

The Interagency Manufacturing Operations Group (IMOG) is established to encourage and coordinate information exchange within the Nuclear Weapons Complex (NWC) in order to improve the manufacturing process of weapon components and assemblies.

The Numerical Systems Group (NSG) of the IMOG is established to exchange information, views, and ideas on numerical control technology and other computer-based systems involved in the related engineering design and manufacturing processes of weapons parts and assemblies. This exchange is designed to promote the advancement of the technology of this field of endeavor, especially within the participating NWC facilities.

NSG Functions

1. Hold periodic meetings in which technical information on timely subjects and current problems is presented and discussed.

2. Publish the minutes of all Group meetings and disseminate pertinent technical data presented at these meetings.

3. Encourage all members to participate actively in group meetings by presenting papers and talks.

4. Maintain liaison with other IMOG groups and appropriate agencies.

Scope

Areas of interest which shall concern the Numerical Systems Group may include the following:

1. Computer programs and programming systems which apply to computer-assisted engineering design and manufacturing.

2. Methods and techniques which will promote uniform and compatible results within the participating agencies.

3. New techniques, methods, materials, and equipment within the broad technology of numerical systems.

4. Surveys of kinds and distribution of numerical systems equipment, used or proposed, within the participating agencies.

APPENDIX B

CHARTER
FOR
THE IMOG NUMERICAL SYSTEMS GROUP

5. The transmission of numerical design and manufacturing data and information between participating agencies.

6. The unified viewpoint of the group in its regulations with other organizations in the same and related fields of interest.

7. Training of personnel for the various functions within the numerical systems field.

Activities

The specific activities of the Numerical Systems Group shall include the following:

To hold meetings at least semi-annually for the purpose of conducting the business of the group.

To form task groups to study special mutual problems and areas of interest.

To make, where appropriate, recommendations for uniform practices and techniques within the participating agencies.

To publish and distribute, to appropriate agencies, the results of surveys, task group studies, and other activities of the group.

To define and maintain a glossary of terms appropriate to the numerical systems field, not covered elsewhere.

To develop or review new programs, systems, languages for possible adoption by the participating agencies.

Membership

Each NWC weapons facility directly concerned with the development or production of nuclear weapon components or assemblies is invited to appoint one prime representative to the IMOG Numerical Systems Group. Some facilities may feel that it is necessary to appoint additional sustaining members to properly represent diverse organizational interests.
A prime member unable to attend a meeting may appoint a responsible alternate as his representative.

Voting

Where necessary to fulfill the purpose, function, and activities within the scope of this group, the following voting procedure is established: Only the prime member from each participating facility or his appointed alternate shall have a vote.

APPENDIX B

CHARTER
FOR
THE IMOG NUMERICAL SYSTEMS GROUP

5. The transmission of numerical design and manufacturing data and information between participating agencies.

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Voting

Where necessary to fulfill the purpose, function, and activities within the scope of this group, the following voting procedure is established: Only the prime member from each participating facility or his appointed alternate shall have a vote.

Meetings

Meetings are to be rotated among the participating facilities sites or at other sites as decided by the members of the NSG.

Election of Officers

The Nominating Committee will present the names of the nominees to the NSG as soon as practicable after the Nominating Committee meeting. Additional nominations will then be entertained from the floor. If there are additional nominations, the Chairman and Vice Chairman will then be elected by secret ballot and the results announced immediately after the ballots are counted. If there are no additional nominations, the NSG will accept the officer nominated by the Committee.

Organization

A chairman and Vice Chairman shall be elected by the NSG prime members to serve for two years.

Duties of Chairman:

1. Notifying members of the time, place, and agenda for meetings.

2. Presiding over meetings.

3. Issuing meeting minutes and various reports to members and other concerned individuals.

4. Appointing, guiding, and terminating working teams to conduct specific assignments.

5. Serving as the official spokesman for the NSG.

6. Maintaining appropriate communication with the IMOG Steering Committee and other groups.

   Arranging for the election of a new Chairman and a new Vice Chairman. At the last meeting of his two year term of office, he will appoint a Nominating Committee, consisting of no less than three prime members, which will nominate a new Chairman and Vice Chairman.

   The Vice Chairman shall succeed to the Chair upon notification that the current Chairman intends to withdraw from his position. In the absence of the Chairman, the Vice Chairman shall temporarily assume the duties of the Chairman.

The Chairman may appoint a Secretary to assist him. For convenience in coordinating administrative matters, the Secretary may be selected from the Chairman's organization. The Secretary's duties shall include preparation and distribution of meeting notices, minutes, and reports and maintenance of the official records of the group.

Charter Approval and Amendment

The charter will be in effect as soon as it is approved by the Steering Committee. Once established, the charter may be amended by majority vote of the group and concurrence by the Steering Committee.

APPENDIX C

Y-12 DIMENSIONAL INSPECTION COORDINATE MEASURING MACHINE TRAINING PROJECT

Presented by:

L. E. Cochran
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

UCN-7721B (2 1-86) MCB 1/28/93

OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No.	Author's Telephone No.	Acct. No.	Date of Request
Y/EN-4849	6-8210	7410-65-0690	01/19/93

Unclassified Title: Y-12 Dimensional Inspection Coordinate Measuring Machine Training Project (U)

Author(s): L. E. Cochran

TYPE: ☐ Formal Report ☒ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☒ Oral Presentation (identify meeting, sponsor, location, date): IMOG/NSG 62nd Meeting 9201-5, Y-12 PLANT, Oak Ridge, TN 37831

☐ Journal Article (Identify Journal): Interagency Mechanical Operations Group Minutes

☐ Other (Specify):

Document will be published in proceedings ☐ No ☒ Yes

Document will be distributed at meeting ☐ No ☐ Yes

Document has patent or invention significance ☒ No ☐ Yes (Identify)

Document has been previously released ☒ No ☐ Yes (Reference)

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

Title(s): (U) Abstract: (U)

DOCUMENT: Level (U) Category (U)

B.T. Bouye — Signature — 1/25/92 — Date

DOCUMENT REQUEST APPROVED (Division or Department)

Signature — Date

Signature — Date

THE REMAINDER OF THIS FORM TO BE COMPLETED BY THE TECHNICAL INFORMATION OFFICE

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☐ Internal Distribution

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M-3679 Category: _____

ANNOUNCE IN: ☐ AWDR (Available from OSTI) ☐ ANCR

Distribution:	UCN-7721B	DOE F-1332.15	Document
Y-12 Central Files	Y-12 RC	Y-12 RC	Y-12 RC
TIO File			
L.E. Cochran			

Distribution Remarks: Cleared for release to the NWC (Limited to the NWC caution notice)

APPROVAL AND RELEASE

Date Received	Date Initiated
1-27-93	1-27-93

☒ CLASSIFICATIONS:

Title(s): U Abstract: NA

DOCUMENT:

Level U Category -

Weapons Data - Sigma -

Y-12 Classification Office — 1/28/93 Date

☐ Editor — Date

☒ Patent Office — 1/29/93 Date

☐ Other — Date

☐ Other — Date

APPROVED FOR: ☐ Declassification ☐ Release subject to use of the following admonitory markings and conditions:

☒ Disclaimer ☐ Copyright ☐ Patent Caution ☒ Other Limited to the NWC caution notice

Technical Information Office — 1/29/93 Date

Conditions/Remarks

Y-12

OAK RIDGE
Y-12
PLANT

MARTIN MARIETTA

Y-12 DIMENSIONAL INSPECTION COORDINATE MEASURING MACHINE TRAINING PROJECT (U)

L. E. COCHRAN

NUMERICAL CONTROL ENGINEERING DEPARTMENT
ENGINEERING DIVISION

62ND IMOG/NSG MEETING

Y-12 Plant

February 9-10, 1993

PREPARED BY THE
OAK RIDGE Y-12 PLANT
OAK RIDGE, TENNESSEE 37831

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE
U. S. DEPARTMENT OF ENERGY
UNDER CONTRACT DE-AC05-84OR21400

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Y-12 DIMENSIONAL INSPECTION COORDINATE MEASURING MACHINE (CMM) TRAINING PROJECT

L. E. COCHRAN

62ND IMOG/NSG MEETING
Y-12 PLANT FEBRUARY 9-10, 1993
OAK RIDGE TN

MARTIN MARIETTA

OAK RIDGE Y-12 PLANT, MANAGED BY MARTIN MARIETTA ENERGY SYSTEMS INC. for the U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

Dimensional Inspection

Coordinate Measuring Machine (CMM)

Training Project

In

Development

- PROJECT TEAM
  - PROCEDURES - - - - - - BOB HAYES
  - TRAINING - - - - - - - - R. L. LUTTRELL
  - D.I. ENGINEERING - - - BOYD BIBEE
  - N.C. ENGINEERING - - - BILL ADKINS
  - N. C. ENGINEERING - - LONNIE COCHRAN

- TWO LEVELS OF TRAINING
  - LEVEL I - - - OPERATOR LEVEL
  - LEVEL II - - OPEN - SETUP LEVEL

- LEVEL I DEVELOPMENT - WHAT'S NEEDED
  - OPERATING PROCEDURE - LEITZ & ZEISS/MAUSER
  - OJT LESSON PLAN/TEST/PDC'S
- OTHER TRAINING
  - OJT INSTRUCTIONS - (Y-12)
  - INTRO TO MICRO - COMPUTERS - (TSI)
  - INTRO TO DOS - (TSI)
  - GEOMETRIC DIM. & TOLERENCES - (PELLISSIPPI STATE)

'/92

Operation of a Leitz Coordinate Measuring Machine (CMM) Dimensional Inspection

PROGRAM: Operation of a Leitz CMM — **DELIVERY:** Clsrm/OJT

Dimensional Inspection — **PROGRAM #:**

TERMINAL OBJECTIVE:

Given a work assignment, Leitz Coordinate Measuring Machine and personal safety equipment safely operate the machine in accordance with procedure 50-65-DI-xxx.

Modules:

Leitz CMM Overview
Given classroom instruction the trainee shall demonstrate general knowledge of the Leitz CMM training program.

Leitz CMM Introduction
Given classroom instruction the trainee shall demonstrate knowledge of definitions and responsibilities in accordance with procedure 50-65-DI-xxx by passing a written examination with 80 % accuracy.

Leitz CMM Computer and Machine Care
Given classroom instruction and demonstration the trainee shall demonstrate knowledge of proper care and use of magnetic media and computer equipment in accordance with good computer use and care by passing a written examination with 80% accuracy.

Leitz CMM Cold Machine Start-Up and Shutdown Procedures
Given demonstration and instruction the trainee will be able to perform Cold Start-Up and Shutdown Procedures per procedure 50-65-DI-xxx by successful completion of a Performance Documentation Checklist (PDC).

Leitz CMM Operating Instructions and Probe Configurations
Given classroom instruction and demonstration the trainee will be able to use NC Operator Instructions, use the CMM probe catalog, properly replace probes and install probes correctly in accordance with the Configuration Control of NC Part Programs, CMM Probe Catalog and Leitz Mescal Operating Instructions by passing a written examination with 80 % accuracy.

Leitz CMM Software Menu Functions and Control Panel Operations
Given demonstration and classroom instruction the trainee shall demonstrate knowledge of the Software Menu Functions and Control Panel operations in accordance with Leitz Mescal Operating Instruction by passing a written examination with 80% accuracy and successful completion of a Performance Documentation Checklist (PDC).

Operation of a Leitz Coordinate Measuring Machine (CMM) Dimensional Inspection

Leitz CMM Calibration, Calibration Check and Rotary Table Theory
Given classroom instruction the trainee shall demonstrate knowledge of Calibration, Calibration Check and Rotary Table Theory in accordance with Leitz Mescal Operating Instructions by passing a written examination with 80 % accuracy.

Leitz CMM Data Output Generation Overview
Given classroom instruction the trainee shall demonstrate knowledge of Leitz CMM Data Output Generation in accordance with Configuration Control of NC part Programs by passing a written examination with 80 % accuracy.

Leitz CMM Fixture and Part Orientation
Given demonstration and classroom instruction the trainee shall demonstrate fixture selection, and part alignment in accordance with Leitz Mescal Operating Instruction by successful completions of a Performance Documentation Checklist (PDC).

Leitz CMM Selection and Execution of NC Part Programs
Given demonstration the trainee shall demonstrate the proper selection, loading and execution of a NC Part Program in accordance with 50-65-DI-xxx by successful completion of a Performance Documentation Checklist (PDC).

Leitz CMM Whirligig Run
Given demonstration the trainee shall demonstrate an NC Whirligig Run in accordance with 50-65-DI-xxx by successful completion of a Performance Documentation Checklist (PDC).

Leitz CMM Evaluation of Machine Problems
Given classroom instruction the trainee shall demonstrate knowledge of evaluation and corrective actions of machine problems in accordance with 50-65-DI-xxx by passing a written examination with 80% accuracy.

Martin Marietta Energy Systems
Quality Services Division

Leitz CMM Course Outline
7/92

Leitz CMM Overview		Classroom	Oral	45 minutes
Leitz CMM Introduction		Classroom	Examination	1 hour
Leitz CMM Computer and Machine Care		Classroom	Examination	30 minutes
Leitz CMM cold Start-up and Shutdown Procedures		Machine/OJT	Performance Documentation Checklist(PDC)	Flexible
Leitz CMM Operating Instructions and Probe Configurations		Classroom - Machine/OJT	Examination/PDC	Flexible
Leitz CMM Software Menu Functions & Control Panel Operations		Classroom - Machine/OJT	Examination/PDC	Flexible
Leitz CMM Calibration, Calibration Check and Rotary Table Theory		Classroom - Machine/OJT	Examination	Flexible

Leitz CMM Course Outline (Continued)
7/92

Leitz CMM Data Output generation Overview		Classroom	Examination	Flexible
Leitz CMM Fixture and Part Orientation		Machine/OJT	Performance Documentation Checklist(PDC)	Flexible
Leitz CMM Selection and Execution of N.C. Part Programs		Machine/OJT	Performance Documentation Checklist(PDC)	Flexible
Leitz CMM Whirligig Run		Machine/OJT	Performance Documentation Checklist	Flexible
Leitz CMM Evaluation of Machine Problems		Classroom	Examination	2 hours

SUBJECT: LEITZ COORDINATE MEASURING MACHINE (CMM) (R)

I. PURPOSE

To provide a procedure for operating a Leitz Coordinate Measuring Machine (CMM).

II. SCOPE/LIMITATIONS

Applicable to the operation of all Dimensional Inspection Department Leitz Coordinate Measuring Machines (CMM).

WARNING

Some machines are located in dryboxes having oxygen deficient atmospheres. ALL Dimensional Inspection personnel are prohibited from entering dryboxes.

NOTE: The use of "machine" "Coordinate Measuring Machine" or "CMM" in this procedure is synonymous.

III. DEFINITIONS

A. *Calibration (CAL):* An operation contained in each Numerical Control (NC) Part Program used to determine the diameter and the mid-point coordinates for all the probes in the probe configuration. A 5/8" (15.875mm) diameter Calibration Sphere and the NC Part Program are used to exercise all probes in the probe configuration during CAL.

Pellissippi State Technical Community College
Course Syllabus

COMPUTER-AIDED MEASUREMENT AND ANALYSIS
MET 2310

Class Hours: 3
Laboratory Hours: 3
Credit Hours: 4
Revised: Fall 1991

Instructor:
Office No.:
Phone No.:

Catalog Course Description:

Computer-Aided Measurement and Analysis is a course in state-of-the-art methods of metrology with emphasis on GD&T (Geometric Dimensioning and Tolerancing) and CMM (Computer-Assisted Coordinate Measuring).

Entry-Level Standards:

Students entering this course should have a fundamental knowledge of geometry, trigonometry, basic machining and drawing practices, and AutoCAD.

Pre-requisites: MET 1020 & CID 1100

Textbooks and Other Supplies:

Textbook:

Geometric Dimensioning and Tolerancing: Neumann & Associates, 1986.

ANSI Y14.5M-1982 [Reaffirmed 1988] Dimensioning and Tolerancing: American Society of Mechanical Engineers.

INSIDE AutoCAD: Raker and Rice, New Riders Publishing, 6th Edition, 1990.
[or instructor approved reference manual]

References:

Geometric Dimensioning and Tolerancing: Madsen, Goodheart-Willcox Company, 1988.

Unimeasure Operator's Manual: NUMEREX Corporation, 1986.

Pellissippi State Technical Community College
&
Martin Marietta Energy Systems

Modified Lab Syllabus
MET 2310
Computer-Aided Measurement & Analysis

CMM Level-I Training

Class Hours:
Laboratory Hours:
Total Hours:
Date: July 1992

Instructor:
Office No.:
Phone No.:

Training Description:

The purpose of CMM Level-I Training is to certify inspection personnel in the care, safety, set-up, and operation of Coordinate Measuring Machines. Inspectors must demonstrate the ability to follow Operator Instructions and execute CMM part programs furnished by N.C. Engineering.

Entry-Level Requirements:

References:

Zeiss COMET Operating Instructions: April 30, 1986

Leitz MESCAL Operating Instructions: 1982

CMM Probe Catalog - Issue 3: April 14, 1987

Configuration Control of N.C. Part Programs
Doc. No. 00-SC-015 Rev B: November 12, 1981

Part Inspection Procedure: Latest Revision

N.C. Operator Instructions: Latest Revision

I. **WEEK/TOPIC:**

WEEK	TOPIC
1-2	System Overview & Introduction Computer & Machine Care System Start-Up & Software Installation Normal & Emergency Shutdown
3-4	Operator Instructions Probe Configuration Probe Replacement, Spacing, & Alignment
5-6	Software Menu Functions Control Panel Operations
7-8	Probe Installation, Clamping, & Balancing Probe Calibration & Calibration Check Pre-Operating Qualification Check
9	Data Output Fixture Selection
10-11	Part/Machine Alignment Part Program: Selection & Recall Part Program Execution Part Program: Potential Causes & Corrective Measures
12-15	CMM Project

II. **CENTRAL COMPETENCIES:**

Upon successful completion of this training, the operator must be able to:

A. perform system start-up and shut-down.

B. set-up system for program execution.

C. execute part program.

D. output gererated data.

III. **INSTRUCTIONAL COMPETENCIES:**

Upon successful completion of this training, the operator must be able to:

1. properly use, maintain, and secure system diskettes. A

2. cold-boot system and load operational software. A

3. prepare and maintain machine table top and ways. A

4. identify system safety precautions. A

5. perform emergency and normal system shutdown. A

6. identify the various types of probes and explain their usage based on the current CMM probe catalog. B

7. configure [and duplicate] probe system(s) based on Operator Instructions and Probe Configuration Drawings furnished by N.C. Engineering. B

8. install and clamp machine probes to machining head. B

9. calibrate and perform calibration check of machine probes and rotary table. B

10. perform pre-operational qualification check. B

11. select and mount fixture(s) for part program. B

12. select and load part program from appropriate source. C

13. align part based on part program. C

14. execute program per instructions. C

15. identify potential causes and initiate corrective action if program fails to run or outputs invalid data. C,D

16. output generated data and record in a standardized format. D

IV. EVALUATION:

Lab evaluation will be performance based and dedicated to a specific CMM system, i.e. Leitz-Mescal, Zeiss-Comet, Leitz-Quindos. Specific guidelines and requirements for project will be provided by the instructor.

Lab grade will count 50 points of total course grade.

Classroom Grade: **Quizzes - 50 Points**

CMM PROJECT SHEET

MET 2310
MMES: CMM LEVEL-I

Operator: _____

Part ID: _____

Program ID: _____

CMM System: _____

Performance Criteria:

System Start-Up & Shut-Down — **5 Points**
- Normal System Start-Up
- Normal System Shut-Down
- Emergency System Shut-Down
- Diskette Use, Maintenance, & Security
- Loading Operational Software
- Basic Machine Maintenance
- System Safety Precautions

System Set-Up — **15 Points**
- Probe Configuration
- Probe Replacement, Spacing, & Alignment
- Probe Installation, Clamping, & Balancing
- Probe Calibration & Calibration Check
- Pre-Operational Qualification Check
- Fixture Selection & Mounting

Part Program — **15 Points**
- Program Selection & Recall
- Part Alignment
- Part Program Execution
- Operational Instructions
- Program Operational Failure

Data — **15 Points**
- Invalid Output Data
- Documentation

TOTAL: 50 Points

FILE: MMES\LEVEL-I\PROJECT

PROJECT PERFORMANCE EVALUATION

MET 2310
MMES: CNC LEVEL-I

Operator: _____ Date: _____

Evaluator: _____

Part ID: _____ Program ID: _____

CNC System: _____

System Start-Up & Shut-Down [Maximum 5 Points] _____

Comments: _____

System Set-Up [Maximum 15 Points] _____

Comments: _____

Part Program [Maximum 15 Points] _____

Comments: _____

Data [Maximum 15 Points] _____

Comments: _____

TOTAL POINTS _____

FILE: MMES\LEVEL-I\EV-SHEET

Level II Development-Whats Needed

OJT Lesson Plan/Test/PDC's

Distribution:

M. B. Biddix
P. F. Boyer
L. E. Cochran
C. E. Costner
T. E. Douglass
R. H. Ford Jr.
M. A. Guthrie (2)
D. W. Howell
Y-12 Plant Recorde Records (RC)

APPENDIX D

IBH NC CONTROLLER

Presented by:

Edwin Evans
Pantex Plant
Amarillo, Texas

CLASSIFICATION REVIEW

DATE 2/18/93

MEDIUM:

Document ✓ Photo ____ Drawing ____ Tape ____ Other ____

TITLE: IBM NC Controller

REQUESTED BY: Edwin Evans, Badge # 7572

DETERMINATION:

1. Top Secret, Secret, Confidential
2. RD, FRD, NSI
3. Unclassified - Sensitive, UCNI, OUO
4. Unclassified - Non-Sensitive

Comments:

mm/class/clsrevfm

IMOG/NSG February 1993

IBH NC Controller

G92 Programming

The G92 code is used for presetting axis positions and specifying the maximum spindle rpm for constant surface speed machining. A G92 without axis addresses cancels any active presets and cancels the specified maximum rpm if the 'S' word is not present. You cannot preset the axes in one G92 block and then set the maximum rpm in a succeeding G92 block. All three addresses must be present in the same block, otherwise any missing address will be canceled.

G95 Feedcoding

At the present time G95 feedcoding is incorrect. the feed value desired must be multiplied by 133.33 to determine the F word value that must be programmed. (Example: If a feedrate of .008 IPR is desired, the F word will be 1.07.) It is believed this can be corrected in-house via the application software.

Rapid positioning moves (G0) are not possible with G95 active. It must be cancelled with G94.

CSS Programming

When using CSS, the control uses the G92 preset X axis position as the radius value which calculates the spindle speed.

G80 Series Cycles

The typical G80 series drilling cycles are non-existent. IBH's position on these cycles is the customer should create their own using sub-routines.

Probing

All data captured during a probing routine is in absolute machine coordinates. This makes a probing cycles more difficult since part coordinates must be translated to machine coordinates.

Parametric programming

1. All parametric blocks must be preceded with an asterisk.
2. When a parametric block consists of an equation, the processing is done from left to right, disregarding conventional operator priorities. This will require careful organization of equations or breaking a single equation into more than one to assure the correct result.
3. The control has an intermediate buffer where blocks are processed prior to execution. As parametric blocks enter the buffer, they are executed immediately after they have been processed. This usually causes the parametric block to be executed before it is desired.

5-axis transformation software

The 5-axis transformation software is supposed to allow tool length offsets to automatically be recalculated trigonometrically and applied to the respective linear axis as the head rotates. We

believe this to be a first in NC controllers. Our past experience has shown tool length offsets could only be applied to a single linear axis at a time.

