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21181

S.B.S. Computers

Ms. Latrech
Contract Officer
Contract Section
General Services Division
Department of Administration
UNIDO, P.O. Box 300 A1400
Vienna, Austria.

Dated: June 15, 1995
Ref : F _ Unido2/95

Dear Ms. Latrech

SUB: FINAL REPORT

- UNIDO PROJECT NO. DP/PAK/84/012
- CONTRACT NO. 94/040

With reference to clause 4(b) to the contract no. 94/040 relating to above project, we enclose 5 copies of Final Report.

This report consist the extent of the work carried during the six weeks of Computer Vison's consultancy services.

Please do not hesitate to ask for any further information or clarification you might require in this connection.

With Best Regards

Your's Sincerely


HAFIZ-UR-REHMAN
Technical Specialist

Consignee:

Recieved on behalf of PMTF


QAZI MOHAMMAD ASLAM
Deputy General Manager (Tech.)
Pakistan Machine-Tool Factory
KARACHI-75030
Mr. Qazi M. Aslam
DGM (Training & Project)

FINAL REPORT

CONTRACT NO. 94/040

UNIDO PROJECT NO. DP/PAK/84/012

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INTRODUCTION

- 1- This has reference to UNIDO Contract No. 94/040 in regard to Project No. DP/PAK/84/012, for provision of consultancy services by Computer Vision Corporation relating to the Computer Vision Software Operation, Integration, and Application of the software installed under Contract No. 92/210.

- 2- The present report has been prepared to meet the requirement as specified in clause 4(b) of the aforesaid contract. It summarises all tasks and activities performed by consultants from ComputerVision Singapore in conjunction with Selling Business Systems (SBS).

- 3- A number of live problems facing by PMTF engineers in the utilization of the supplied Hardware (see Appendix 'A') and Software(see Appendix 'B') has been sent to Chartered System Network Ptd Ltd, Singapore to the expert via fax which are enclosed herewith as Appendix 'C' .

- 4- To solve the problem as mentioned in Appendix 'C' three expert were visit to PMTF as per decided consultancy program see Appendix 'D' for the name, duration and field of consultancy services.

- 5- List of PMTF personal who participate in the consultancy program from Tool Design, Product Design & CNC Shop is enclosed as Appendix 'E'.

CONSULTANCY

- 6- During the Six weeks of consultancy by three experts the problem as mention in Appendix 'C' has been solved and practised by PMTF engineers.

The summary of consultancy with recomendation of experts along with the solution of the live problem are as:

See Appendix 'F' for CADD5 & System Administration consultancy

See Appendix 'G' for Personal Designer & 3D Surfacing consultancy

See Appendix 'H' for Personal Machinist & Post Processor consultancy

GENERAL OBSERVATIONS:

7- On conclusion of the consultancy assignment, we feel satisfied that most of the practical problem faced by PMTF team of engineers have been solved by the experts.

After a long period utilization of the available software, the PMTF engineers are now in a position of having some new or upgrade release of software as also mentioned by the experts in their reports.

CONCLUSION

8-In our opinion the consultancy services was given in good condition with the entire satisfaction of PMTF's Engineers/Participants.

Finally, we would like to thanks all concerned of PMTF and UNIDO of taking their interest in successful implementation of this consultancy services.

Appendix A

LIST OF HARDWARE

<u>Product Description</u>	<u>Qty</u>
19" SPARC STN IP x (424)	2
Memory : 16 Mbyte Exp (IPX)	2
DISK : CD-ROM Optical Disk Drive 644 Mbytes	2
Calcomp 1025 Pen Plotter	1
Tektronix Phaser II PXE Color screen Printer	1
UPS 3.0 KVA POM	2
21" Daewoo Server with 1GByte HDD	2
21" Daewoo 486 3D-Workstation	2
21" Daewoo 486 3D/2D-Workstation	4
21" Daewoo 486 Workstation (CNC Shop)	1
HP Laser Jet 4 Printer	2
Paper Tape Punch - GN Data Corporation	1
UPS 600 VA	1