APPENDIX E

AUTOMATICALLY PROGRAMMED METROLOGY

Presented by:

Van V. Graves
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

UCN-7721B (2 1-86) mcB 1/28/93

OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

DOCUMENT DESCRIPTION (Completed By Requesting Division)

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Y/DX-2188	6-3690	SB0086-BP	1/25/93

Unclassified Title: Automatically Programmed Metrology

Author(s) Van B. Graves

TYPE: ☐ Formal Report ☐ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☒ Oral Presentation (identify meeting, sponsor, location, date): IMOG-NSG Meeting, Y-12, 2/9 - 2/10/93

☐ Journal Article (Identify Journal):

☐ Other (Specify):

Document will be published in proceedings ☐ No ☒ Yes

Document will be distributed at meeting ☐ No ☒ Yes

Document has patent or invention significance ☒ No ☐ Yes (Identify)

Document has been previously released ☒ No ☐ Yes (Reference)

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

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DOCUMENT: Level UNCL Category —

J. T. Fisher — Signature — 1/25/93 — Date

DOCUMENT RELEASE APPROVED (Division or Department)

D W Post by R. Hawsley — Signature — 1/25/93 — Date

Signature — Date

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M-3679 Category _____

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Distribution:	UCN-7721B	DOE F-1332.15	Document
Y-12 Central Files	Y-12 RC	Y-12 RC	Y-12 RC
TIO File			
V.B. Graves			

Distribution Remarks: Cleared for release to the NWC

APPROVAL AND RELEASE

Date Received	Date Initiated
1-27-93	1-27-93

[2] CLASSIFICATIONS:

Title(s): U Abstract —

DOCUMENT:

Level U Category —

Weapons Data — Sigma —

A. Smith CC — Y-12 Classification Office — 2-3-93 — Date

☐ Editor — Date

[3] Patent Office — 2/3/93 — Date

☐ Other — Date

☐ Other — Date

APPROVED FOR: ☐ Declassification ☐ Release subject to use of the following admonitory markings and conditions:

☒ Disclaimer ☐ Copyright ☐ Patent Caution ☐ Other

Technical Information Office — 2/3/93 — Date

Conditions/Remarks:

Abstract

The goal of the Automatically Programmed Metrology (APM) project is to develop a Y-12 production system that semi-automatically generates coordinate measurement machine (CMM) programs from official plant product definition. The functionality of this system is based on that demonstrated in a prototype system developed at Y-12 which output programs in the Dimensional Measuring Interface Specification (DMIS) format for specific, routine weapons part features. The production system has greatly expanded the number of recognized features, and much effort has been involved in updating the user interface. The prototype version ran in a text-based VAX environment, whereas the current system was designed for Unix workstations and has a graphical user interface. Both versions of the software run against Anvil-5000, Y-12's production CAD system, but the current version has incorporated an Applications Interface which will allow other CAD systems to be used.

APM is comprised of three software modules, Model Enhancement, Inspection Plan, and Program Plan. Model Enhancement is used to allow the designer to supplement the native CAD data with information needed to drive the rest of the APM software. The Inspection Plan allows a Quality Services engineer to create an electronic work request of the tolerances to be inspected on a particular part along with the standard inspection methodology to be used. The Program Plan allows an NC programmer to define the programming parameters necessary to drive the automatic DMIS program generation which is built into the system.

Automatically Programmed Metrology

Van Graves
Y-12 Development

MOG-NSG Meeting
Y-12 Plant
Oak Ridge, TN
February 9-10, 1988

Prepared by Oak Ridge Y-12 Plant
Oak Ridge, Tennessee 37831
Managed by Martin Marietta Energy Systems, Inc.
for the U.S. Department of Energy
under Contract DE-AC05-84OR21400

Automatically Programmed Metrology

- History/Overview
- Project Description
- Current Status

APM History

- Automated inspection information project initiated in 1986 with participation from Development, Engineering, and Quality Services personnel
- Its objective: To significantly improve CMM programming performance by providing new computer tools which utilize Y-12's production CAD system
- Two systems delivered in 1990:
  - -Advanced Inspection Module
  - -APM Prototype

APM Prototype

- Semi-automated system for creating DMIS CMM part programs
- Ran within ANVIL-5000 v1.2 (VAX)
- Developed in-house using ANVIL's Interface Kit

Automatically Programmed Metrology

Current APM Characteristics

- "Productionized" version of the prototype
- Developed for a workstation environment
- Adheres to Motif user interface guidelines
- External to any CAD system, but contains an Applications Interface to ANVIL-5000 v2.0
- Written using C++, an object-oriented programming language

Automatically Programmed Metrology

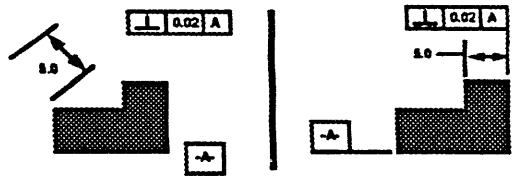
APM Modules

- Model Enhancement - used during CAD model creation to incorporate additional information necessary to drive process
- Inspection Plan - intelligent electronic work request system used by Quality Services personnel
- Program Plan - uses inspection plan data along with NC information to define parameters necessary to automatically create part program

Automatically Programmed Metrology

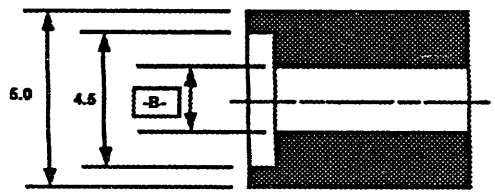
Model Enhancement

- Provides computer sensible product definition
- Tolerance, datum symbols, centerlines, and other geometry are associated with part features



Automatically Programmed Metrology

Model Enhancement Example



Inspection Plan

- A specification of the methods to be used in inspecting the tolerances which occur in a single setup on a CMM
- An electronic communication aid between Dimensional Inspection and NC Engineering personnel
- A necessary precursor to an automatically generated NC program

Inspection Features

- Combinations of tolerances with associated geometry
- Defined by Y-12 NC programmers based on past experience
- Provide standardized inspection methodology

Inspection Plan Interface

- Administrative data window
- Two inspection windows - one for features, one for datums
- Tolerance selection
  - -Recognizes standard tolerance/feature combinations
  - -Automatically calculates and displays standard inspection method
  - -Allows method interrogation and editing

Inspection Feature Examples

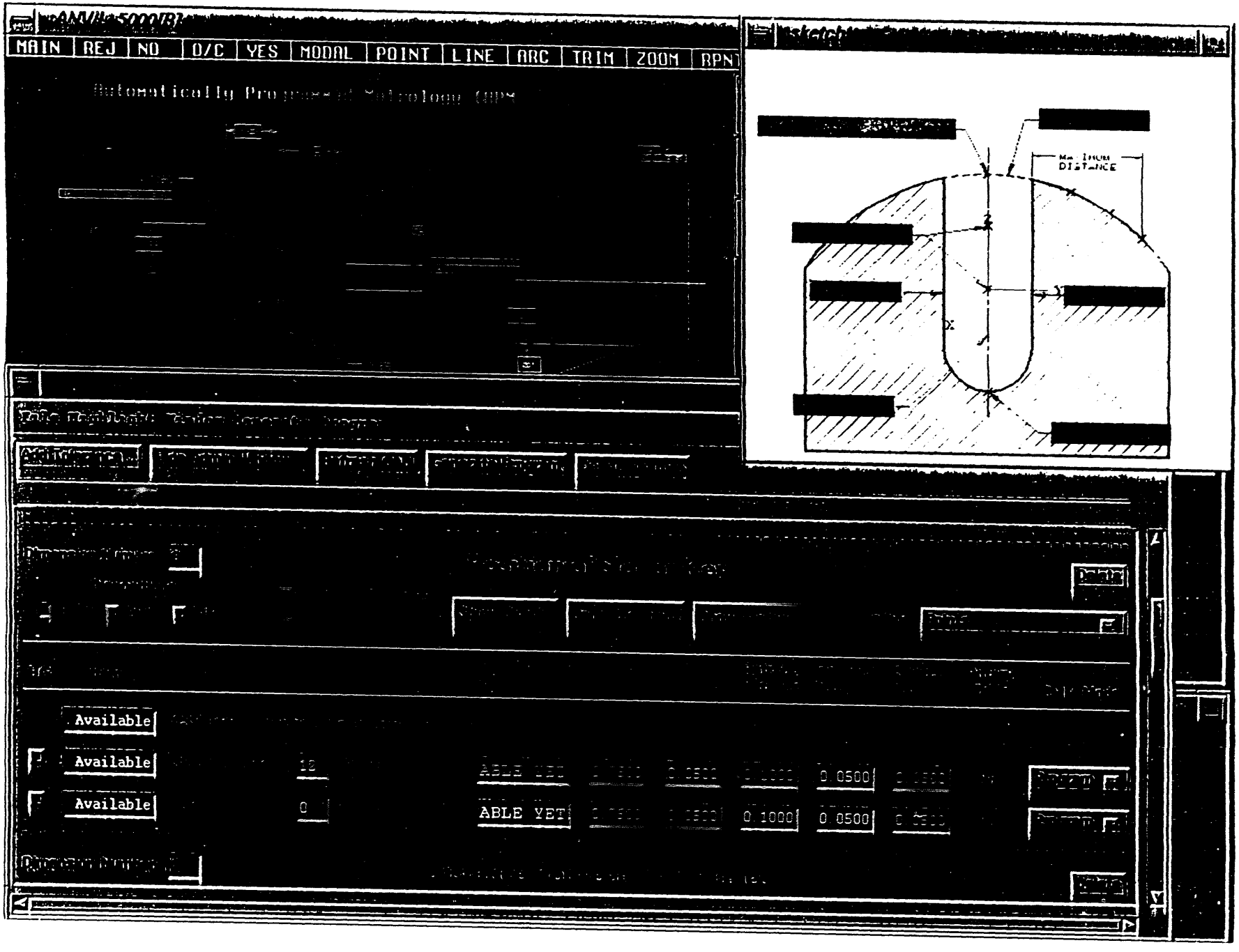
- Position of a slot/key
- Flatness of an annular surface
- Flatness of a non-annular surface
- Diameter of step on a rotational part
- Distance between two planar surfaces
- Depth of a blind round hole measured to the theoretical center intersection with a curved surface

Program Plan

- Adds NC programming practices & standards to inspection plan data to drive DMIS program output
- Provides measurement parameter editing
- Allows for part setup and probe configuration information

Current APM Status

- In final year of three-year effort to complete production system
- Model Enhancement and Inspection Plan modules functional and available for testing
- Program Plan module being completed, DMIS output code must be written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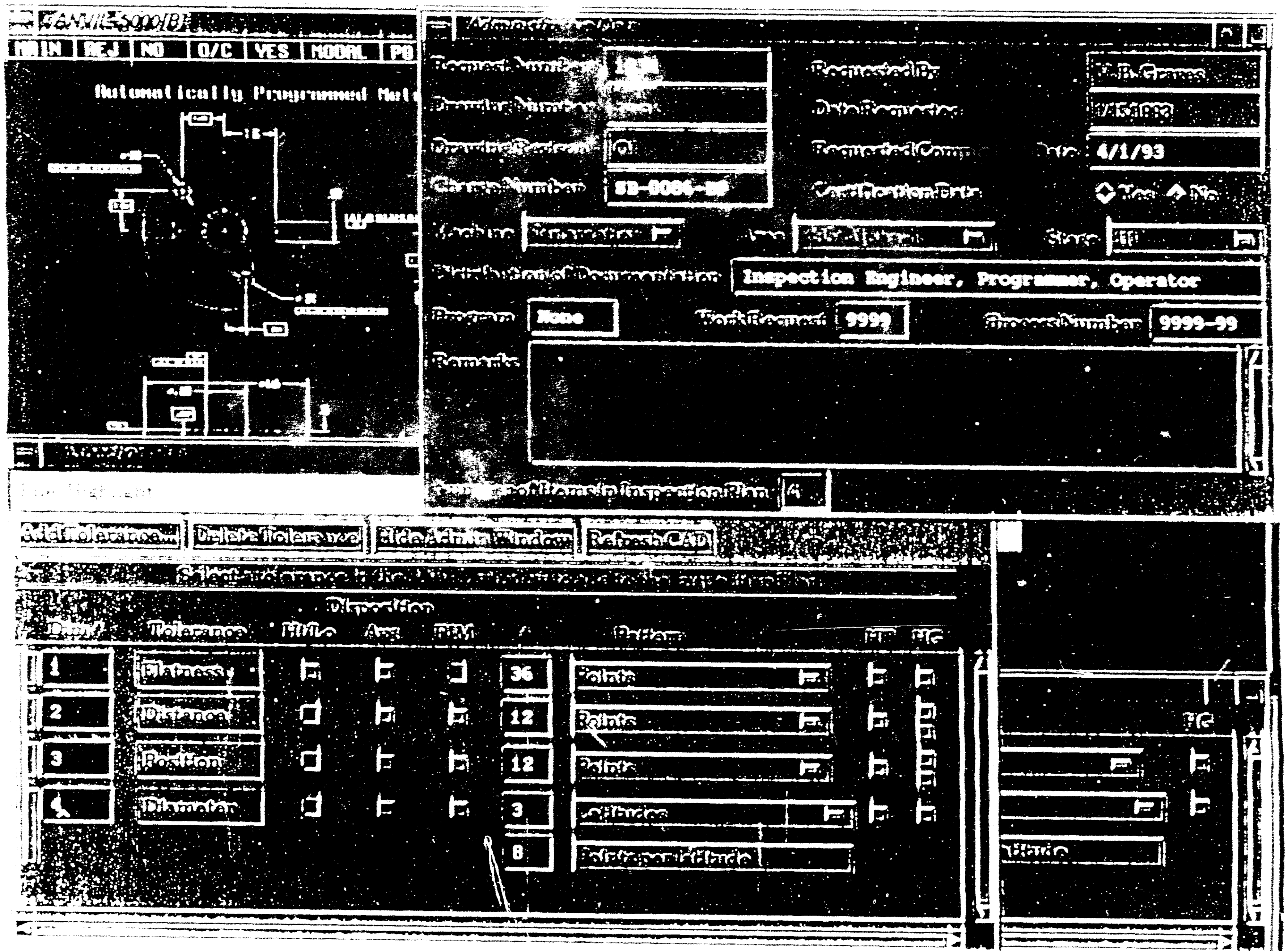
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Inspection Engineer, Programmer, Operator
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Position
Diameter
36
12
12
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APPENDIX F

CERTIFYING ANVIL-5000 FOR PRODUCTION USE AT THE Y-12 PLANT

Presented by:

W. H. Gray
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

UCN-7721B (2 1-86) 2/3/93

OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No.	Author's Telephone No.	Acct. No.	Date of Request
Y/CSD/INF-93/10a Visuals	4-1476	S24002-00	2/3/93

1993 FEB -3 PM 12:46

Unclassified Title: Certifying ANVIL-5000 for Production Use at the Y-12 Plant

Author(s): W. H. Gray (4-1476) - contact V. F. Smith 4-9780

TYPE: ☐ Formal Report ☒ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☒ Oral Presentation (identify meeting, sponsor, location, date): Abstract for submission to: The 61st Interagency Manufacturing Operations Group/Numerical Systems Group, Oak Ridge, TN - February 9, 1993

☐ Journal Article (Identify Journal): _____

☐ Other (Specify): _____

Document will be published in proceedings ☐ No ☑ Yes

Document will be distributed at meeting ☐ No ☑ Yes

Document has patent or invention significance ☑ No ☐ Yes (Identify) _____

Document has been previously released ☑ No ☐ Yes (Reference) _____

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

Title(s): UNCLASSIFIED Abstract: _____

DOCUMENT: Level UNCLASSIFIED Category _____

D. O Calcaterra Jr 2/3/93
Signature Date

DOCUMENT REQUEST APPROVED (Division or Department)

[signature] 2/3/93
Signature Date

_____ _____
Signature Date

THE REMAINDER OF THIS FORM TO BE COMPLETED BY THE TECHNICAL INFORMATION OFFICE

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Distribution:	UCN-7721B	DOE F-1332.15	Document
Y-12 Central Files	Y-12 RC	Y-12 RC	Y-12 RC
TIO File			
W.H. Gray			

Distribution Remarks: Cleared for Release to NWC

APPROVAL AND RELEASE

Date Received	Date Initiated
2-3-93	2-3-93

☐ CLASSIFICATIONS:
Title(s): U Abstract NA
DOCUMENT:
Level U Category -
Weapons Data - Sigma -

[signature] 2/3/93
Y-12 Classification Office Date

☐ _____ Date
Editor

☒ [signature] 2/3/93
Patent Office Date

☐ _____ Date
Other

☐ _____ Date
Other

APPROVED FOR: ☐ Declassification ☐ Release subject to use of the following admonitory markings and conditions:

☒ Disclaimer ☒ Copyright ☐ Patent Caution ☐ Other

[signature] 2/4/93
Technical Information Office Date

Conditions/Remarks:

[signature]

Certifying ANVIL-5000 for Production Use at the Y-12 Plant

presented at the 62nd
Interagency Manufacturing Operations Group/
Numerical Systems Group
Oak Ridge, TN

February 9, 1993

MARTIN MARIETTA

W. Harvey Gray

Introduction

- If you know how to **AVOID** 8 year Software Projects, please tell me!
- Brief ANVIL history at Y-12
- NWC ANVIL Steering Committee
- Y-12's 80-Series Procedures
- Certification using Regression Analysis
- Fini

In the Beginning (1984) There was ANVIL-4000

- OMNISOLIDS announced in '84
  - ⇨ A revolutionary solids modeler
  - ⇨ That didn't work for us
- Y-12 was a source code customer
  - ⇨ Modified ANVIL-4000 until '88
  - ⇨ Tektronix drivers optimized

In the Beginning ... (continued)

- Still in production
  - ⇨ Works great for 2-D drawings
  - ⇨ A lot of NC done with it
- Many local enhancements built in
  - ⇨ Especially file management
  - ⇨ Numerous IGES modifications

And Anvil-4000 Begat ANVIL-5000 v1.x

- Interface Kit replaced source code license
  - ⇨ Most file management enhancements emulated with interface kit
- Ready to certify ANVIL-5000 v1.2 (1989), but
  - ⇨ MCS, Inc. discontinued Interface Kit
  - ⇨ NC deemed not production worthy
  - ⇨ Generated 134 NC error reports
  - ⇨ Trimmed surface containment didn't work
- Never reached consensus to certify for production

And Anvil-5000 v1.x Begat ANVIL-5000 v2.x

- GRAPL-IV replaced Interface Kit which replaced source code
  - ⇨ Threw away v1.2 Interface Kit code
- NWC Steering Committee (1988) helped
  - ⇨ Issue management
  - ⇨ Requirements definition
  - ⇨ Pooling NWC/ANVIL seats gave extra clout
  - ⇨ Provided mechanism for membership on NC focus group

NWC ANVIL Steering Committee

- Membership
  - ⇨ Sandia
  - ⇨ Y-12
  - ⇨ Pantex
  - ⇨ Occasional attendance by others
    - ★ LLNL and LANL
- Charter
  - ⇨ Provide NWC/ANVIL vision for the future
  - ⇨ Manage important NWC/ANVIL issues

NWC ANVIL Steering Committee

Successes

- File Management
  - ⇨ Pantex, Sandia, and Y-12
  - ⇨ NWC requirements for ANVIL-5000 v2 File I/O
  - ⇨ MSC responded favorably
- NURBS
  - ⇨ Non-uniform Rational B-splines
  - ⇨ Enhancements to IGES processor
  - ⇨ Enhancements to ANVIL-5000 v2.x functionality
  - ⇨ Made Seawolf Digital Product Definition transfers a success

NWC ANVIL Steering Committee

Successes (continued)

- NC Modifications
  - ⇨ Lead Angle plunge and cutting
  - ⇨ Toroidal Cutters (rapid cutting)
  - ⇨ Re-write of NC from v1.2 to v2.2
- MSC adopted regression testing their software product

NWC ANVIL Steering Committee

Disappointments

- Solids
  - ⇨ Sandia's requirement for a functional modeler
  - ⇨ Not yet attained
- General IGES Processing Requirements
  - ⇨ Several voluminous letters about IGES postprocessing philosophy
  - ⇨ Followed by one-on-one discussions with developers
  - ⇨ Didn't produce hoped for result

NWC ANVIL Steering Committee

Disappointments (continued)

- Tektronix terminal support
  - ⇨ Speed of Anvil-4000 Tektronix drivers
  - ⇨ Replaced by slow ANVIL-5000 generic Tektronix drivers

The Y-12 Plant's 80-Series Procedures

Software Development Methodology

- Project Initiation
- Feasibility Study
- Requirements Document
- Functional System Design
- Application Security Specifications and Controls
- Certification Test Plan

The Y-12 Plant's 80-Series Procedures

Software Development Methodology (continued)

- Organizational Implementation Plan
- Training Plan
- Establish Product Baseline
- Perform Certification Test Plan
- Create Software Version Release
  - ⇨ 19-Nov-92
- Perform 80-Series Self-assessment

Certification Testing

Regression Analysis

Applies known inputs to a new configuration item
to create new outputs
which are compared to old outputs
from a previously baselined item

How do you prime the pump?

First set of outputs must be rigorously checked and inspected
else you could perpetuate bad data

Regression Testing Summary

- MCS regression data
  - ⇨ 100+ test cases
  - ⇨ UNIX shell script drives process
  - ⇨ Inputs are a combination of key-stroke files and GRAPL-IV
- Energy Systems
  - ⇨ Translated shell script to VAX/VMS
  - ⇨ Added about 12 additional tests, based upon Y-12's requirements
  - ⇨ Created a validated set of outputs

Regression Testing Summary(continued)

- Executed test upon
  - ⇨ Sun
  - ⇨ Hewlett-Packard
  - ⇨ Silicon Graphics
  - ⇨ VAX

FINI

- ANVIL-5000's Software Version Release
  - ⇨ Signed 15-Nov-92
  - ⇨ Certified for production use at Y-12

APPENDIX G

ACCORD PROJECT

Presented by:

Charles R. Miller
Allied Signal (KCD)
Kansas City, Missouri

REPORT APPROVALS

Allied Signal

Report _____ **Title** ACCORD PROJECT

PDO or EP _____

Classification Unclassified **Author** Charles R. Miller

Previous Number _____ **Department** 872-2 **Extension** 4736 **Control No.** _____

Technical Writer _____ **Extension** _____ **WPC Code** _____

Does this report contain any COPYRIGHTED material? Yes ___ No X
If yes, has permission been obtained for use of all Copyrighted materials? Yes ___ No ___

Name of JOURNAL, if applicable _____

Title of CONFERENCE or PRESENTATION, if applicable 1993 IMOG Numerical Systems Group Meeting February 9-10, 1993

Date February 9-10, 1993 Location Y-12/Oak Ridge

SPONSORING ORGANIZATION _____

PATENT REVIEW CERTIFICATION (must be completed before distribution.)

I have reviewed the attached material for patentable items or processes.

Date of Certification _____ Author's Supervisor _____

Has an INVENTION DISCLOSURE been filed with BKC on any item or process?

Yes _____ No _____ Disclosure No. _____

APPROVALS for DOE DISTRIBUTION

Submitted by Technical Writing _____ Return Requested by _____ Returned _____

	Signature	Date
Requester I have reviewed the attached material for technical accuracy and completeness and approve its release.	Charles R Miller	2/3/93
Supervisor I have reviewed the attached material for accuracy and technical content and approve its release.	for William R Sprague	2/3/93
Department Supervisor I have reviewed the attached material for classification and timeliness. It is compatible with mission assignment and represents no duplication of effort. Its distribution is approved.		

	Yes	No	Reason for Refusal (Spinoff Only)
BTQ (Summary Only)	☐	☐	
Spinoff	☐	☐	

EXTERNAL RELEASE APPROVALS Comm. Rel. _____

Final Classification Review

I have reviewed the attached material, and the classification is as follows:

Unclassified X RD _____

Confidential _____ FRD _____

Secret _____ NSI _____

Signed Nelson E. Beard 2/4/93

Patent and Legal Review

I have reviewed the attached material and approve it for release. Release was approved by the AL Patents Division, per ~~telephone call of~~ Legal Dept.

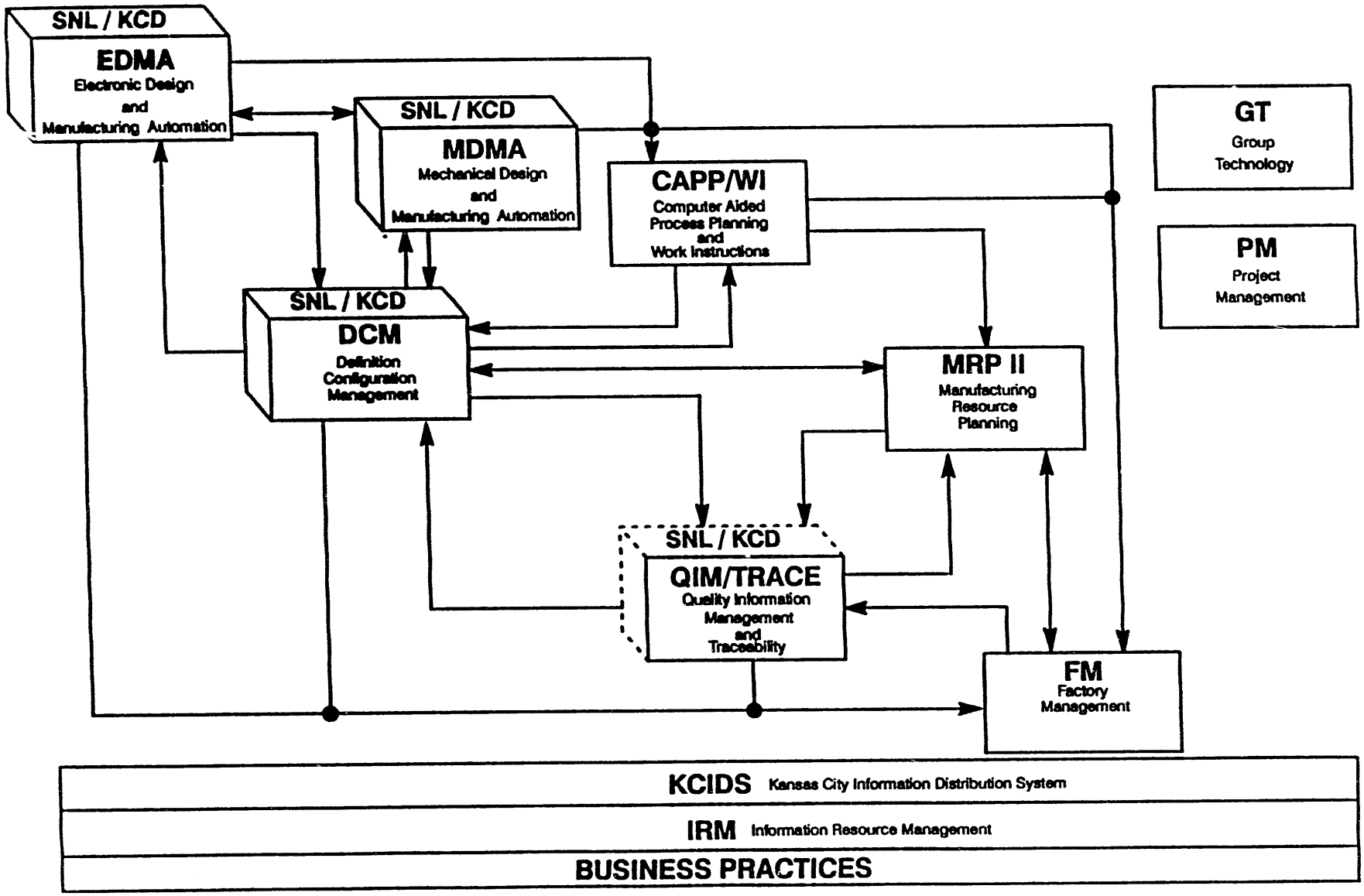
Signed _____ Date 2/4/93

KCD-1989 (9/87)

Project ACCORD

AlliedSignal
AEROSPACE

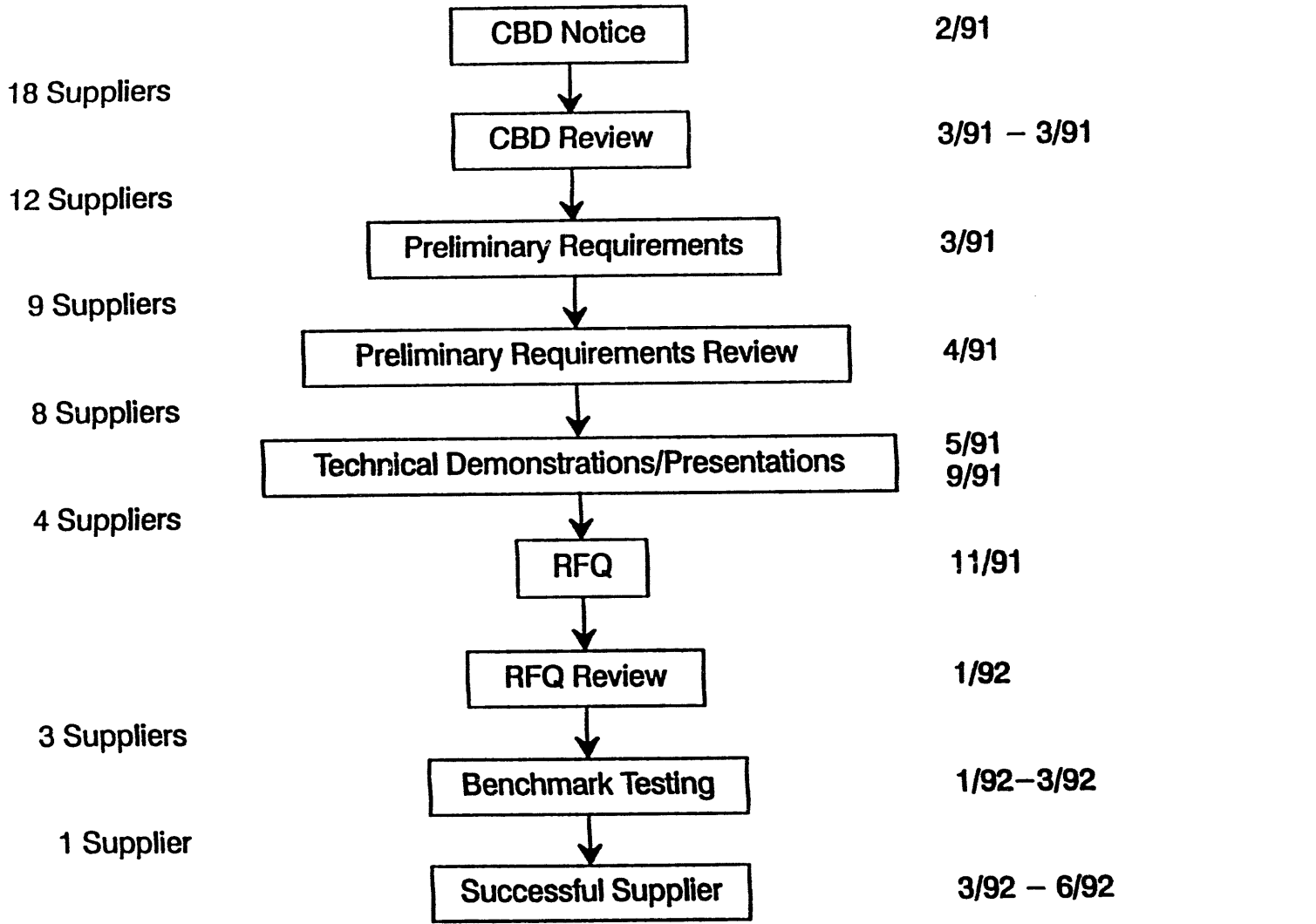
FOCUS FACTORY INFORMATION SYSTEM INTEGRATION



ACCORD PROJECT

- **STEERING COMMITTEE**
  - 6 SNL
  - 6 KCD
- **CORE TEAM**
  - 7 SNL
  - 5 KCD
- **RESOURCE TEAM**
  - 17 SNL
  - 22 KCD

ACCORD PROCESS FLOW



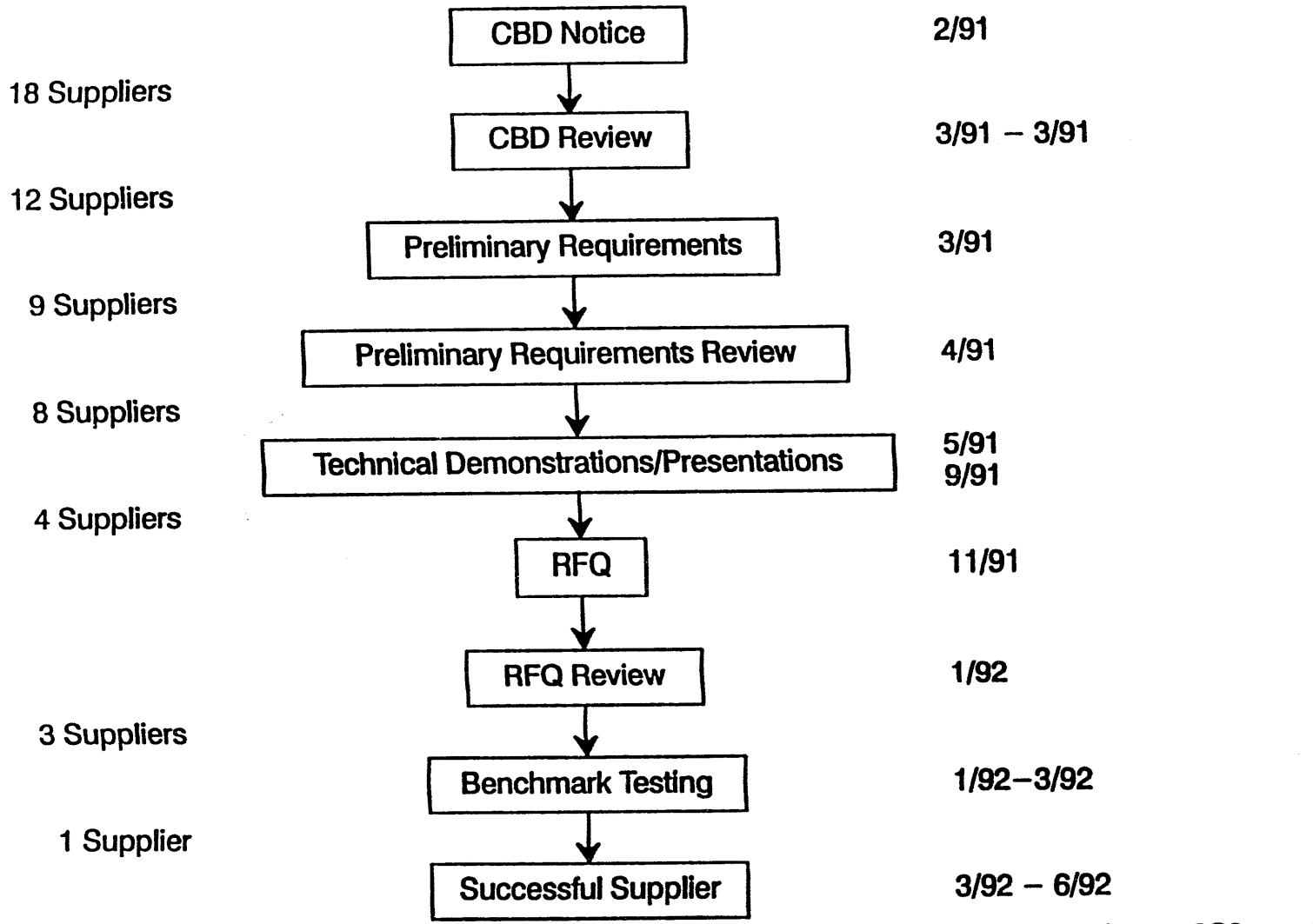
AlliedSignal
AEROSPACE

CATEGORY WEIGHTING

CATEGORY	WEIGHT	PERCENT
Integration within MDMA	3	12.0
Engineering Design & Drawings	3	12.0
Solid Modeling	3	12.0
Product Data Management	3	12.0
Numerical Control	3	12.0
Integration with DCM	1	4.0
System–Wide Features	2	8.0
Engineering Analysis	2	8.0
Integration with EDMA	2	8.0
Inspection	1	4.0
Process Planning	1	4.0
Robotics	1	4.0
	25	100.0

AlliedSignal
AEROSPACE

ACCORD PROCESS FLOW



AlliedSignal
AEROSPACE

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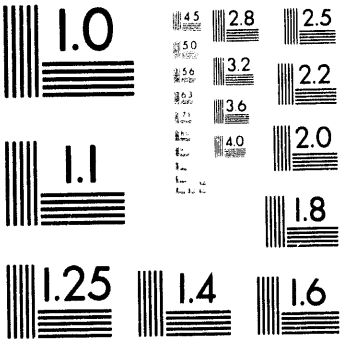
Process Planning	1	4.0
Robotics	1	4.0
	25	100.0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4.5
5.0
5.6
6.3
7.1
8.0
9.0
10.0

2 of 2

MAY 13, 1992 JPD

ACCORD

SPECIFICATION & BENCHMARK TEAMS

4.0 INTEGRATION WITHIN MDMA

CHAMPION: CHARLIE MILLER

SNL: LARRY GRUBE
RICK HARRIS

KCD: DAN LEWIS
JIM DYCUS

5.0 ENGINEERING DESIGN AND DRAWINGS

CHAMPION: MARTY WINTERFELD

SNL: RON HENRY
GLENN RACKLEY

KCD: BILL MAYOR
KEITH MAZACHEK
CARL MURPHY

6.0 SOLID MODELING

CHAMPION: ROSS BUCHARD

SNL: RICH ROBISON
BOB HABBIT
GALE HUDSON

KCD: ROSE STUCKEY
LISA VERNON
STEVE BROOKS

7.0 PRODUCT DATA MANAGEMENT
9.0 INTEGRATION WITH DCM

CHAMPION: DICK THOMPSON,

SNL: ALEC WILLIS
SANDY BABB

KCD: MIKE DUNLAP
BRENDA ROSSINI
CAROL GARDNER

8.0 NUMERICAL CONTROL
15.0 ROBOTICS

CHAMPION: JIM BUTLER

SNL: PAUL PLOMP
JOHN DUNTON
BRUCE AFFELDT

KCD: BYRL HODGSON
JOHN SALZMAN
TIM REEVES

10.0 SYSTEM–WIDE FEATURES

CHAMPION: GREG NEUGEBAUER

SNL: BRUCE KOOPMANN
PHIL KENNICOTT
DAVE SAYLORS

KCD: BOB BASKERVILLE
JIM BOYLE

11.0 ENGINEERING ANALYSIS

CHAMPION: JIM MAHONEY

SNL: RICK HARRIS
JIM SCHULZE
KEITH SNYDER

KCD: RICK LAVELOCK

12.0 INTEGRATION WITH EDMA

CHAMPION: LARRY GRUBE

SNL: TOMMY GLAUNER

KCD: GWEN PARSONS
TIM PROHASKA

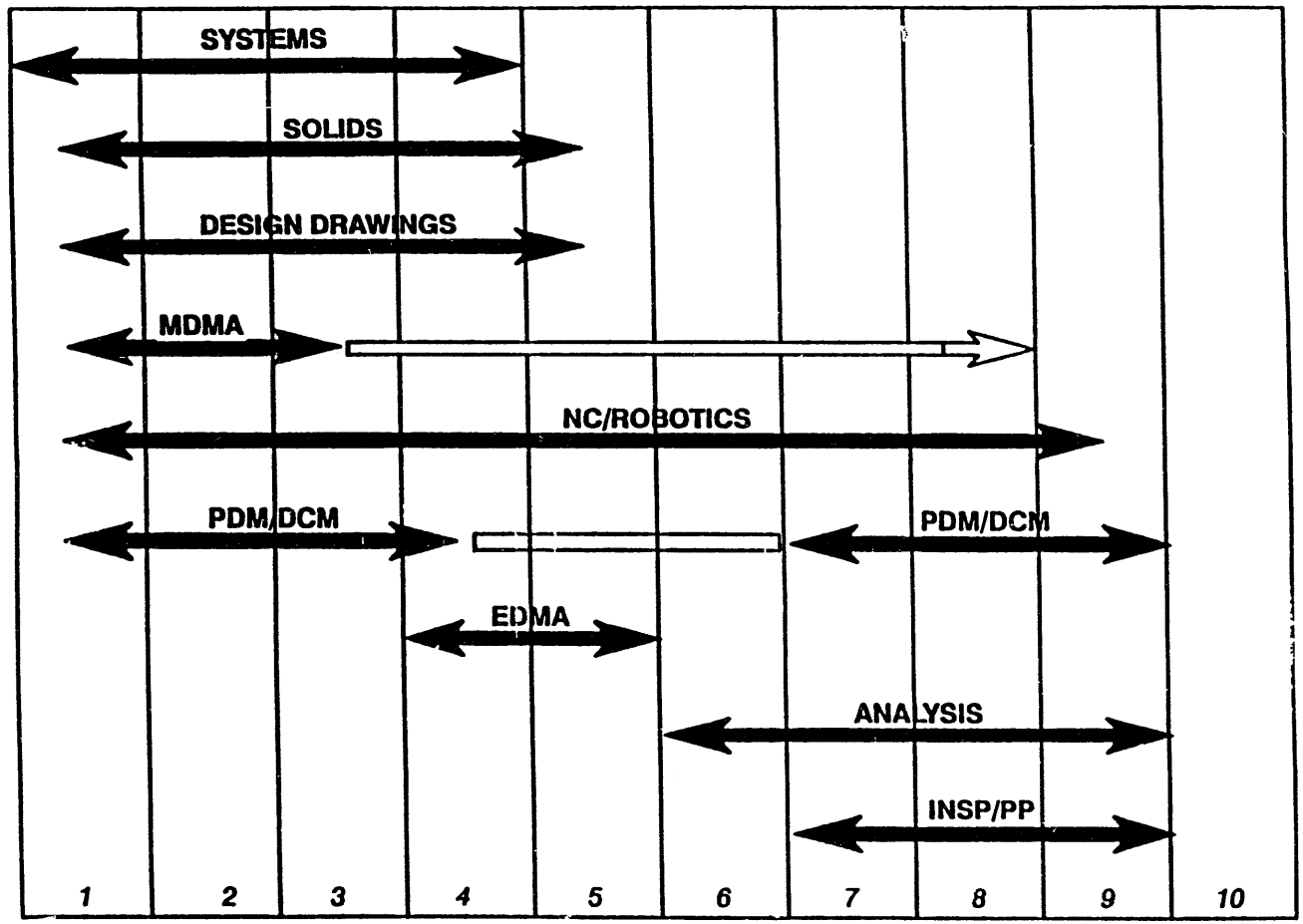
13.0 INSPECTION
14.0 PROCESS PLANNING

CHAMPION: JOHN SALZMAN

SNL: JAKE GONZALES

KCD: CURTIS BROWN
DAVE GILES
RUSS BRUCH

Benchmark Schedule
Based on First Draft Dependencies



TEST DAY

AlliedSignal AEROSPACE

BENCHMARK

- **ELECTRONIC DATA SYSTEMS (EDS)**

  DESIGN & MANUFACTURING – UGII

- **PARAMETRIC TECHNOLOGIES**

  DESIGN – PRO / ENGINEER
  MANUFACTURING – PRO / MANUFACTURING

- **CONTROL DATA CORPORATION**

  DESIGN – PRO / ENGINEER & ICEMDDN
  MANUFACTURING – ICEMDDN

ACCORD PROJECT

VENDOR SELECTION

- PARAMETRIC TECHNOLOGIES CORPORATION
  - PRO/ENGINEER
- THIRD PARTY
  - FRAMEMAKER
  - PATRAN
  - DADS
  - CIMSTATION
  - CAM-POST
  - INTELLICAP
- WORKSTATION
  - SILICON GRAPHICS (SGI)

TRAINING COMPLETED AS OF DECEMBER 1992

CLASSNAME	TRAINING SESSIONS									
	TOOL DES	DRFT	ENGR	QUAL	IMPL	NC	FIRE SETS	SNL	MISC	TOTAL
ADV SYS ADMIN					1			1		2
C FOR NEW PROGRAMMERS	1	2	1	1	5	8	2		3	23
CAMPOST PROGRAMMING					4	5		2		11
CIMM INSPECTION				3		1				4
FRAMEMAKER					4					4
INTRO TO WORKSTATION		5	4	1			2		1	11
MASTERING IRIX	1	2	2	2	7	6	1			21
PRO/ENGR BASIC & DESIGN	1	6	5	2	9	6	2		2	33
PRO/ENGR ADV PART & DES	1	1			3	1				6
PRO/ENGR PROD DRFT	1	4			4	1				10
PRO/ENGR DEVELOP	1	1	1		4					7
PRO/ENGR PROJECT	1	2	1		5				1	10
SHELL PROGRAMMING	1	1			6	6				14
TOTAL	8	24	12	9	52	34	7	3	7	156

FIRST QUARTER FY93 ACCORD TRAINING

CLASSNAME	TRAINING SESSIONS									
	TOOL DES	DRFT	ENGR	QUAL	IMPL	NC	FIRE SETS	SNL	MISC	TOTAL
ADV SYS ADMIN					1					1
FRAMEMAKER	1	2	6	4	4	2	2		4	24
INTRO TO WORKSTATION	2	12	12	5		2	6		2	41
PRO/ENGR BASIC & DESIGN	2	12	12	5		2	6		2	41
PRO/ENGR ADV PART & DES		3	4	2	8	2	2		2	23
PRO/ENGR PROD DRFT		12								12
PRO/ENGR MANUFACTURING			1		4	7				12
PRO/ENGR SURFACE	2	6	6	2	4	7	2		1	30
TOTAL	7	46	41	18	21	22	18	0	11	184

ACCORD WORKSPACE INTERFACE INSTRUCTIONS

The WorkSpace interface should appear on your workstation automatically every time you log on. This interface should provide you with most functions you need to perform your tasks with Pro/Engineer, Frame, and UNIX. WorkSpace ICONS allow access to ACCORD applications, and pop-up menus and other features in WorkSpace allow you to manage your personal directories and files, and even share files with other users. For a complete description of how to use WorkSspace, you need to thoroughly read the manual titled "IRIS WorkSpace User's Guide" which was supplied with your workstation. This manual will guide you to basic functions in Workspace, and provides easy to follow tutorials. This set of instructions will describe the additional functionality which has been added to Workspace for the ACCORD Interface, and Workspace functions which are important for proper operation of the interface.

1.0 Opening ACCORD Applications;

To open any ACCORD application, simply point to the ICON with the mouse pointer, and "double click" the left mouse button. The following applications are available:

Pro_Eng

This ICON will access the basic Pro/ENGINEER application which includes Pro/ASSEMBLY, Pro/DETAIL, Pro/DRAFT, Pro/DESIGN, Pro/FEATURE, Pro/INTERFACE, Pro/NLO, Pro/PLOT, Pro/PROJECT, Pro/ECAD, Pro/REPORT, and Pro/SURFACE.

Pro_Man

This ICON will access the Pro/MANUFACTURING application, which includes all packages in the basic Pro/ENGINEER package, plus, Pro/SHEETMETAL, Pro/MANUFACTURING, Pro/LIBRARY, and the Tooling database.

Pro_Cab

This ICON will access the Pro/CABLING application, which includes the Pro/MANUFACTURING package, plus Pro/CABLING.

Pro_Mol

This ICON will access the Pro/MOLDDESIGN application, which includes the Pro/MANUFACTURING package, plus Pro/MOLDDESIGN.