Appendix B

LIST OF SOFTWARE

<u>Product Description</u>	<u>Model No.</u>	<u>Qty.</u>
Personal Designer rev 5.0	954200	2
Micro Draft rev 5.0	954206	6
UPL rev 5.0	954610	4
Data Extract rev 2.0	924630	3
Personal DXF rev 5.0	954625	7
Design View rev 3.0	731700	7
PD/CADDS Direct Translator	954622	2
Page Maker (Technical Publishing Editor)	TP6423	1
PlotWare - Calcomp Single seat License	SXXX-V0500	1
CV Ware Parametric Design	SXXX-V1303	2
PM 2.5 Axis rev 4.1 including PD 5.0	944561	1

Appendix - C

Problems Facing

by

PMTF
Engineers

REQUIREMENTS AND OBSERVATIONS OF TOOL DESIGN IN CADD5 5 (SOLID MODELLING)

DATA BASE

For the storage of standard part dimensions a data base is required which can be read into CADD5 5. So as to relate with model parameters.

PROGRAMMING LANGUAGE "C"

"C" will help to manipulate the equations defined in CADD5 5 and link them to the values read from the data base.

SPATIAL SURFACE

How are spatial surfaces generated using the command in CADD5 5 by picking the points as well as spline curves. Detailed solved example required.

CIRCLE

Circle which is tangent to two or more circles. The command is not available in CADD5 5.

ASSEMBLY MODULE

Module required for creating jig and fixture assemblies in CADD5 5.

COMPRESSION SPRING

Detail on development of compression spring & Helix curve.

FEATURES

Features is not functioning now previously it was operational.

CHANGE OF PARAMETERS

Number of multiple entities modelled through array or rotate copy does not change through change of parameter " n " (number of).

Please see attached sheets annex 1 & 2.

ANNEX " 1 "

Solid model of standard part in CADDS 5 with defined variables and equations, so that manual input of given dimensions regenerates the resized model.

If all the standard data for various sizes is fed into a data base software which is linked with CADDS 5 and "C" programming language. Then standard or custom data, according to the choice of user can be read into CADDS 5 data base, hence regenerate the solid model.

Thus with the entry of just one code number such as example 3110 210, a resized model will be generated, instead of the current method of manual entry.

If possible, then addition of graphic entities, that is selected planar views of the standard part solid model in the data base will highly facilitate its use.

WORK PLAN FOR THE EXPERT OF "PERSONAL DESIGNER"

The "Personal Designer" software has been utilized mostly in Tool Design Department for the drafting of various drawings of dies & tooling of various range Dies equipments etc. This software has been found very helpful in templates' drawings of intricate shape. The drawings of various parts like geometry and dimensions of the templates drawings are very helpful in tool manufacturing.

Following are the practical problem for which we need the solution.

(1) 3D SURFACING:

Making an impression die block of a pressure die cast part, its detailing (Sectioning by split command and dimensioning) and tool path generation for CNC machine.

- (2) Sectioning (Splitting) of a Cadd5 drawing in PD5 environment.
- (3) Making libraries of standard parts.
- (4) Use of icon menu to generate repeatative work e.g, assembly making.
- (5) Use and importance of various icon (not so far used)e.g ,SEMA,REMA etc.
- (6) How to use "HIDE" command.
- (7) PD5 interface with CMM.
- (8) User programming language (UPL).
 - (i) Data base format
 - (ii) Executing data base file for UPL program.
 - (iii) Advance user commands.
- (9) Arrow head size to be modified.
- (10) Size of dashed line not working.
- (11) Transfer of file from PD5 to Design view/Page maker.
- (12) Macros keys/Functions to be explained.
- (13) Up-dating of post processors of: (i) Mandelli (ii) Galaxy (iii) Ab 7340.
- (14) Problems in application of milling commands for machining center.

WORK PLAN FOR THE EXPERT OF "PERSONAL DESIGNER/PERSONAL MACHINIST"

PMTF CNC Machine Shop is using "Personal Machinist" mostly for their Turning Centres and has generated/manufactured a number of components. There has been some difficulty in successfully utilizing "Personal Machinist" for our Turning Centres and Machining Centre (Mandelli) due to the reasons mentioned below and need to be sorted out during the visit of Expert from ComputerVision:-

1. For Turning Centres:

i) Updating of Post Processor for :

- a) Galaxy b) Ab 7340

Some of the parameters are required to be changed/modified according to the requirements.

ii) The files (nc2) created after post processing are found to be lengthy as compared to our manual programmes which of course require large memory of machine control.

iii) The nc2 files show errors and not created for more than six tool paths generated for one component.