KCD ACTIVITY REPORT

- POSTPROCESSOR WORDS STANDARDS BY TOTAL QUALITY (TQ) TEAM

- MIGRATE ALL POSTPROCESSORS TO ICAM GENERALIZED POSTPROCESSOR

- EXTENSIVE TRAINING INITIATIVE IN '93

- SPLIT OF CLASSIFIED AND UNCLASSIFIED HAS CREATED A GREATER DEPENDENCE ON MYLAR - LESS ON DNC

- SOME N/C EQUIPMENT HAS BEEN SURPLUSED

- STEREOLITHOGRAPHY APPLICATIONS HAVE INCREASED

KCD ACTIVITY REPORT

- FMS OPERATION HAS BEEN VERY SUCCESSFUL
  - WENT FROM PROVE-IN TO THREE SHIFT OPERATION IN SHORT TIME
  - FIVE N/C PROGRAMMERS WHOSE FUNCTIONS INCLUDE:
    * FMS COMPUTERS SYSTEM MANAGER
    * N/C MACHINING PROGRAMMING
    * CMM INSPECTION PROGRAMMING

KCD ACTIVITY REPORT

MECHANICAL DESIGN AND MANUFACTURING AUTOMATION (MDMA)

- 48 SGI WORKSTATIONS INSTALLED
  - R4000 AND R3000 WITH 48M MEMORY
- 2 SGI SERVERS INSTALLED

ELECTRICAL DESIGN AND MANUFACTURING AUTOMATION (EDMA)

- 47 INTERGRAPH CLIPPER
  - 2020 AND 2430 WITH 32M AND 48M MEMORY
- 7 INTERGRAPH SERVERS
- 1 OPTICAL "JUKEBOX" ON-LINE STORAGE AND RETRIEVAL (RECEIVED)

KCD ACTIVITY REPORT

PLANNED

MDMA

- 41 SGI WORKSTATIONS — MAR. '93
- 20 SGI WORKSTATIONS & PERIPHERAL DEVICES — MAY '93
- 15 SGI WORKSTATIONS — JULY '93

EDMA

- 10 INTERGRAPH WORKSTATIONS — FEB. '93
  - 2730 WITH 48M MEMORY
- 38 INTERGRAPH WORKSTATIONS
  - UPGRADE 2020 TO 2730

APPENDIX H

SNLA "ACCORD"

Presented by:

John Dunton
Sandia National Laboratory
Albuquerque, New Mexico

SF 1003-MF(7-90)

Do not enter classified information.

REVIEW AND APPROVAL FOR JOURNAL ARTICLES, CONFERENCE PAPERS, PRESENTATIONS (ORAL OR WRITTEN)

(See instructions on back and SLI's 1008, 1008-4 for details on form completion)

1. IDENTIFICATION

SAND/Control Number 93-1851C Title STATUS OF "ACCORD" NC GROUP AT SANDIA NATIONAL LABORATORIES, ALBUQUERQUE

Send 3 copies of final draft of unclassified "C" SLI fixed material to Division 3151.

Has an invention disclosure relating to the subject matter of this publication or presentation been filed with Division 4051? ☐ Yes ☒ No

Author JOHN L. DUNTON (Please Print) Org. 2483 Case No. 6103003

Signature ____ Date ____

Proposed for Publication in 61ST MEETING IMOG NUMERICAL SYSTEMS GROUP (Name of Journal)

Proposed for Presentation at ____ (Name of meeting, conference, or symposium)

Date of Meeting 2/9/93 Location OAK RIDGE Y12 Sponsoring Org. ____

2. CLASSIFICATION

CLASSIFICATION LEVEL, CATEGORY AND EXTRA MARKINGS (Must be completed by originating organization)

Title U Abstract U Total Report U Authorized Classifier PAUL W. PLOMP

☐ NWD Sigma ____ ☐ WNINTEL ☐ SUCI Title DEPARTMENT SUPERVISOR

☐ CNWDI ☐ Classified Computer Software ☐ Other ____ Org. 2483 Date 7-29-93

3. DISSEMINATION (For Unclassified Reports - Must be completed by originating organization)

☐ **Restricted Dissemination:** This presentation contains sensitive unclassified information that requires dissemination restriction in accordance with one of the following control categories:

- ☐ Unclassified Controlled Nuclear Information (UCNI)
- ☐ Reactor Safeguards Information (RSI)
- ☐ Export Controlled Information (ECI)
- ☐ Other (explain) ____
- ☐ Official Use Only (OUO)
- ☐ Proprietary Information
- ☐ Unclassified Computer Software
- ☐ Small Business Innovation Research (SBIR)

☐ **Internal Dissemination Only**

☒ **Unlimited Release:** *This information has had prior release, or is to be released, without restriction to the public* ☐ Yes ☐ No

4. LINE SIGNATURES/APPROVALS THROUGH DIVISION

Author(s)	Ext. No	E No(s).	Division Supervisor	Org.	Date
[signature]	4-6603	20568	[signature]	2483	7-29-93

5. CLASSIFICATION & SENSITIVE INFORMATION REVIEW 2180 (C524)

Signature [signature] Date 7-30-93

6. INTELLECTUAL PROPERTY REVIEW 4051 (8524)

Copyright Interest: ☐ YES ☒ No

Patent Interest: ☐ YES ☒ No

Patent Caution: ☐ YES ☒ No

Signature [signature] Date 7-30-93

7. LINE DEPARTMENT AND DIRECTOR APPROVAL

Department	Org.	Date	Department	Org.	Date
Director	Org.	Date	Director	Org.	Date

8. TECHNICAL COMMUNICATIONS DEVELOPMENT REVIEW 3151 (TECHNICAL PUBLICATIONS 8535)

☐ Abstract Release ☐ Full Paper Release

(If full paper is prepared, it must be approved and reviewed before release)

Signature ____ Date ____

Status of "ACCORD" NC Group
at Sandia/New Mexico

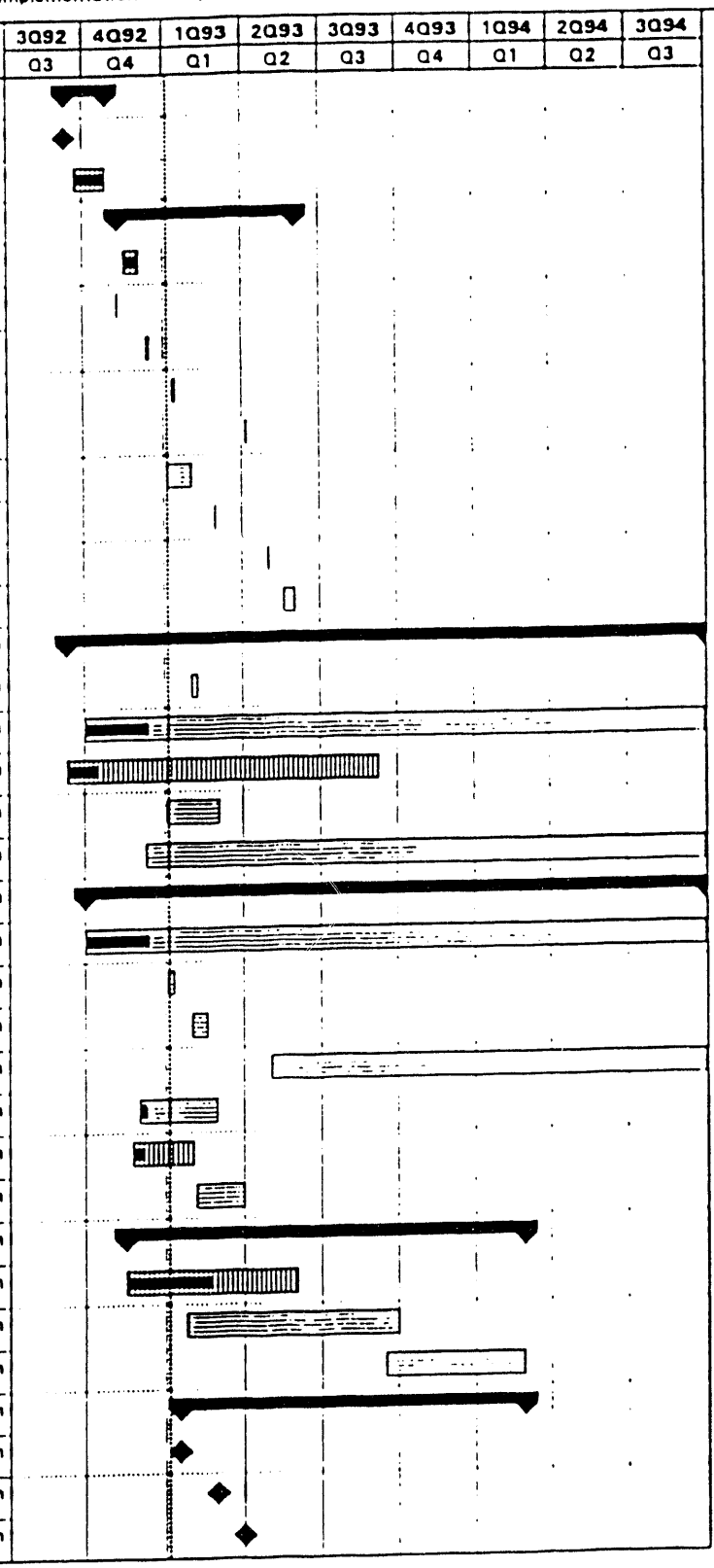
John Dunton

In a joint effort with KCD, Sandia has completed the ACCORD Project. The project was an effort to designate a system which provided a common, interactive, feature-based solid model definition. The database being a vital link for concurrent engineering activities between design and manufacturing. The system chosen in this process was Parametric Technologies. Currently, the entire NC Section is in the process of implementing the new system. We are moving from a VMS mainframe-based system to a workstation environment. Hardware installation was completed in October for the NC Engineering Group and rapid prototyping. Sheet Metal and Mechanical Measurements groups are scheduled in the future. Although these systems are installed, there is still a considerable effort required before we become fully operational.

Tasks to be addressed include networking the systems lab-wide to provide an environment accommodating concurrent engineering; updating and transferring all post processors to the new system; providing printing and plotting capabilities; examining and implementing NC verification software; addressing security issues in the UNIX environment; and providing necessary training for all users. We are using Pro/Engineer to create solid models for creation of STL files required in rapid prototyping. But, as of now, have not used their manufacturing package to create NC CL tool path files.

ACCORD Implementation -- Dept. 2483

ID	Name	Work
1	Accord startup	160h
2	Receive Pro/E	0h
3	Receive & Install H/W (SGI)	160h
4	Training	1016h
5	Pro/E Modeling	280h
6	Pro/E Sheetmetal	16h
7	ICAM, CAMPOST	48h
8	Pro/Mfg.	240h
9	Pro/Mfg. Adv.	72h
10	Pro/Project	64h
11	FrameMaker	16h
12	DMCS	40h
13	SILMA CIMSTATION	240h
14	System support	2080h
15	V10.2-7 VAX ICAM Post	48h
16	Pro/E	250h
17	CAM-APT-SURF	120h
18	Install Pro/E Version 10 & Test	360h
19	ICAM Post.	350h
20	Network	402h
21	Network Security	242h
22	VAX ISN Connection	48h
23	Security Plan (LAN-25) Update	112h
24	Silma Software	250h
25	Tooling Library	80h
26	Setup Postprocessors	100h
27	MicroVAX for Classified	120h
28	Ramp-up Activities	1400h
29	Pro/E Modeling	400h
30	Pro/E NC Prog.	600h
31	CMM Programming	400h
32	Using Pro/E.	0h
33	Pro/E Customer Database	0h
34	Pro/E, Milling (1st Job)	0h
35	Pro/E, Lathe (1st Job)	0h

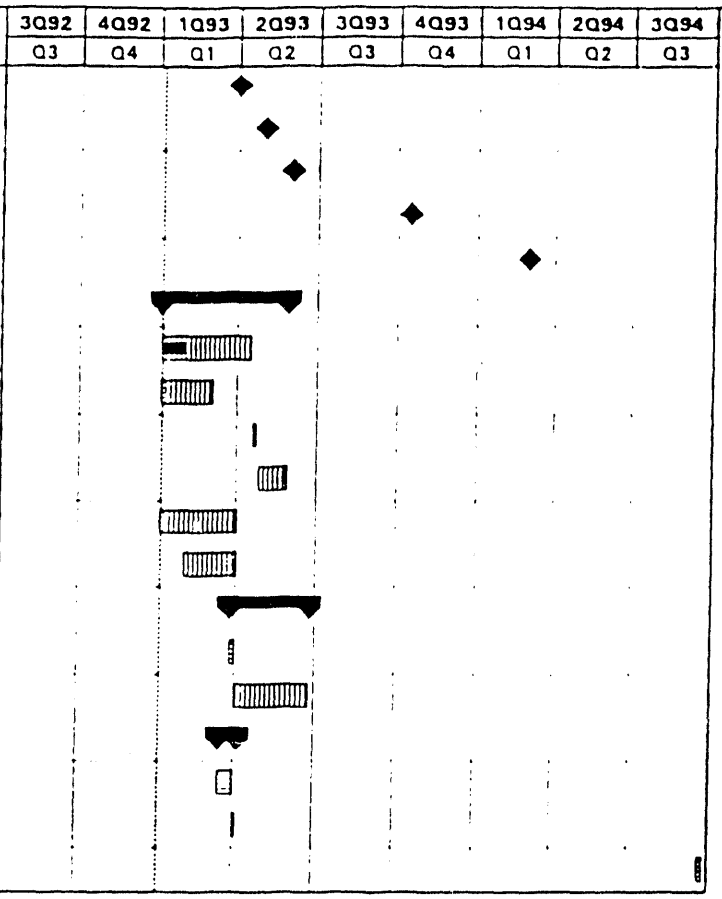


Project: Accord-2483
Date: 1/4/93

Critical
Noncritical
Progress
Milestone
Summary
Rolled Up

ACCORD Implementation -- Dept. 2483

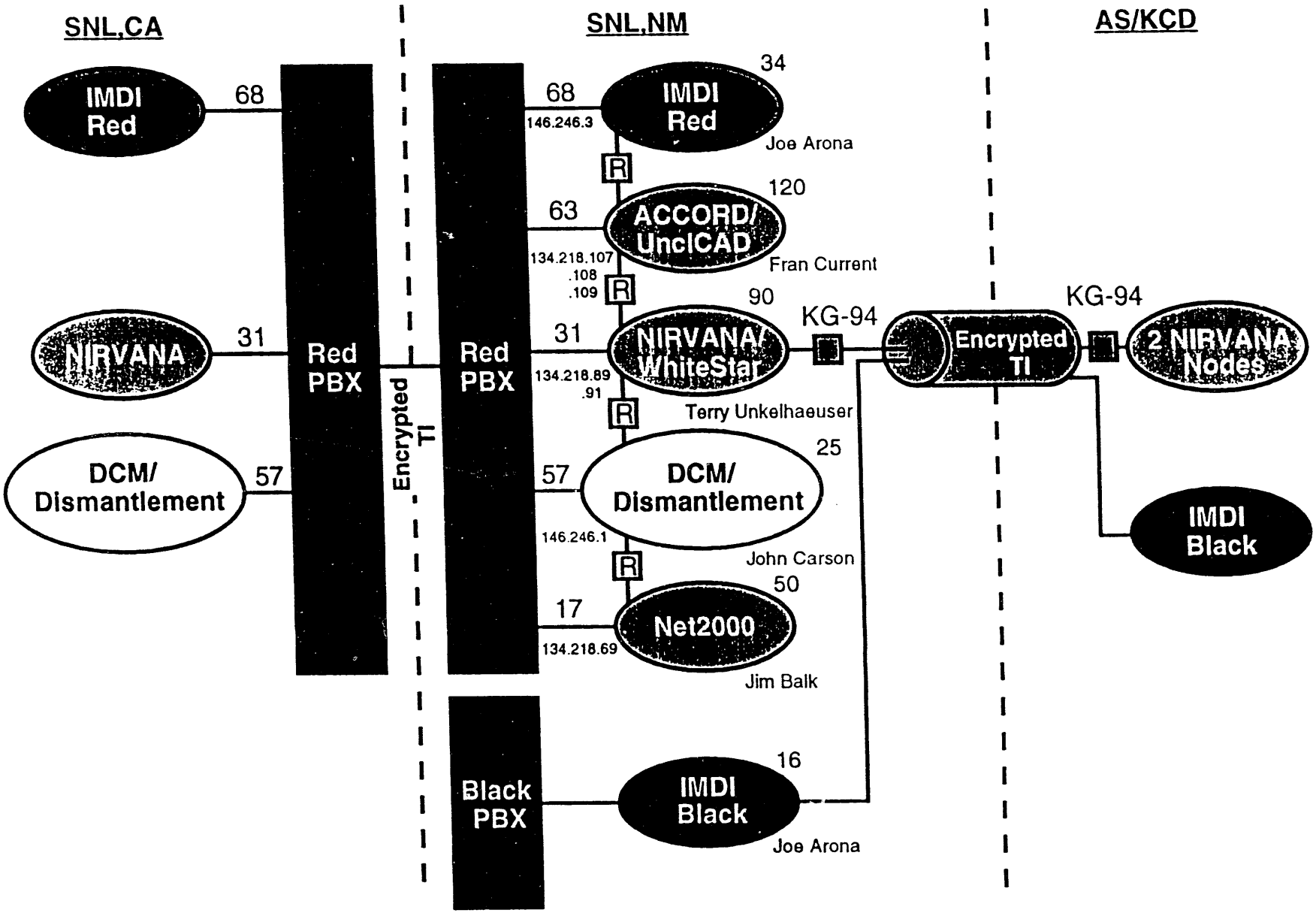
ID	Name	Work
36	Manage files (Pro/Project)	0h
37	Pro/E Sheetmetal (1st Job)	0h
38	Routine DMCS Usage	0h
39	CMM Prog., Pro/Eng (1st Job)	0h
40	Full ACCORD Production	0h
41	Server & Network Setup	300h
42	Setup LAN with Server	80h
43	PFQ on Server	120h
44	Auto-backup (server)	16h
45	Printing on the Network	20h
46	Backup At the workstations	24h
47	Buy peripheral Equipment	40h
48	Greco DNC Unit	160h
49	Procure Unit	40h
50	Install & Test System	120h
51	Stand-alone Workstation	128h
52	Setup W/S for Classified	112h
53	Security Plan (1 Page)	16h
54	Unplug VAX-8550	40h



Project: Accord-2483
Date: 1/4/93

Critical
Noncritical
Progress
Milestone
Summary
Rolled Up

Unclassified Engineering Information Network Topology



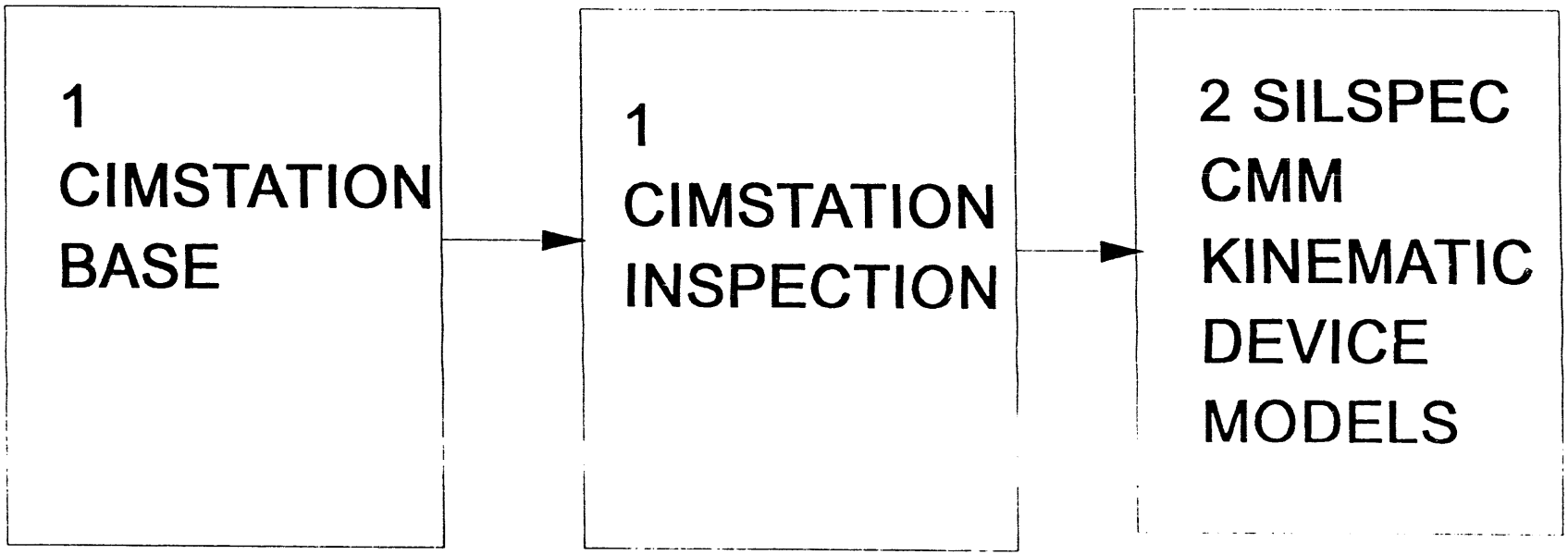
ACCORD SOFTWARE

- MANUFACTURING
  - 6 PRO/ENGINEER-MANUFACTURING PACKAGES
  - 1 PRO/MOLD DESIGN MODULE
  - 1 PRO/DETAIL AND DESIGN
  - 1 ICAM-PUNCH
  - PRO/NC-CHECK?
  - 3 CAM-POST
  - 1 CAM-APT-SURF

ACCORD SOFTWARE

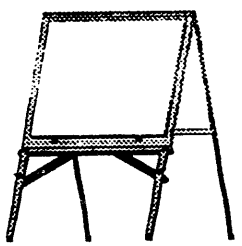
- INSPECTION
  - 1 CIMSTATION BASE
  - 1 CIMSTATION INSPECTION
  - 2 SILSPEC-CMM KINEMATIC DEVICE MODELS

I N S P E C T I O N

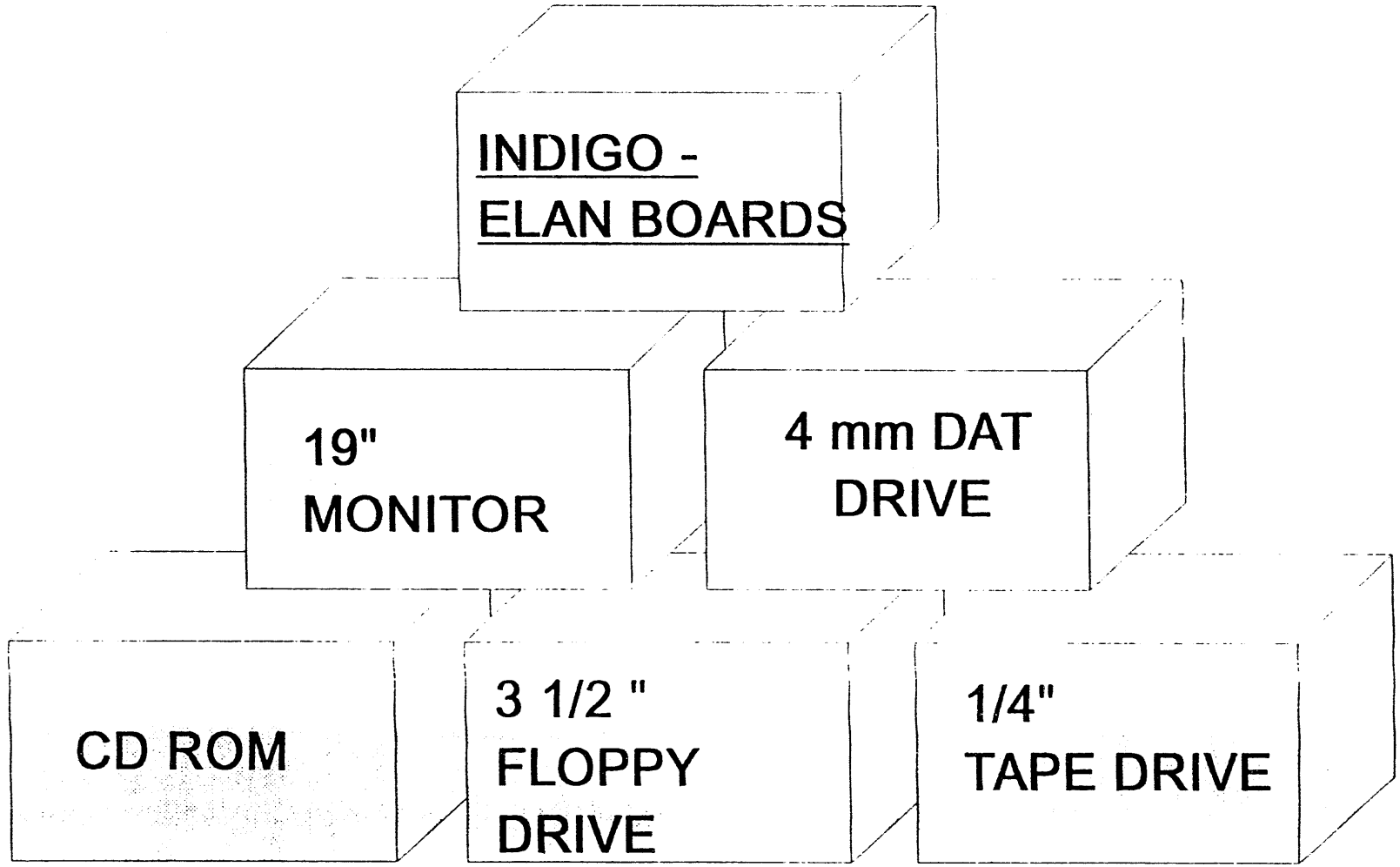

1
CIMSTATION
BASE
1
CIMSTATION
INSPECTION
2 SILSPEC
CMM
KINEMATIC
DEVICE
MODELS

ACCORD HARDWARE PROCUREMENT

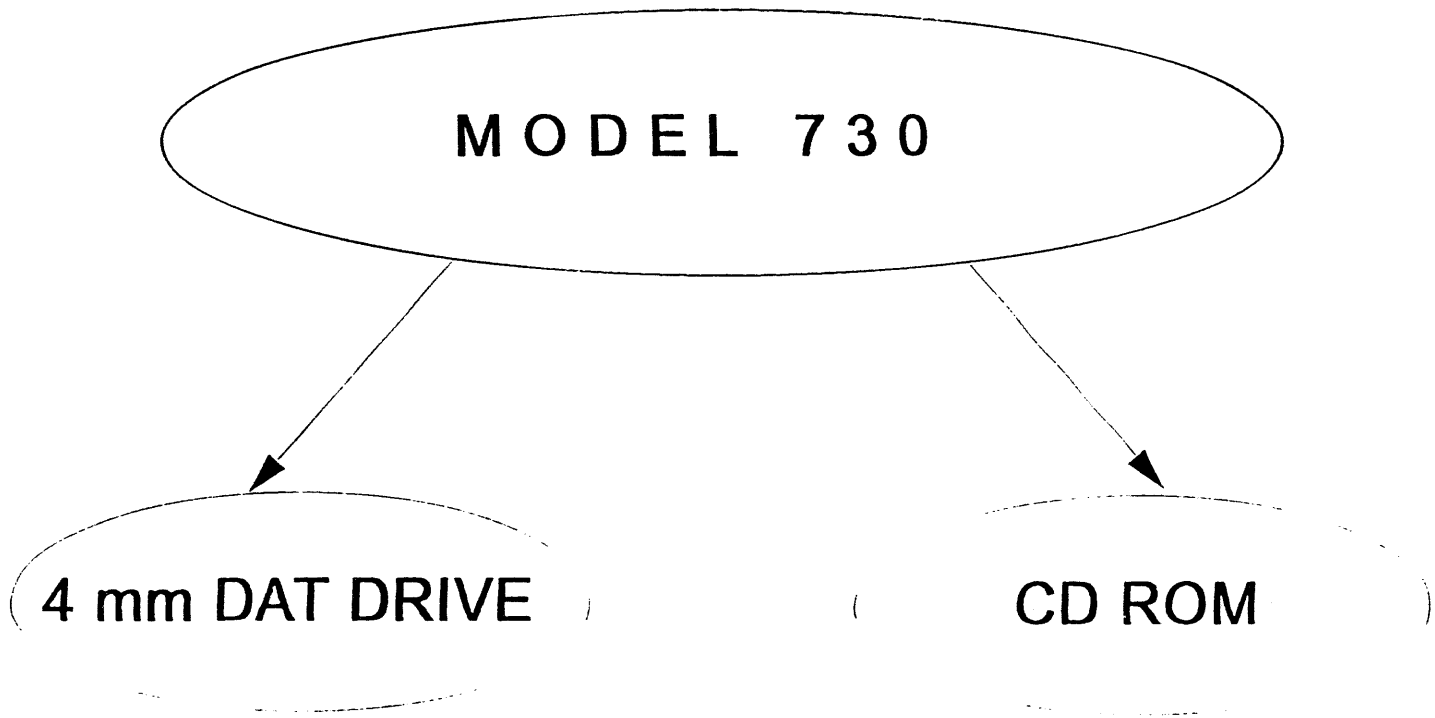
DEPARTMENT 2483



5 SILICON GRAPHICS WORKSTATIONS



1 HEWLETT PACKARD WORKSTATION



- 2 PRINTERS
  - LASERJET III Si
- SERVER
  - IRIS CRIMSON

SANDIA NATIONAL LABORATORIES

FACILITIES REPORT

NEW CNC MACHINES

- BOSTOMATIC 5-AXIS
  - X=40", Y=12.5", Z=17"
  - BDC 3200 CONTROLLER

NEW RAPID PROTOTYPE MACHINES

- DESK TOP MANUFACTURING (DTM)
  - SELECTIVE LASER SINTERING (SLS)
  - BETA MACHINE
  - INVESTMENT CASTING WAX
- SOLIGEN
  - DIRECT SHELL PRODUCTION CASTING (DSPC)
  - ALPHA MACHINE
  - 3D PRINTING

APPENDIX I

DEMO
ANVIL TOOL PATH GENERATION
5-AXIS

Presented by:

J. D. May
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

APPENDIX J

DEMO
VIDEO MACHINE/ROBOT
ANIMATION DYNAMICS

Presented by:

Janie Lunsford
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

J. D. MAY - Y-12

APPENDIX K

DEMO
CERTIFICATION OF ANVIL
TOOL PATH GENERATION

Presented by:

J. V. May
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

J. V. MAY - Y-12

APPENDIX L

TOUR
M-60 INSPECTION MACHINE

Presented by:

Nick Zurcher
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

APPENDIX M

DISTRIBUTED NUMERICAL CONTROL CERTIFICATION (DNC)

Presented by:

Gene J. Maes
Los Alamos National Laboratory
Los Alamos, New Mexico

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

TECHNICAL INFORMATION RELEASE

(Instructions on back.)

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1. AUTHOR(S) (Full name and group affiliation)

Gene J. Maes, WX-3

2. AUTHOR(S) (Signature and date)

Gene J. Maes

1-27-93

3. Title of Article (in caps) (Spell out all symbols)

DISTRIBUTED NUMERICAL CONTROL CERTIFICATION

4. ☒ Abstract Intended for: ☐ Journal ☐ Proceedings ☒ Meeting ☐ Talk ☐ Other Controlled Meeting/Journal ☒ Yes ☐ No
☐ Full Paper Particulars:
☒ Other Viewgraphs

62nd IMOG/NSG Meeting
Y-12 Oak Ridge, Tennessee
February 9-10, 1993

5. List numbers of previous reports that might be useful to reviewer.
LA-CP-91-379, LA-CP-93-002

6. Research sponsored by: ☐ DOE ☐ DOD ☐ NRC ☐ Other 7. Funding agency release required ☐ Yes ☒ No COPY ATTACHED ☐ Yes ☐ No		Program Code CW10
8. Deadline Date	Group Office Telephone 667-6310	Mail Stop C930
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A S Hlavaty 1-28-93

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Reviewer	Date	☐ U ☐ C ☐ S ☐ RD ☐ FRD ☐ NSI ☐ UCNI ☐ ECI For NSI: Guide _____ Duration _____

PATENT LAW

Patent Interest ☐ Yes ☐ No	Docket Number	Patent Law Reviewer and Date
Comments:		

Abstract
1993 IMOG/NSG Meeting
February 9-10, 1993
Oak Ridge, Tennessee

Gene J. Maes
High Explosives Fabrication (WX-3)
Los Alamos National Laboratory
Los Alamos, New Mexico

Because of safety issues associated with machining high explosives (HE), Los Alamos has been justly cautious about allowing the machining of HE via computer networks.

Group WX-3 Weapons Prototype and Group WX-12 Engineering and Information Resources are now shipping numerical data electronically to the equipment used in machining high explosives via a DNC network.

The first phase in certifying the DNC system has been completed and we have initialized the phase two mode, which includes enhancements to the menu.

Distributed Numerical Control Certifaction (DNC)

62nd IMOG/NSG MEETING MARTIN MARIETTA ENERGY SYSTEMS INC. FEBRUARY 9-10, 1993 OAK RIDGE TENN.

Presented by:

Gene J Maes
Numerical Control
Process Coordinator

Los Alamos National Laboratory

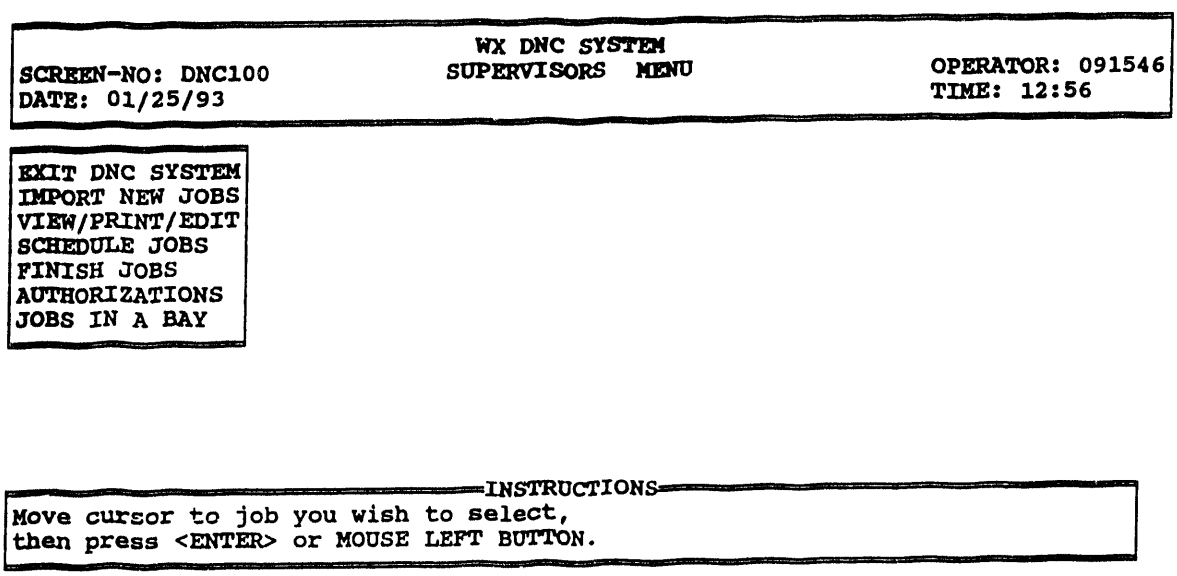
Los Alamos National Laboratory

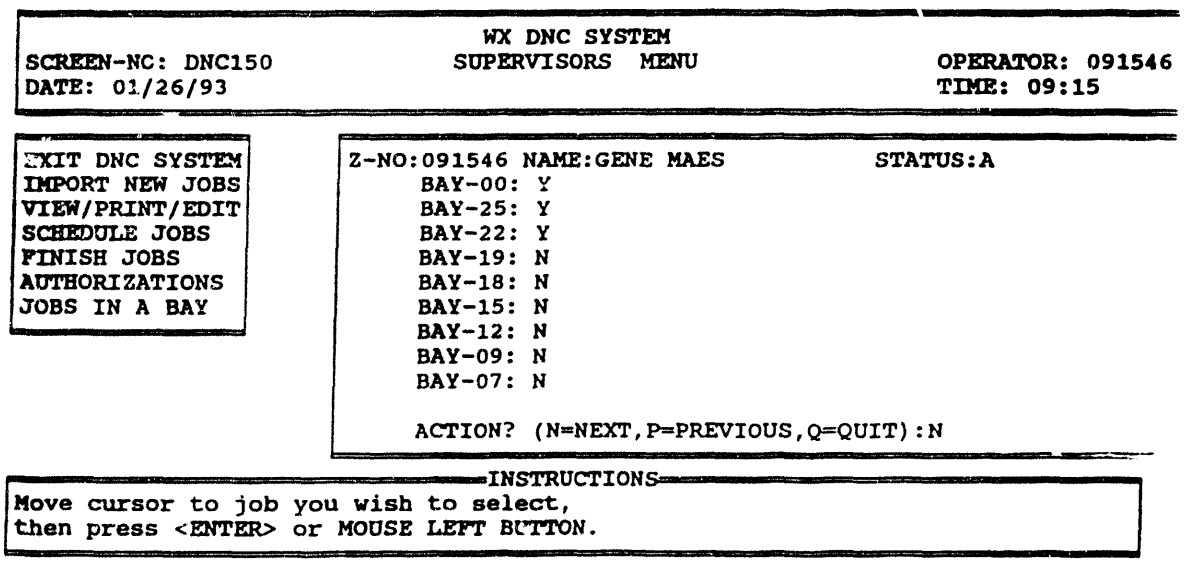
WX Division

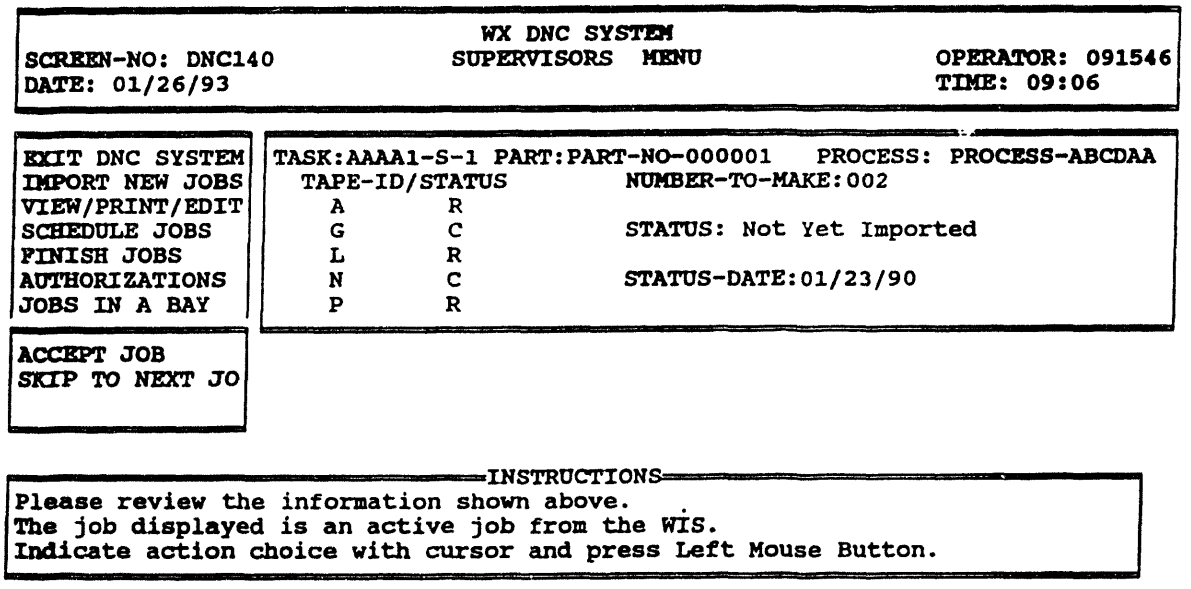
Distributed Numerical Control System

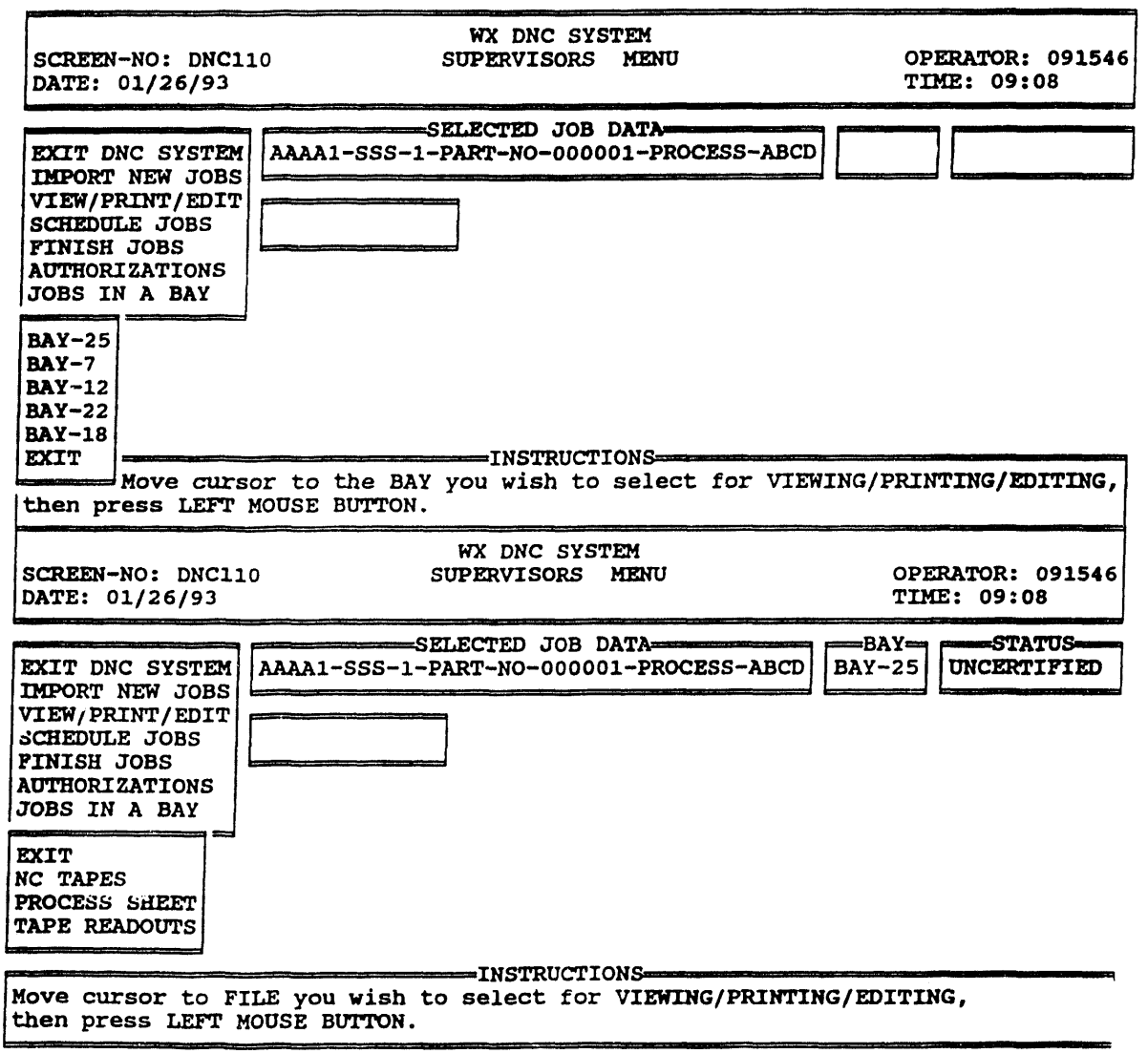
Enter Z # 091546
Password

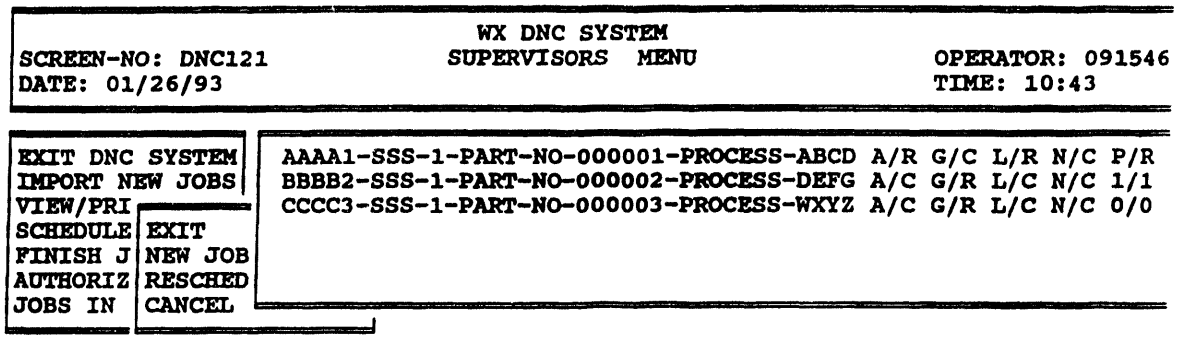
January 25, 1993 12:51:26

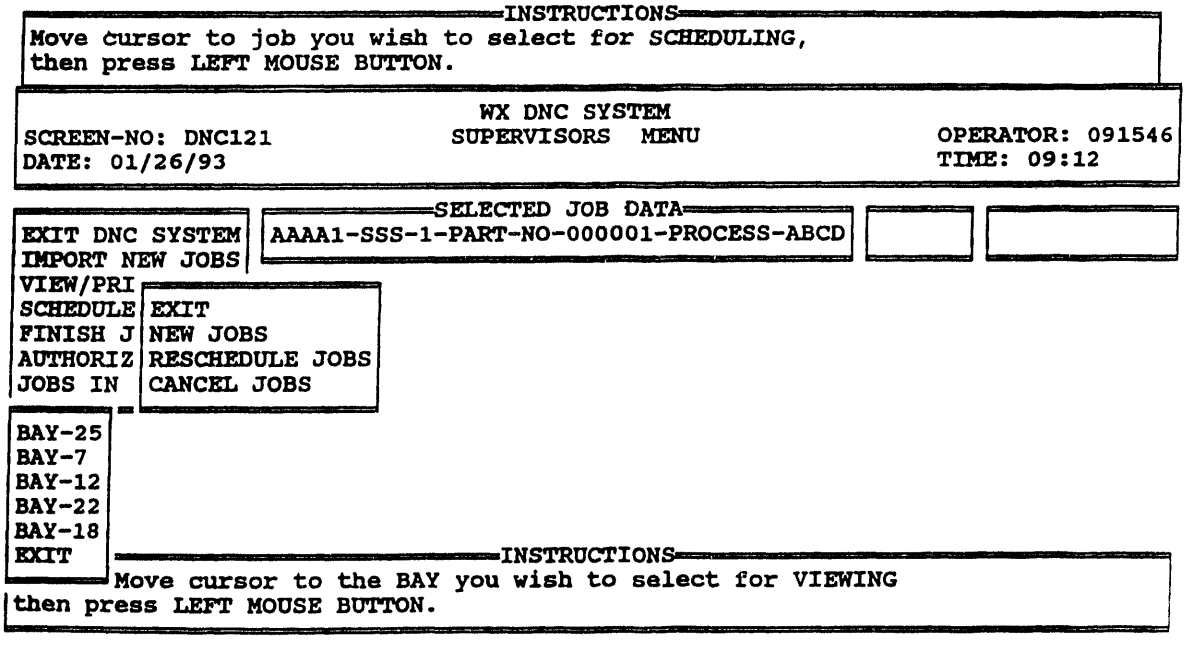

WX DNC SYSTEM
SCREEN-NO: DNC100
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/25/93
TIME: 12:56
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
INSTRUCTIONS
Move cursor to job you wish to select,
then press <ENTER> or MOUSE LEFT BUTTON.