2. For Machining Centre:

i) Updating of Post Processor for Mandelli machine.

ii) We are facing following problems in the generation of nc2 files.

a) Post processor does not convert axes according to the axes of machine.

b) In a component if we require to machine for example five faces in one setting then the axis should be shifted with respect to each face whereas it is not the case with available Post Processor and each time the origin for each surface machining is taken from the origin of the drawing.

3. Expert should assist PMTF engineers in writing of Post Processor for any CNC machine and its practical application during his stay.

Lan

Gazi Muhammad Aslam
Dy General Manager (Engg)

Appendix D

Consultancy Schedule

S.No	Name of Consultant	Duration	Field of Consultancy
1	Mr. K.S. TAM	15th JAN to 30th JAN 1995	CADD5 & System Administrator
2	Mr. B.H. THONG	18th March to 31st March 1995	Personal Designer & 3D Surfacing
3	Mr. M.S. TONG	20th May to 1st June 1995	Personal Machinist & Post Processor

Appendix E

List of Participants

1- CADD 5 & System Administration:

Mr. Aftab Iqbal	Tool Design
Mr. Maaz-ul-Masaid Siddiqui	Tool Design
Mr. Maqsood Ahmed Khan	Tool Design
Mr. Mohammad Moiz Alvi	Product Design
Mr. Shaukat Ali	Product Design

2- Personal Designer & 3D Surfacing

Mr. Aftab Iqbal	Tool Design
Mr. Asim Fazal Chohan	Tool Design
Mr. Maaz-ul-Masaid	Tool Design
Mr. Maqsood Ahmed Khan	Tool Design
Mr. Mohammad Moiz Alvi	Product Design
Mr. Shoukat Ali Khwaja	Product Design
Mr. Kamal uddin Sheikh	Product Design
Mr. Mushtaq Ahmed Javed	Product Design
Mr. Nusrat Ali	Product Design

3- Personal Machinist & Post Processor

Mr. Aftab Iqbal	Tool Design
Mr. Maaz-ul-Masaid	Tool Design
Mr. Maqsood Ahmed Khan	Tool Design
Mr. Manzoor Hussain	CNC Shop

Appendix - F

CADDS5

&

***System Administration
Consultancy***

Mr. K.S. TAM	15th JAN to 30th JAN 1995
--------------	------------------------------

There are two SUN workstation in PMTF located in Product Design and Tool Design departments. Nature of work in both departments differ slightly. Team of five Engineers who were initially trained are committed to work on these stations. They are

- | | | |
|----|-------------------------|----------------|
| 1. | Aftab Iqbal | Tool Design |
| 2. | Maaz-ul-Masaid Siddiqui | Tool Design |
| 3. | Maqsood Ahmed Khan | Tool Design |
| 4. | Mohammad Moiz Alvi | Product Design |
| 5. | Shaukat Ali | Product Design |

This consultancy from Computer Vision was built in the program contract with the view that the above engineers will sharpen and fine-tune their skill with reference to specific problems to their work and faced during usage of CV Software. For this purpose it was understood that PMTF engineers will send their specific problems to the expected consultant who will come prepared with answers and solutions. In this regard we sent our specific problems to CV Singapore to the expert via fax which is enclosed herewith as Annex 'A'.

The live problems mentioned in the fax were discussed / worked out with CV consultant Mr. Tam in PMTF during his two weeks consultancy period and the solutions found and practiced. These are summarized by PMTF engineers and referred in Annex 'B'.

Besides the above the PMTF engineers also discussed following practical problems:

1. Printing and Plotting of Cadd5 drawing and text files directly from Sun Work Station through PCs Workseats. The available system were very helpful in achieving the said goal except the need of "Postscript" option on laser printer which is not available and is required for taking the printout of Cadd5 drawings
2. Unix to DOS and DOS to Unix conversion of text files

- 3 interfacing Sun Workstation with Coordinate Measuring Machine (CMM) , discussed with the view of oncoming consultancy from the manufacturer of CMM! machine.
- 4 Customization of Cadds5.
- 5 Capturing screen for Demonstration / Printout.
- 6 Use of 'Tag'.

The detailed solutions of all the above mentioned problems were found during the consultancy of Mr. Tam are included in the Annex 'B'. The contents of Annex 'B' has been prepared by PMTF team of engineers after rechecking each practically.

For reference we are enclosing herewith some figures showing the solution of our practical problems.