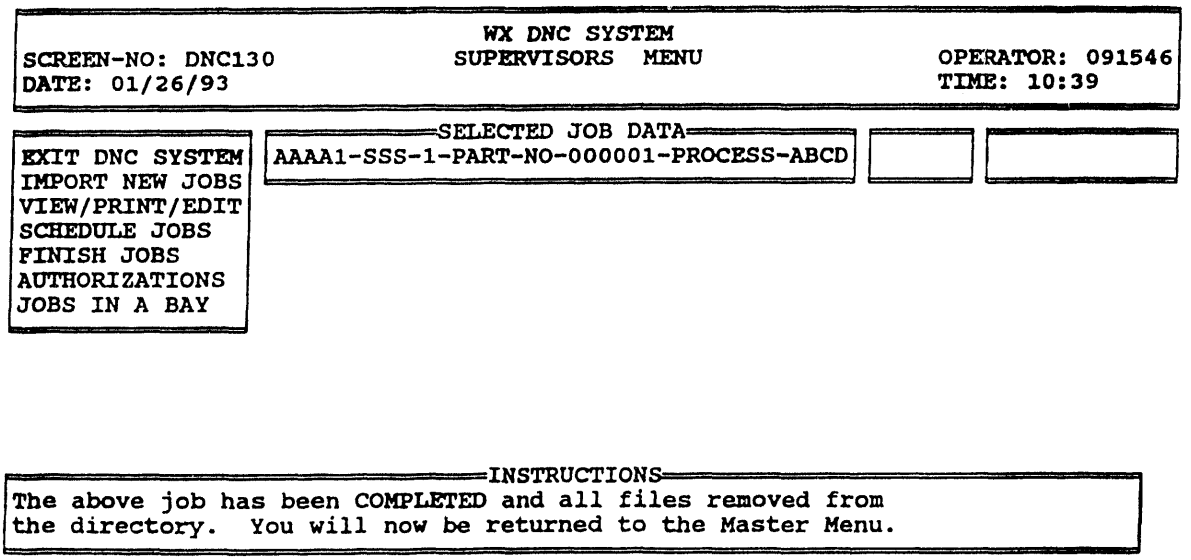

WX DNC SYSTEM
SCREEN-NC: DNC150
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 09:15
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
Z-NO:091546 NAME:GENE MAES
STATUS:A
BAY-00: Y
BAY-25: Y
BAY-22: Y
BAY-19: N
BAY-18: N
BAY-15: N
BAY-12: N
BAY-09: N
BAY-07: N
ACTION? (N=NEXT,P=PREVIOUS,Q=QUIT):N
INSTRUCTIONS
Move cursor to job you wish to select,
then press <ENTER> or MOUSE LEFT BUTTON.

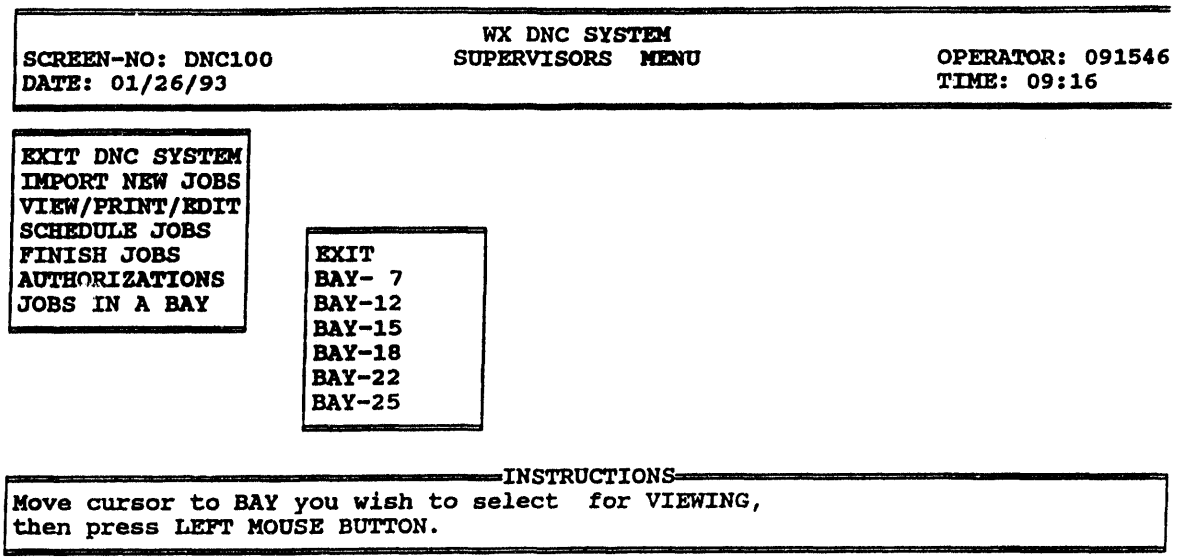

WX DNC SYSTEM
SCREEN-NO: DNC140
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 09:06
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
ACCEPT JOB
SKIP TO NEXT JO
TASK:AAAA1-S-1 PART:PART-NO-000001 PROCESS: PROCESS-ABCDAA
TAPE-ID/STATUS
NUMBER-TO-MAKE:002
A R
G C
STATUS: Not Yet Imported
L R
N C
STATUS-DATE:01/23/90
P R
INSTRUCTIONS
Please review the information shown above.
The job displayed is an active job from the WIS.
Indicate action choice with cursor and press Left Mouse Button.

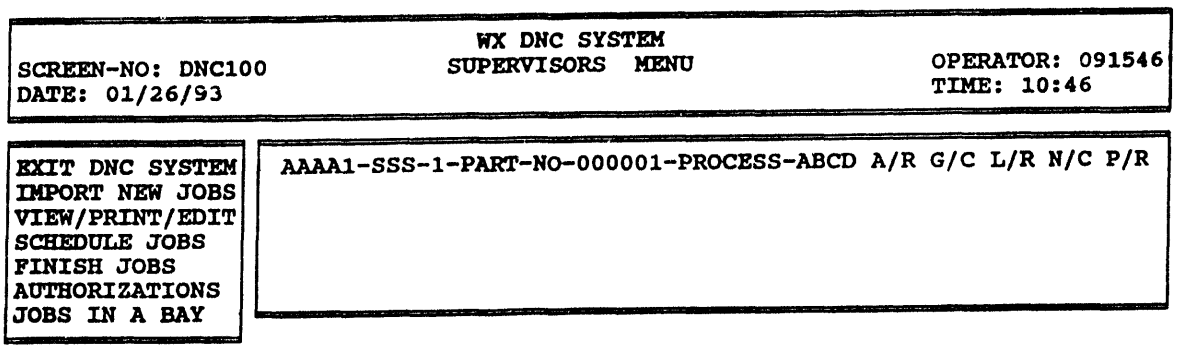

WX DNC SYSTEM
SCREEN-NO: DNC110
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 09:08
SELECTED JOB DATA
AAAA1-SSS-1-PART-NO-000001-PROCESS-ABCD
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
BAY-25
BAY-7
BAY-12
BAY-22
BAY-18
EXIT
INSTRUCTIONS
Move cursor to the BAY you wish to select for VIEWING/PRINTING/EDITING,
then press LEFT MOUSE BUTTON.
WX DNC SYSTEM
SCREEN-NO: DNC110
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 09:08
SELECTED JOB DATA
AAAA1-SSS-1-PART-NO-000001-PROCESS-ABCD
BAY
BAY-25
STATUS
UNCERTIFIED
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
EXIT
NC TAPES
PROCESS SHEET
TAPE READOUTS
INSTRUCTIONS
Move cursor to FILE you wish to select for VIEWING/PRINTING/EDITING,
then press LEFT MOUSE BUTTON.


WX DNC SYSTEM
SCREEN-NO: DNC121
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 10:43
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRI
SCHEDULE
FINISH J
AUTHORIZ
JOBS IN
EXIT
NEW JOB
RESCHED
CANCEL
AAAA1-SSS-1-PART-NO-000001-PROCESS-ABCD A/R G/C L/R N/C P/R
BBBB2-SSS-1-PART-NO-000002-PROCESS-DEFG A/C G/R L/C N/C 1/1
CCCC3-SSS-1-PART-NO-000003-PROCESS-WXYZ A/C G/R L/C N/C 0/0


INSTRUCTIONS
Move cursor to job you wish to select for SCHEDULING,
then press LEFT MOUSE BUTTON.
WX DNC SYSTEM
SCREEN-NO: DNC121
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 09:12
SELECTED JOB DATA
AAAA1-SSS-1-PART-NO-000001-PROCESS-ABCD
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRI
SCHEDULE
FINISH J
AUTHORIZ
JOBS IN
EXIT
NEW JOBS
RESCHEDULE JOBS
CANCEL JOBS
BAY-25
BAY-7
BAY-12
BAY-22
BAY-18
EXIT
INSTRUCTIONS
Move cursor to the BAY you wish to select for VIEWING
then press LEFT MOUSE BUTTON.


WX DNC SYSTEM
SCREEN-NO: DNC130
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 10:39
SELECTED JOB DATA
AAAA1-SSS-1-PART-NO-000001-PROCESS-ABCD
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
INSTRUCTIONS
The above job has been COMPLETED and all files removed from
the directory. You will now be returned to the Master Menu.


WX DNC SYSTEM
SCREEN-NO: DNC100
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 09:16
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
EXIT
BAY- 7
BAY-12
BAY-15
BAY-18
BAY-22
BAY-25
INSTRUCTIONS
Move cursor to BAY you wish to select for VIEWING,
then press LEFT MOUSE BUTTON.


WX DNC SYSTEM
SCREEN-NO: DNC100
SUPERVISORS MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 10:46
EXIT DNC SYSTEM
IMPORT NEW JOBS
VIEW/PRINT/EDIT
SCHEDULE JOBS
FINISH JOBS
AUTHORIZATIONS
JOBS IN A BAY
AAAA1-SSS-1-PART-NO-000001-PROCESS-ABCD A/R G/C L/R N/C P/R

WX DNC SYSTEM

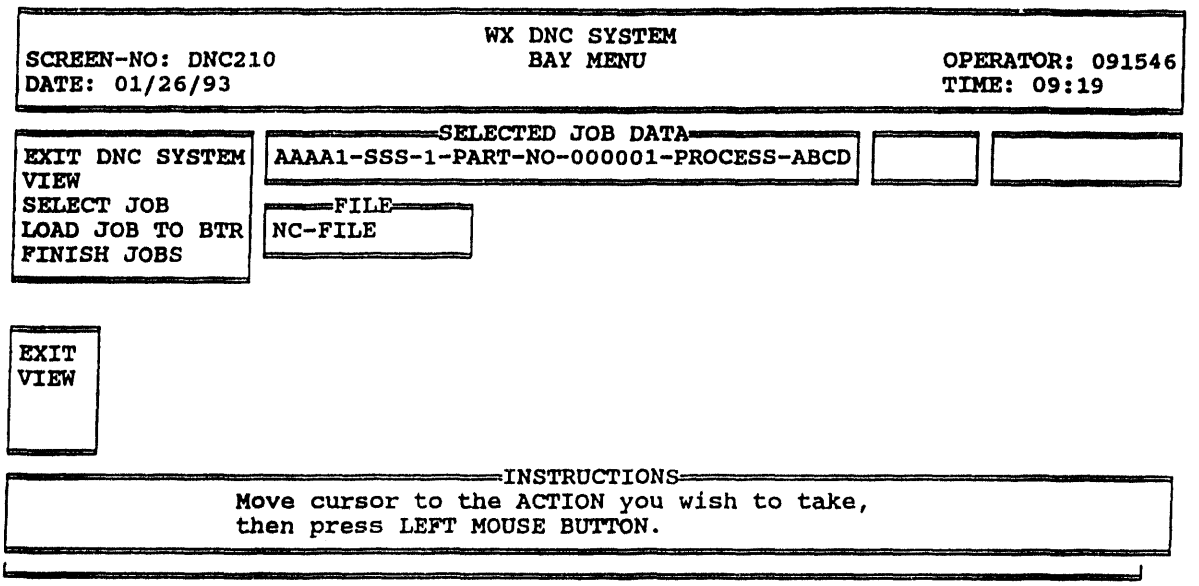
SCREEN-NO: DNC200
DATE: 01/25/93

BAY MENU

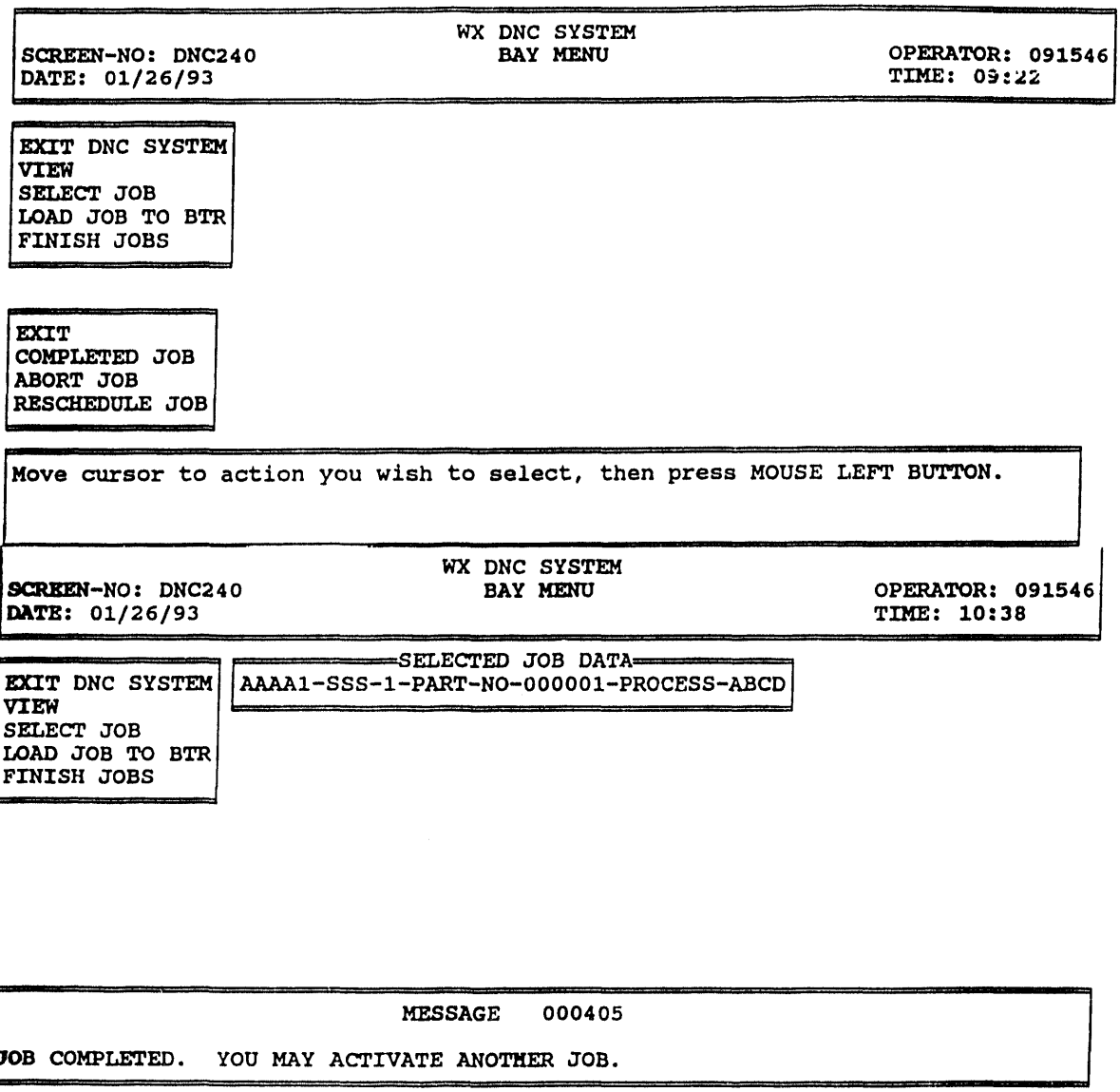
OPERATOR: 091546
TIME: 12:55

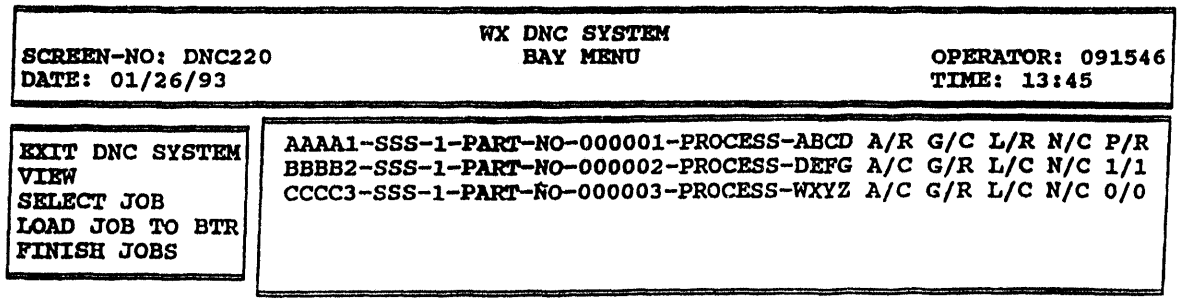
EXIT DNC SYSTEM
VIEW
SELECT JOB
LOAD JOB TO BTR
FINISH JOBS

Move cursor to action you wish to select, then press MOUSE LEFT BUTTON.




```
(FAMILYDAYS13-14-90G.MAES)
(PROG.NO.FAMILYDAYS01AMDWG.NO.FAMILYDAYSSHEET1)
(DWG.REVISIONADETNO.FAMILYDAYS-0101A)
(PROG.REVISIONAPROG.VERSION1)
N0001G99
(OPER.1)
(USE.250RADBUTTONTOOL)
(ROUGHI.D.)
(TOOLEXTENSION.75MINIMUM)
N0010G92X50000Z50000
N0011G90
N0012G95T101
N0013G92S00350
N0014G96R50000S2100M03
N0015G04F00006M08
N0016M09
N0017G70
N0018G90
N0019G95
N0020G00X23750Z33000F0
N0021G04F00006M07
N0022G01X0F1500
Use  → ↑ ↓ or PgUp/PgDn to scroll; Home for beginning; End for end; ESC to quit
```


WX DNC SYSTEM
SCREEN-NO: DNC240
BAY MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 09:22
EXIT DNC SYSTEM
VIEW
SELECT JOB
LOAD JOB TO BTR
FINISH JOBS
EXIT
COMPLETED JOB
ABORT JOB
RESCHEDULE JOB
Move cursor to action you wish to select, then press MOUSE LEFT BUTTON.
WX DNC SYSTEM
SCREEN-NO: DNC240
BAY MENU
OPERATOR: 091546
DATE: 01/26/93
TIME: 10:38
EXIT DNC SYSTEM
VIEW
SELECT JOB
LOAD JOB TO BTR
FINISH JOBS
SELECTED JOB DATA
AAAA1-SSS-1-PART-NO-000001-PROCESS-ABCD
MESSAGE 000405
JOB COMPLETED. YOU MAY ACTIVATE ANOTHER JOB.



Move cursor to job you wish to ACTIVATE for LOADING.
Press LEFT MOUSE BUTTON after you have made your pick.

DATE	TIME	LOCATION	OPERATOR	ERROR CODE	ERROR MESSAGE
'012693'	'091831'	'16'	'260DNC25'	'091546'	'000451'	' '
'012693'	'091831'	'16'	'260DNC25'	'091546'	'000425'	' '
'012693'	'091847'	'16'	'260DNC25'	'091546'	'000128'	' '
'012693'	'091848'	'16'	'260DNC25'	'091546'	'000129'	' '
'012693'	'091952'	'16'	'260DNC25'	'091546'	'000112'	' '
'012693'	'092105'	'16'	'260DNC25'	'091546'	'000306'	'AAAA1SSS'
'012693'	'092119'	'16'	'260DNC25'	'091546'	'000130'	' '
'012693'	'092119'	'16'	'260DNC25'	'091546'	'000409'	' '
'012693'	'092119'	'16'	'260DNC25'	'091546'	'000129'	' '
'012693'	'092122'	'16'	'260DNC25'	'091546'	'000400'	'AAAA1SSS1'	'PART-NO-000001
'012693'	'092130'	'16'	'260DNC25'	'091546'	'000302'	' '
'012693'	'092134'	'16'	'260DNC25'	'091546'	'000123'	' '
'012693'	'092202'	'16'	'260DNC25'	'091546'	'000402'	'AAAA1SSS1'	'PART-NO-000001
'012693'	'092206'	'16'	'260DNC25'	'091546'	'000131'	' '
'012693'	'092250'	'16'	'260DNC25'	'091546'	'000405'	'AAAA1SSS1'	'PART-NO-000001
'012693'	'092314'	'16'	'260DNC25'	'091546'	'000130'	' '
'012693'	'092314'	'16'	'260DNC25'	'091546'	'000409'	' '
'012693'	'092315'	'16'	'260DNC25'	'091546'	'000129'	' '
'012693'	'092321'	'16'	'260DNC25'	'091546'	'000109'	' '
'012693'	'092330'	'16'	'260DNC25'	'091546'	'000452'	' '

Use → ↑ ↓ or PgUp/PgDn to scroll; Home for beginning; End for end; ESC to quit

APPENDIX N

SPLINE USAGE METHOD

Presented by:

Ralph J. Gladfelter
Los Alamos National Laboratory
Los Alamos, New Mexico

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

TECHNICAL INFORMATION RELEASE

(Instructions on back.)

GROUP OS-6
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This form is to be completed and submitted to OS-6, Classification Group, with copies as required of abstract or paper BEFORE any presentation or submittal for publication is made of the technical work of the Laboratory. LA-UR cover (Form 836) required on all copies of full papers. For LA-series reports, use green Form 595. Allow three days for review. For complete policy on publications, refer to Laboratory Manual 4
APPROVALS: Division(s) approval REQUIRED on all submittals.

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~~LA-UR~~/LA-CP: LA-CP-93-182

1. AUTHOR(S) (Full name and group affiliation)
Ralph J. Gladfelter, Jr.
WX-12 7-7501

2. AUTHOR(S) (Signature and date)
Ralph J. Gladfelter, Jr.
7-12-93

3. Title of Article (in caps) (Spell out all symbols)
Current Spline Usage Method, Slide 1
Proposed Spline Usage Method, Slide 2
Features of Proposed Method, Slide 3

4. ☐ Abstract ☐ Full Paper ☒ Other
Intended for: ☐ Journal ☐ Proceedings ☒ Meeting ☒ Talk ☐ Other — Controlled Meeting/Journal ☐ Yes ☐ No
Particulars:
1993 DOE Interagency Mechanical Operations Group Meeting
Numerical Systems Group Oak Ridge, TN
2/8-10/93

5. List numbers of previous reports that might be useful to reviewer. NONE

6. Research sponsored by: ☒ DOE ☐ DOD ☐ NRC ☐ Other
7. Funding agency release required ☐ Yes ☒ No COPY ATTACHED ☐ Yes ☐ No

Program Code: CW10

8. Deadline Date: 8/30/93
Group Office Telephone: 505-667-4772
Mail Stop: C932

9. Derivative Classifier's Signature: James M. Haines — Date: 7/12/93 — ☐ Classified ☐ Unclassified, limited. Explain: ☒ Unclassified

10. Division(s) Signature and Date: [signature] 7-12-93

CLASSIFICATION GROUP

Date Received	DOE/NRC Category	Group/Author Notification of Release
7-14-93	706	Elaine 7-15-93
Reviewer: BP B. Palen	Date: 7/14/93	☒ U ☐ C ☐ S ☐ RD ☐ FRD ☐ NSI ☐ UCNI ☐ ECI — For NSI: Guide ____ Duration ____

PATENT LAW

Patent Interest	Docket Number	Patent Law Reviewer and Date
☐ Yes ☐ No		

Comments:

ST 2668

Proposed Spline Usage Method

1 **Receive** design data from physics designers.

2 **Leave analytical geometry alone** and **keep all the through points** supplied for each spline.

3 **Store splines on WFSYS** (a spline data base).

4 **Read spline data into CAE system** and generate 3rd or higher splines. Keep analytical curves analytical.

5 **Perform all necessary spline manipulations** on CAE system spline geometry.

6 **Generate APT compatible geometry** from CAE system definition using IS software. Fan and/or eliminate points as necessary.

7 **QA model**

a) Put APT equivalent spline definition on drawing tables

b) Compare final spline geometry against initial spline geometry and report back to the physics designers. If analytical curves must be converted to splines, compare the final splines with their appropriate analytical curve.

APPENDIX O

FACILITY REPORTS

Presented by:

Paul F. Boyer
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

UCN-7721B (2 1-66) mcb 1/28/93

OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

DOCUMENT DESCRIPTION (Completed By Requesting Division)

Document No.	Author's Telephone No.	Acct. No.	Date of Request
Y/EN-4848 Visuals	4-2148	7410-65-0690	01/19/93

1993 JAN 27 PM 7:51

Unclassified Title: Facility Reports (U)

Author(s): Paul F. Boyer

TYPE: ☐ Formal Report ☒ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☒ Oral Presentation (identify meeting, sponsor, location, date): 62nd IMOG/NSG Meeting
9201-5, Y-12 Plant, Oak Ridge, TN 37831

☐ Journal Article (Identify Journal): Interagency Mechanical Operations Group Meeting Minu

☐ Other (Specify):

Document will be published in proceedings ☐ No ☒ Yes

Document will be distributed at meeting ☐ No ☐ Yes

Document has patent or invention significance ☒ No ☐ Yes (Identify)

Document has been previously released ☒ No ☐ Yes (Reference)

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

Title(s): (U) Abstract: (U)

DOCUMENT: Level (U) Category (U)

B.F. Boyer — Signature — 1/25/93 Date

DOCUMENT REQUEST APPROVED (Division or Department)

Signature — Date

Signature — Date

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ANNOUNCE IN: ☐ AWDR (Available from OSTI) ☐ ANCR

Distribution:	UCN-7721B	DOE F-1332.15	Document
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TIO File			
P.F. Boyer			

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Lloyd B Porter 1/28/93
Y-12 Classification Office — Date

☐ Editor — Date

☒ 3 Patent Office — 1/29/93 Date

☐ Other — Date

☐ Other — Date

APPROVED FOR: ☐ Declassification ☐ Release subject to use of the following admonitory markings and conditions:

☒ Disclaimer ☐ Copyright ☐ Patent Caution ☐ Other

M. L. Bond 1/29/93
Technical Information Office — Date

Conditions/Remarks:

Y/EN-4848

Y-12

FACILITY REPORTS (U)

OAK RIDGE
Y-12
PLANT

MARTIN MARIETTA

P. F. BOYER

NUMERICAL CONTROL ENGINEERING DEPARTMENT
ENGINEERING DIVISION

62ND IMOG/NSG MEETING

Y-12 Plant

February 9-10, 1993

PREPARED BY THE
OAK RIDGE Y-12 PLANT
OAK RIDGE, TENNESSEE 37831

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE
U. S. DEPARTMENT OF ENERGY
UNDER CONTRACT DE-AC05-84OR21400

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

FACILITY REPORTS
NC ENGINEERING Y-12
P. F. BOYER

62nd. IMOG/NSG MEETING
Y-12 PLANT FEBRUARY 9-10, 1993
OAK RIDGE TN

MARTIN MARIETTA

OAK RIDGE Y-12 PLANT, MANAGED BY MARTIN MARIETTA ENERGY SYSTEMS INC. for the U.S. DEPARTMENT OF ENERGY under contract DE-AC05-84OR21400

FACILITY REPORT
ABSTRACT

ABSTRACT

THE STATUS OF MAJOR ON-GOING NC ENGINEERING ACTIVITIES INCLUDING ANVIL STATUS, NC STATISTICS, MEASURES OF PERFORMANCE, CUSTOMER SATISFACTION, CHANGING STAFF/WORKLOAD.

ABSTRACT

FACILITY REPORT
Y-12 ANVIL STATUS

- ANVIL STATUS
  - ANVIL 4000 VERSION 1.8
    - ANVIL 4000 VERSION 1.8 STILL AVAILABLE FOR USE. SCHEDULED TO BE PHASED OUT WHEN ALL ANVIL 5000 INTERFACES ARE OPERATIONAL.
  - ANVIL 5000, STATUS
    - ANVIL 5000, VERSION 2.2 HAS BEEN CERTIFIED FOR USE ON ALL WORK INCLUDING WR, CASH, AND WFO'S.
    - PRIMARY USE OF ANVIL 5000 TODAY IS ON WORKSTATIONS GENERATING WFO'S MULTI AXIS TAPES AND FOR INSPECTING WFO'S PARTS WITH CIMSTATION.
    - THE ELECTRONIC FILE MANAGER (EFM) DEVELOPED FOR ANVIL 4000 IS NOT YET OPERATIONAL FOR ANVIL 5000.

FACILITY REPORT
NC HARDWARE/SOFTWARE STATUS

- NC HARDWARE/SOFTWARE STATUS
  - 3, SG INDIGO W/S'S DELIVERED AND BEING USED IN STAND ALONE MODE FOE MULTI-AXIS WFO'S TOOLPATH GENERATION AND CMM PROGRAMMING VIA CIMSTATION.
  - ONE COLOR PLOTTER FOR SG PROCURED
  - MIE FUNDING FOR 2 W/S'S
  - SOFTWARE
    - SITE LICENSE PROCURED FOR CIMSTATION
    - AIM CONTRACT W/SILMA FOR YZ AIM IN TESTING PHASE.
  - ADP SECURITY PLANS
    - Y-12 SECURITY/DOE APPROVAL PENDING TO W/S'S VIA ETHERNET

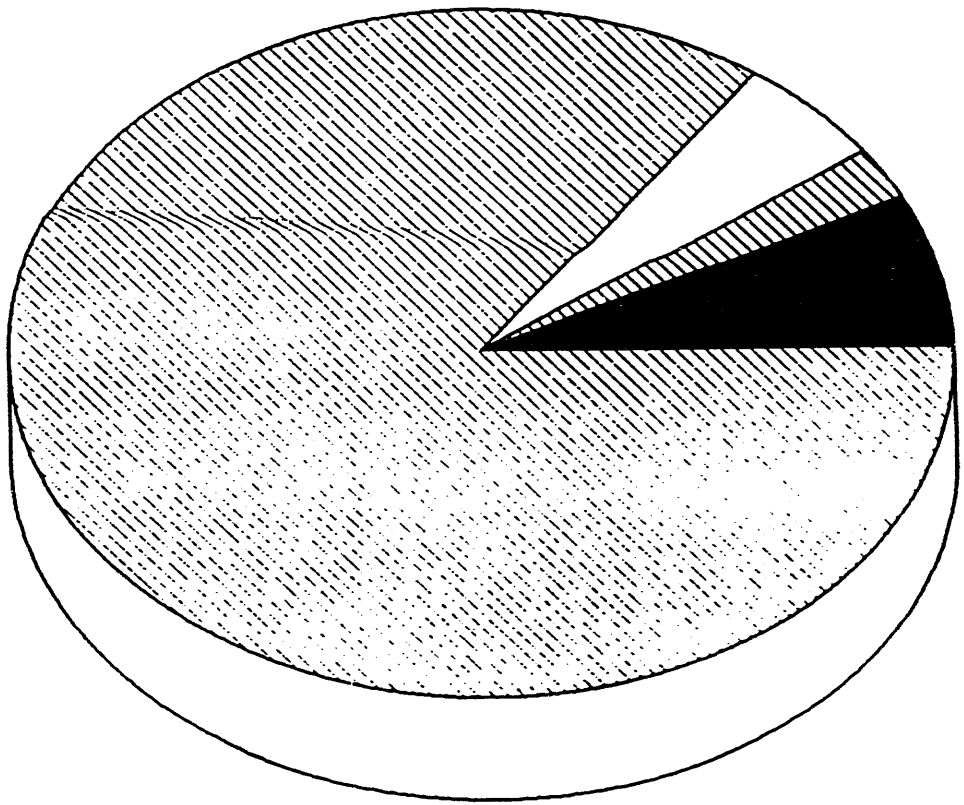
FACILITY REPORTS
NC HARDWARE/SOFTWARE STATUS

- NC HARDWARE/SOFTWARE CONT'D
  - SIMULATION SOFTWARE
    - DENEB/IGRIP SIMULATION SOFTWARE PROCURED FOR SG W/S
    - ALL WFO'S TAPES FOR 8-AXIS G&L BEING SIMULATED BEFORE DELIVERY
    - MACHINE MODEL DEVELOPED AND BEING TESTED FOR K&T MOD 3, 5 AXIS TO SIMULATE ADDITIONAL WFO'S PP OUTPUTS

FACILITY REPORT
NC ENGINEERING STAFF/WORKLOAD STATUS

- NC ENGINEERING STAFF STATUS
  - OCTOBER 1, 1991
    - 44 PROGRAMMERS ON STAFF
  - JANUARY 31,1993
    - 24 PROGRAMMERS CN STAFF
      - ✓ 3 VRIFS
      - ✓ 20 TRANSFERS TO OTHER POSITIONS IN ENG.
      - ✓ 0 LAYOFFS
  - PART PROGRAMMING WORKLOAD
    - MORE THAN COMFORTABLE TODAY
    - HEAVY EMPHASIS ON WFO'S AND NWC CASH WORK
    - STILL SOME TOOLBUILDINFUNDING
    - SOME TECHNOLOGY TRANSFER DEMOS BEING WORKED
    - ONE CRADA APPROVED
    - ?? ON ETDAM INVOLVEMENT

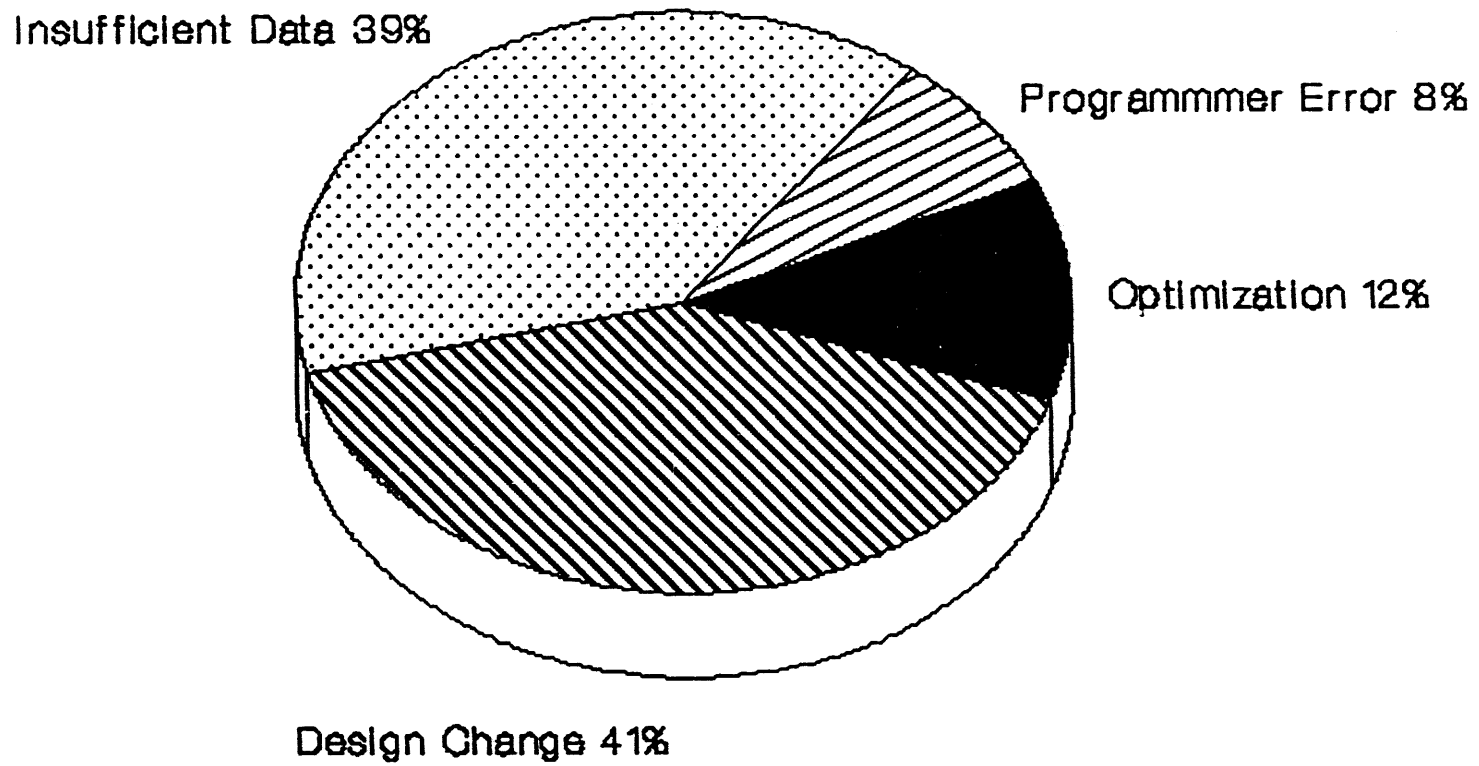
NC Tape Delivery Statistics
Jan 1 - Dec 31, 1992



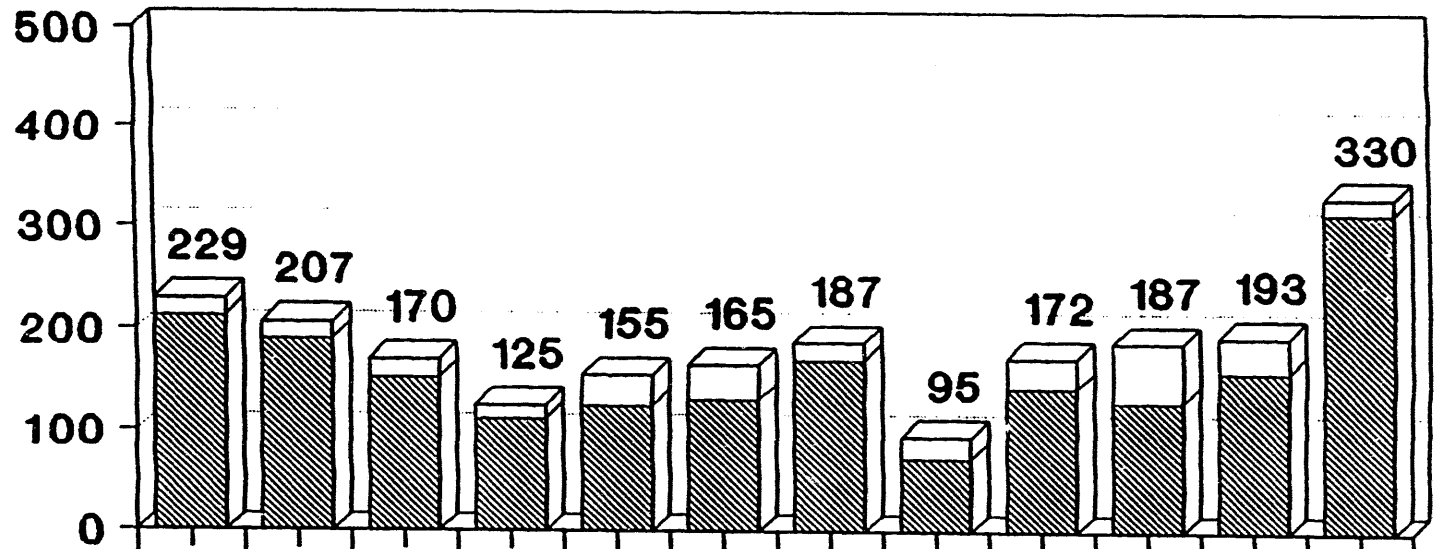
NC Tape Revision Statistics

Manufacturing

Jan 1 - Dec 31, 1992



1C Engineering Tapes Shipped
Jan 1 - Dec 31, 1992



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Late	16	17	17	13	30	34	17	22	29	57	34	15
On time	213	190	153	112	125	131	170	73	143	130	159	315
Total shipped	229	207	170	125	155	165	187	95	172	187	193	350

On time Late

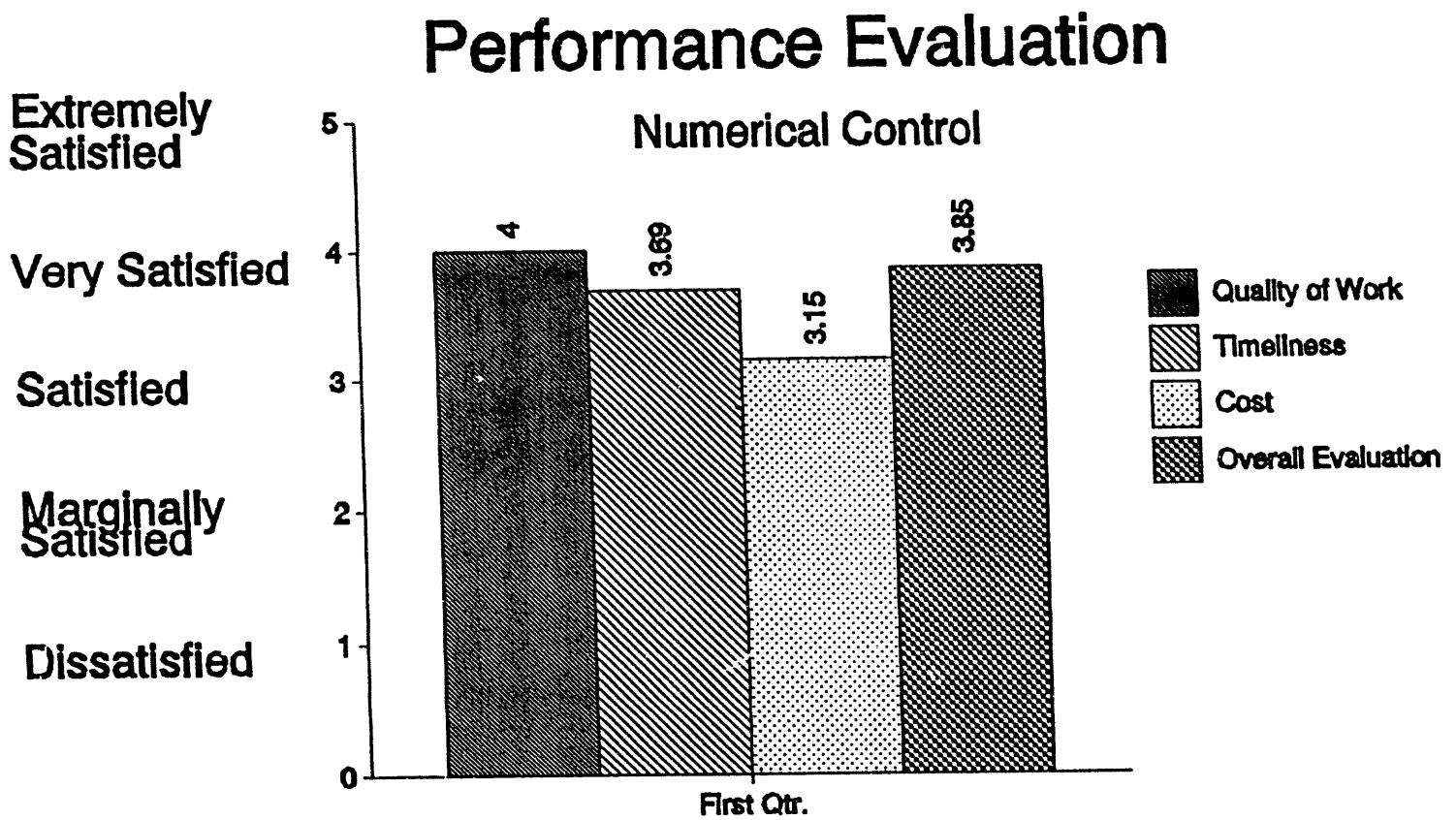
NUMERICAL CONTROL STATISTICS - FY1992

FY 92	TOTAL JOBS	ANV. MACH	ANV. INSP	TOT. ANV.	ANVIL %	CMM OMM	CMM OMM %	TOTAL APT JOBS	APT %	APT INSP. WORK	APT MACH. WORK	Other ANVIL Work	CMM/ OMM ANVIL
Oct.	218	84	19	103	47.2%	19	8.7%	75	34.4%	16	59	23	2
Nov.	227	76	45	121	53.3%	65	28.6%	64	28.2%	15	49	2	25
Dec.	165	46	0	46	27.9%	39	23.6%	80	48.5%	30	50	0	0
Jan.	229	62	45	107	46.7%	71	31.0%	81	35.4%	41	40	3	33
Feb.	207	90	26	116	56.0%	45	21.7%	46	22.2%	0	46	25	25
March	170	21	15	36	21.2%	54	31.8%	81	47.6%	11	70	2	3
April	125	24	8	32	25.6%	15	12.0%	79	63.2%	18	61	0	1
May	155	30	12	42	27.1%	52	33.5%	60	38.7%	12	48	8	7
June	165	41	1	42	25.5%	7	4.2%	115	69.7%	35	80	2	1
July	187	35	32	67	35.8%	23	12.3%	93	49.7%	40	53	6	2
Aug.	95	28	5	33	34.7%	6	6.3%	46	48.4%	9	37	10	0
Sept.	172	49	10	59	34.3%	11	6.4%	90	52.3%	35	55	12	0
	2115	586	218	804	38.0%	407	19.2%	910	43.0%	262	648	93	99

NUMERICAL CONTROL STATISTICS - FY1993

FY 93	TOTAL JOBS	ANV. MACH.	ANV. INSP.	TOT. ANV.	ANVIL %	CMM OMM	CMM OMM %	TOTAL APT JOBS	APT %	APT INSP. WORK	APT MACH. WORK	Other Work	CMM/ OMM ANVIL	NC Staff
Oct.	187	57	4	61	32.6%	23	12.3%	91	48.7%	14	77	12	0	25
Nov.	193	49	13	62	32.1%	88	45.6%	48	24.9%	10	38	0	5	25
Dec.	350	169	4	173	49.4%	83	23.7%	80	22.9%	34	46	14	0	25
	730	275	21	296	40.5%	194	26.6%	219	30.0%	58	161	26	5	

SUMMARY	TOTAL JOBS	ANVI MACH	ANVI INSP	TOTA ANVI	CADA CATI	TOT GRA	ANVIL %	CADAM CATIA %	GRA. %	CMM OMM	CMM OMM %	TOTAL APT JOBS	APT %	APT INSP. WORK	APT MACH. WORK	Other ANVIL Work	ANVIL CMM/ OMM
FY1985	6165			540	229	769	8.8%	3.7%	12.5%	148	2.4%	5248	85.1%				
FY1986	6866	1340	193	1533	322	1855	22.3%	4.7%	27.0%	313	4.6%	4698	68.4%	1068	3630	1303	
FY1987	5929	1285	235	1520	708	2228	25.6%	11.9%	37.6%	463	7.8%	3245	54.7%	766	2479	2938	
FY1988	5451	1297	297	1594	305	1899	29.2%	5.6%	34.8%	409	7.5%	3211	58.9%	784	2427	3308	
FY1989	3490	854	477	1331	71	1402	38.1%	2.0%	40.2%	341	9.8%	1792	51.3%	405	1387	807	75
FY1990	3024	729	143	872	41	913	28.8%	1.4%	30.2%	248	8.2%	1792	59.3%	600	1192	76	6
FY1991	4112	1585	218	1803	1	1804	43.8%	0.0%	43.9%	336	8.2%	1846	44.9%	609	1237	151	25
FY1992	2115	586	218	804	0	804	38.0%	0.0%	38.0%	407	19.2%	910	43.0%	262	648	93	99


Performance Evaluation
Numerical Control
Extremely Satisfied
Very Satisfied
Satisfied
Marginally Satisfied
Dissatisfied
5
4
3
2
1
0
4
3.69
3.15
3.85
First Qtr.
Quality of Work
Timeliness
Cost
Overall Evaluation

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M. A. Guthrie (2)
D. W. Howell
Y-12 Plant Recorde Records (RC)

APPENDIX P

Y-12 MANUFACTURING CAD EVALUATION

Presented by:

R. H. Ford
Oak Ridge Y-12 Plant
Oak Ridge, Tennessee

UCN-7721B (2 1-86) mcb 1/28/93

OAK RIDGE Y-12 PLANT INFORMATION CONTROL FORM

DOCUMENT DESCRIPTION (Completed By Requesting Division)

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Author(s): R. H. Ford, Jr.

TYPE: ☐ Formal Report ☒ Informal Report ☐ Progress/Status Report ☐ Co-Op Report ☐ Thesis/Term Paper

☒ Oral Presentation (identify meeting, sponsor, location, date): 62ND IMOG NSG MEETING 9201-5, Y-12 Plant, Oak Ridge, TN 37831

☐ Journal Article (Identify Journal): Interagency Mechanical Operations Group

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Document has patent or invention significance ☒ No ☐ Yes (Identify)

Document has been previously released ☒ No ☐ Yes (Reference)

DIVISION REVIEW AND APPROVAL (Completed By Requesting Division)

TECHNICAL CLASSIFICATION REVIEW (Divisional Classification Representative)

Title(s): (U) Abstract: (U)

DOCUMENT: Level (U) Category (U)

B.T. Boyer — Signature — 1/25/93 Date

DOCUMENT REQUEST APPROVED (Division or Department)

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Signature — Date

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TIO File			
R.H. Ford, JR.			

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DOCUMENT:

Level Unclassified Category —

Weapons Data ____ Sigma ____

Lloyd B Porter — Y-12 Classification Office — 1/28/93 Date

☐ Editor — Date

☒ Patent Office — 1/29/93 Date

☐ Other — Date

☐ Other — Date

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M. L. Bond — Technical Information Office — 1/29/93 Date

Conditions/Remarks

Y/EN-4847

Y-12

Y-12 MANUFACTURING CAD EVALUATION

OAK RIDGE
Y-12
PLANT

MARTIN MARIETTA

R. H. FORD, JR.

NUMERICAL CONTROL ENGINEERING DEPARTMENT
ENGINEERING DIVISION

62ND IMOG/NSG MEETING

Y-12 Plant

February 9-10, 1993

PREPARED BY THE
OAK RIDGE Y-12 PLANT
OAK RIDGE, TENNESSEE 37831

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE
U. S. DEPARTMENT OF ENERGY
UNDER CONTRACT DE-AC05-84OR21400

MANAGED BY
MARTIN MARIETTA ENERGY SYSTEMS, INC.
FOR THE UNITED STATES
DEPARTMENT OF ENERGY

Y-12 MANUFACTURING CAD SYSTEM EVALUATION
NUMERICAL CONTROL ENGINEERING

R. H. FORD, JR.

62ND IMOG/NSG MEETING
Y-12 PLANT FEBRUARY 9-10, 1993
OAK RIDGE TN

MARTIN MARIETTA

OAK RIDGE Y-12 PLANT, MANAGED BY MARTIN MARIETTA ENERGY SYSTEMS INC. for the U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-84OR21400

Y-12 MANUFACTURING CAD EVALUATION CHARTER

- JULY 1992, HUGH C. BEESON, MANAGER DESIGN ENGINEERING ISSUED THIS CHARTER:

  - EVALUATE OPTIONS, ASSOCIATED COSTS/BENEFITS OF PROVIDING CAD SUPPORT FOR Y-12 MANUFACTURING.

- ACTION TAKEN:

  - TEAM ESTABLISHED REPRESENTING COMPUTER AIDED ENG., PROGRAM MANAGEMENT, AND COMPUTING & TELECOMMUNICATION DIVISIONS

  - CHARGE GIVEN TO EVALUATE SOFTWARE/HARDWARE OPTIONS, COST AND BENEFITS FOR PROVIDING Y-12 MANUFACTURING SUPPORT

RHP1

Y-12 MANUFACTURING CAD EVALUATION CHARTER (continued)

- FACTORS DETERMINING CHARTER
  - PLANNED PURCHASE OF 25 ENGINEERING UNIX WORKSTATIONS
  - ENGINEERING SELECTION OF INTERGRAPH FOR FACILITY DESIGN
  - MIGRATION FROM VAX ANVIL 4000 TO WORKSTATION ANVIL 5000
  - SELECTIONS OF CAD SYSTEMS BY NWC DESIGN AGENCIES

RHF1a

Y-12 MANUFACTURING CAD EVALUATION REQUIREMENTS FOR THE SYSTEM

Y-12 MANUFACTURING CAD SYSTEM REQUIREMENTS ESTABLISHED

REQUIREMENTS AND CAPABILITIES CONSIDERED:

- PRODUCT MODELING
- COMMENT/APPROVE/REVIEW
- DESIGN AND DRAFTING
- NC PROGRAMMING
- ANALYSIS
- VISUALIZATION/SIMULATION
- COMPATIBILITY WITH FACILITY DESIGN SYSTEM
- FILE MANAGEMENT/CONFIGURATION CONTROL
- INTERFACE WITH EXISTING SOFTWARE NOT TO BE REPLACED

A LIST OF MUSTS AND WANTS CREATED FOR EACH REQUIREMENT

Y-12 MANUFACTURING CAD EVALUATION NUMERICAL CONTROL SYSTEM MUSTS

- ✓ 2D PROFILES, 3D WIREFRAMES, SURFACES ON WIREFRAMES
- ✓ FULL ASSOCIATIVITY BETWEEN SOLID MODEL AND DOWNSTREAM APPLICATIONS DERIVED FROM SOLID MODEL
- ✓ EDITING OF CUTTER PATHS, POSTPROCESSOR COMMANDS, NON-POSITIONAL COMMANDS IN NC TOOL PATH FILE
- ✓ SUPPORT MATERIAL REMOVAL TOOL PATH GENERATION, 2 THROUGH 5 AXIS CONTINUOUS PATH CONTOURING
- ✓ OUTPUT SHALL BE CUSTOMER SELECTIVE INCLUDING: APT SOURCE, IBM CL FILE, OR ANSI CL FILE

Y-12 MANUFACTURING CAD EVALUATION
NC - SYSTEM MUSTS (continued)

- ✓ OUTPUT SHALL BE COMPLETE APT AND/OR CL SOURCE FILE READY FOR POSTPROCESSING -WITHOUT USER EDITS
- ✓ SUPPORT VARIABLE LEAD AND TILT ANGLE CUTTING IN MULTI-AXIS CONTOURING MODE, UTILIZING NON-SPHERICAL CUTTERS
- ✓ FEEDRATE CONTROL WITH IN TOOL PATH, ALLOWING CHANGING FEED RATES ANYWHERE WITHIN A TOOL PATH
- ✓ AUTOMATIC GENERATION OF TOOL PATHS FOR FAMILIES OF PARTS
- ✓ SIMULATION OF CL FILE TOOL PATH PLAYED AGAINST SOLID AND/ OR SHADED SURFACES MODEL OF PART

Y-12 MANUFACTURING CAD EVALUATION NUMERICAL CONTROL - SYSTEM WANTS

- ✓ CAPABILITY TO CREATE MMC, LMC OR NOMINAL MODELS FROM GEOMETRY IN ANY OF THESE STATES
- ✓ SUPPORT OF DESIGN AND MANUFACTURING FEATURES WITH ABILITY TO CREATE USER DEFINED FEATURES
- ✓ CREATE GEOMETRY AND/OR TOOL PATHS PARAMETRICALLY
- ✓ SUPPORT, INTERFACE AND/OR INTEGRATED WITH MACHINABILITY DATA BASE

Y-12 MANUFACTURING CAD EVALUATION
NC - SYSTEM WANTS (continued)

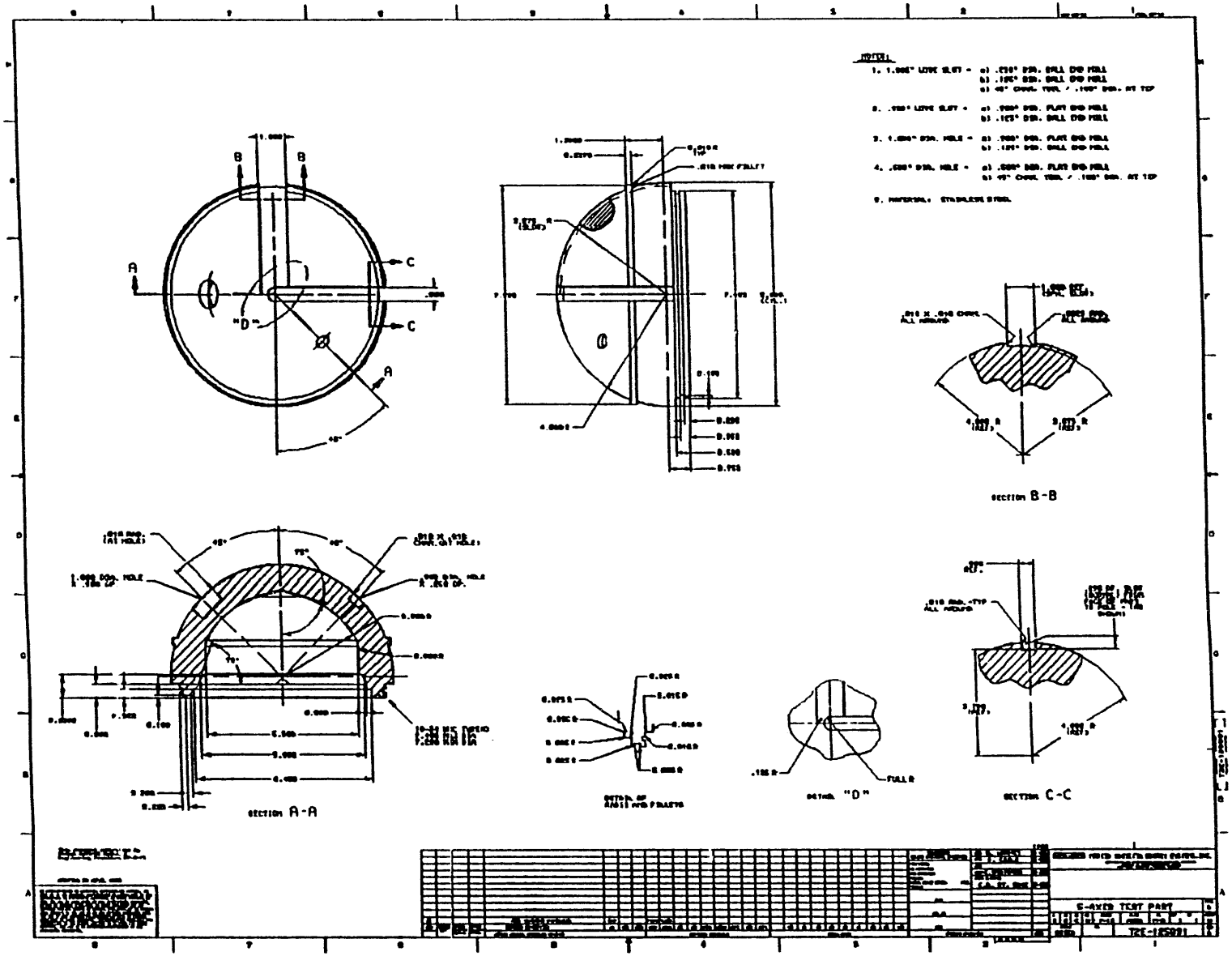
- ✓ PERMIT POSTPROCESSED TOOL PATH (MACHINE CODE) TO BE PLAYED BACK AGAINST SOLID MODE OF PART
- ✓ SUPPORT OF IN-PROCESS VERIFICATION PROBING, PARAMETRIC LANGUAGE SUPPORTING PROBING ON CNC CONTROLLERS, AND INTERACTION BETWEEN PROBE OUTPUT AND THE CONTROLLER
- ✓ SUPPORT OF GENERATION OF TOOL PATHS FOR INSPECTION MACHINES - 2 AXIS POSITIONING THROUGH MULTI-AXIS CONTINUOUS PATH
- ✓ SUPPORT GENERATION OF TOOL PATHS FOR COORDINATE MEASURING MACHINES INCLUDING OUTPUT BEING DMIS/ANSI CAMI 101 1990

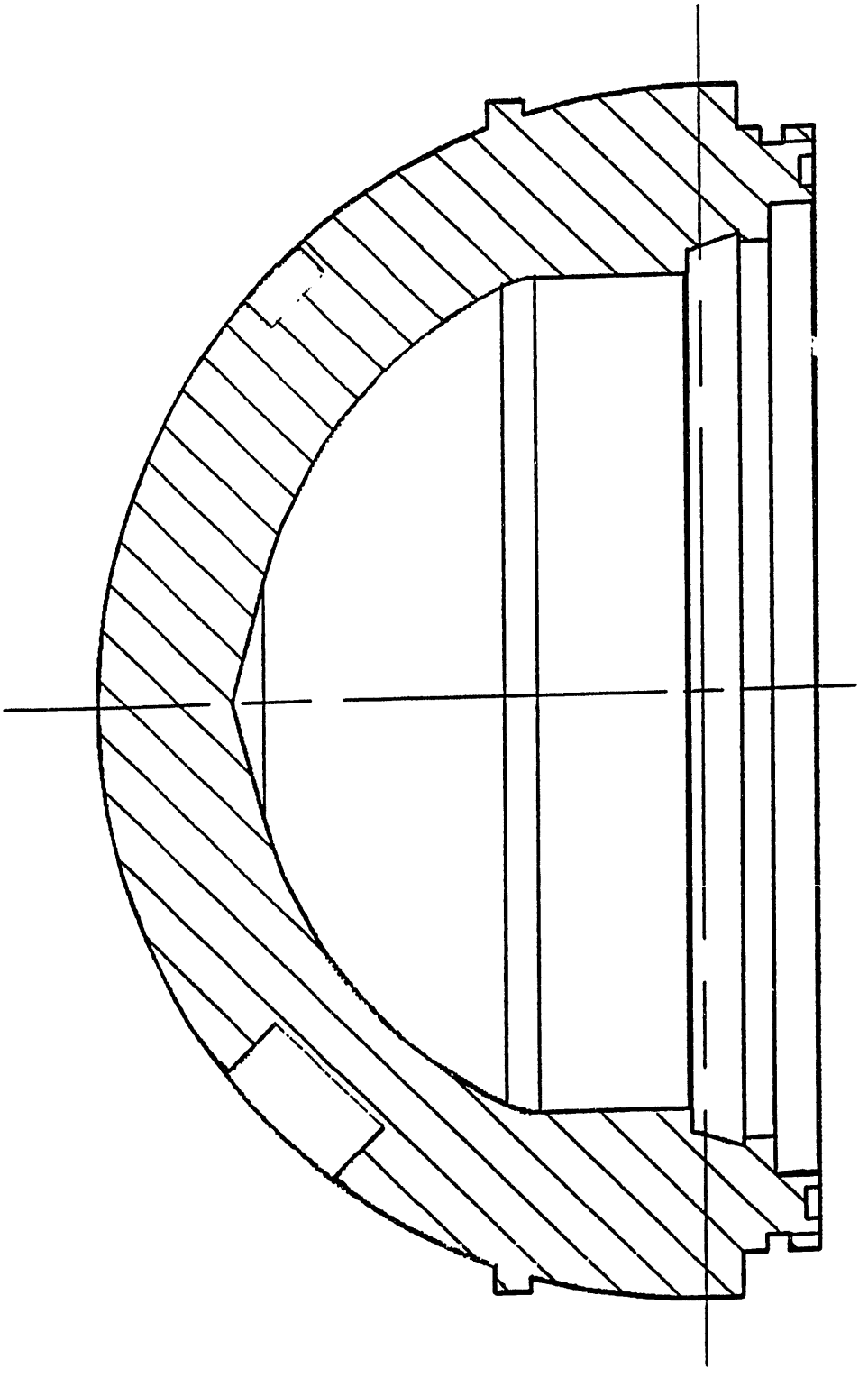
Y-12 MANUFACTURING CAD EVALUATION NUMERICAL CONTROL TEST

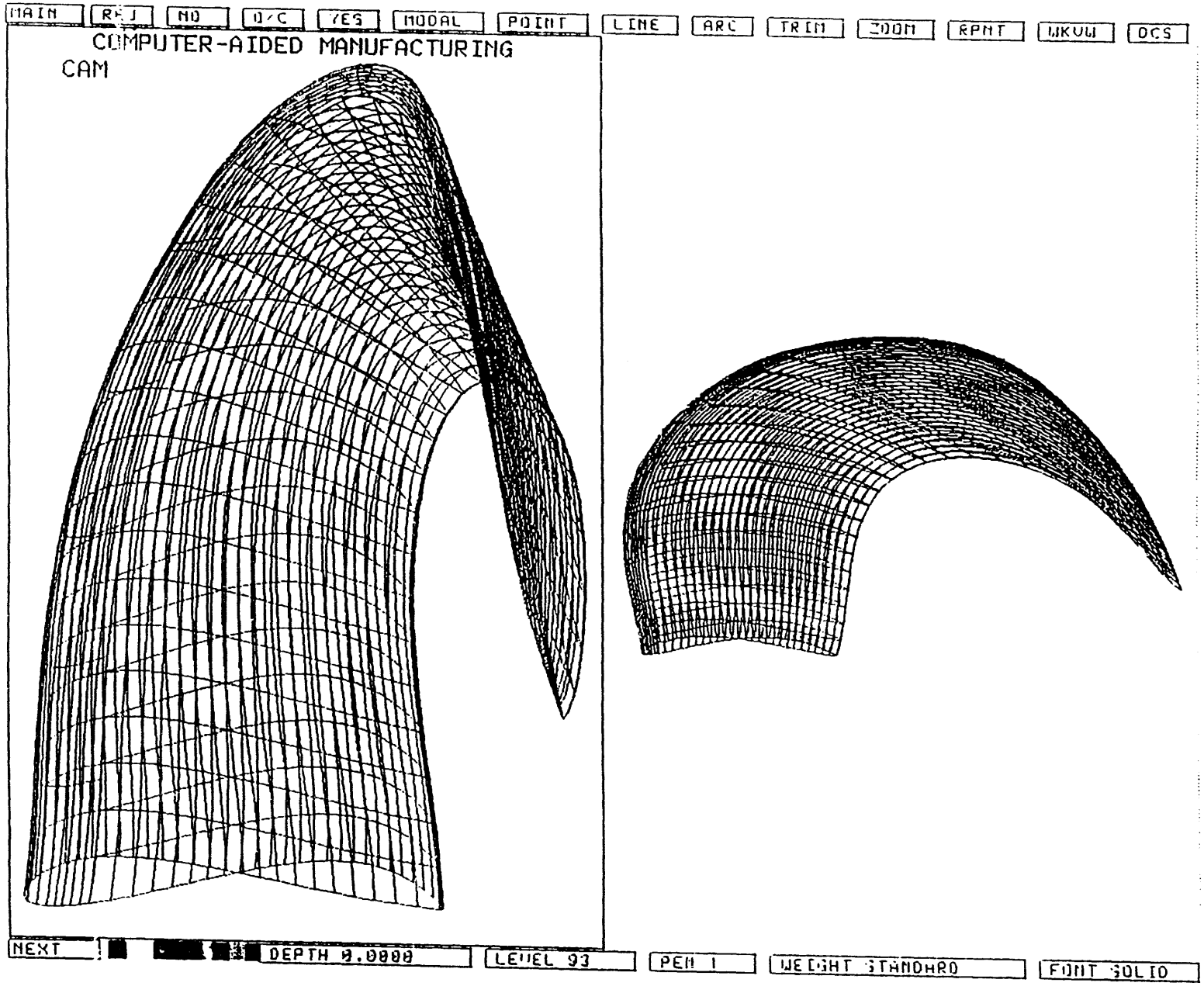
EACH VENDOR REQUESTED TO PERFORM TEAM SUPPLIED BENCHMARK TESTS TWO TYPES OF PARTS WERE PROVIDED FOR THE NC BENCHMARK TEST.

- GENERIC HEMI SHELL PART TESTING THE CREATION OF 2-AXIS TURNING TOOL PATHS AND 5-AXIS MILLING AND DRILLING OPERATIONS

- A CURVE-MESH SURFACE TESTING MULTI-AXIS, CONTINUOUS PATH MILLING OPERATIONS


NOTES:
1. 1.000" LONG SLOT = a) .750" DIA. DRILL END MILL
b) .125" DIA. DRILL END MILL
c) 45° CHAM. TOOL / .100" DIA. AT TOP
2. .750" LONG SLOT = a) .500" DIA. FLAT END MILL
b) .125" DIA. DRILL END MILL
3. 1.000" DIA. HOLE = a) .500" DIA. FLAT END MILL
b) .125" DIA. DRILL END MILL
4. .500" DIA. HOLE = a) .500" DIA. FLAT END MILL
b) 45° CHAM. TOOL / .100" DIA. AT TOP
5. MATERIAL: STAINLESS STEEL
SECTION A-A
SECTION B-B
SECTION C-C
DETAIL "D"
6-AXIS TEST PART




MAIN
REJ
NO
O/C
YES
MODAL
POINT
LINE
ARC
TRIM
ZOOM
RPNT
WKVW
DCS
COMPUTER-AIDED MANUFACTURING
CAM
NEXT
DEPTH 0.0000
LEVEL 93
PEN 1
WEIGHT STANDARD
FONT SOLID

Y-12 MANUFACTURING CAD EVALUATION VENDOR RESPONSE AND TRAINING

RESPONSE FROM VENDORS ON THE BENCHMARK TESTING WAS GOOD. DECISION WAS MADE TO SUFFICIENTLY TRAIN TEAM MEMBERS TO ALLOW THE TEAM TO DO MORE TESTING OF THE SYSTEMS

- MCS - ANVIL

  THREE NC ENGINEERING STAFF/THREE DAYS MCS - DALLAS

  ANVIL 5000 CAM INNOVATIONS/TECHNIQUES SHOWN IN BENCHMARK DEMO RESULTED IN NEW IDEAS FOR APPLICATION AT Y-12

RHF7

Y-12 MANUFACTURING CAD EVALUATION VENDOR RESPONSE & TRAINING (cont'd)

- INTERGRAPH - EMS

  FOUR NC ENGINEERING STAFF/WEEK INTERGRAPH - HUNTSVILLE

  BASIC EMS TRAINING AND PROVIDED COMPUTER BASED TRAINING SOFTWARE TO ASSIST IN ACQUIRING KNOWLEDGE OF EMS

- PTC - PRO/ENGINEER

  ONE PERSON FROM PROGRAM MANAGEMENT AND NC ENGINEERING ATTENDED BASIC DESIGN COURSE. NC PERSON ATTENDED PTC'S PRO/MANUFACTURING COURSE

RHF7a

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Y-12 MANUFACTURING CAD EVALUATION VENDOR RESPONSE & TRAINING (cont'd)

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RHP7a

Y-12 MANUFACTURING CAD EVALUATION SUMMARY

PRELIMINARY REVIEW OF MUSTS AND WANTS FOR EACH VENDOR SENT TO EACH VENDOR AND FOLLOW-UP FROM VENDORS IS EXPECTED

AFTER RESPONSES ARE RECEIVED, TEAM WILL AGAIN REVIEW, AND RATE MUSTS AND WANTS LIST

AFTER COMPLETION OF FINAL REVIEW, REPORT OF TEAM RECOMMENDATION/DECISION WILL BE PROVIDED TO ENGINEERING MANAGEMENT

RHFB

DATE
FILMED
11/17/93
END