1. Fig 1 : This is made in Cadds5 with the help of 'C' language program and "data base" which are enclosed as Annex 'E' to 'G' of Annex 'B'.
2. Fig 2 : Showing the printout of Cadds5 drawing through laser printer via Word perfect. Since this is the available software wherein CGM files of Cadds5 can be converted to laser printer format. This was mentioned by the expert Mr. TAM. Alternatively the other way to obtain printout on laser printer was through "Postscript" card , which would have been another investment in terms of money.

**REQUIREMENTS AND OBSERVATIONS OF TOOL DESIGN
IN CADD5 5 (SOLID MODELLING)**

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If possible, then addition of graphic entities, that is selected planar views of the standard part solid model in the data base will highly facilitate its use.

Figure - 1

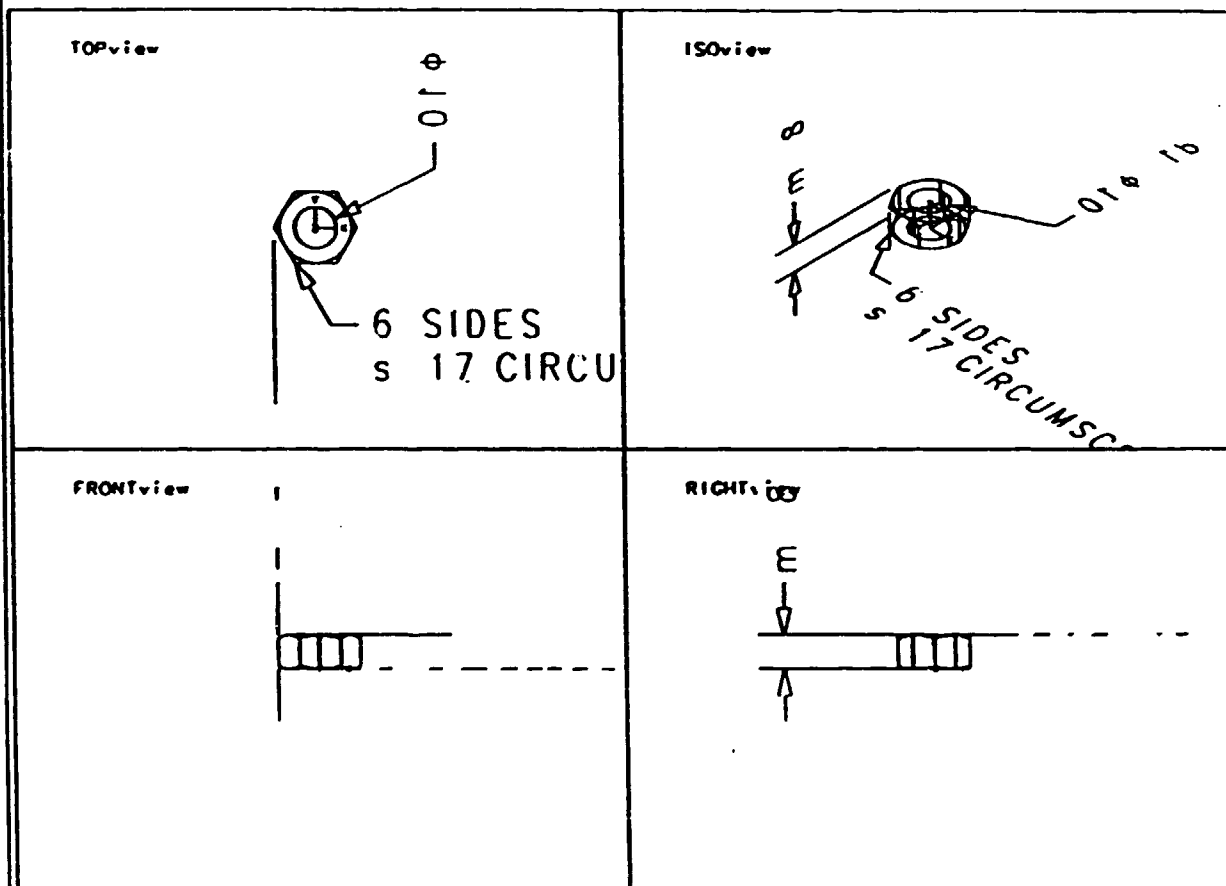
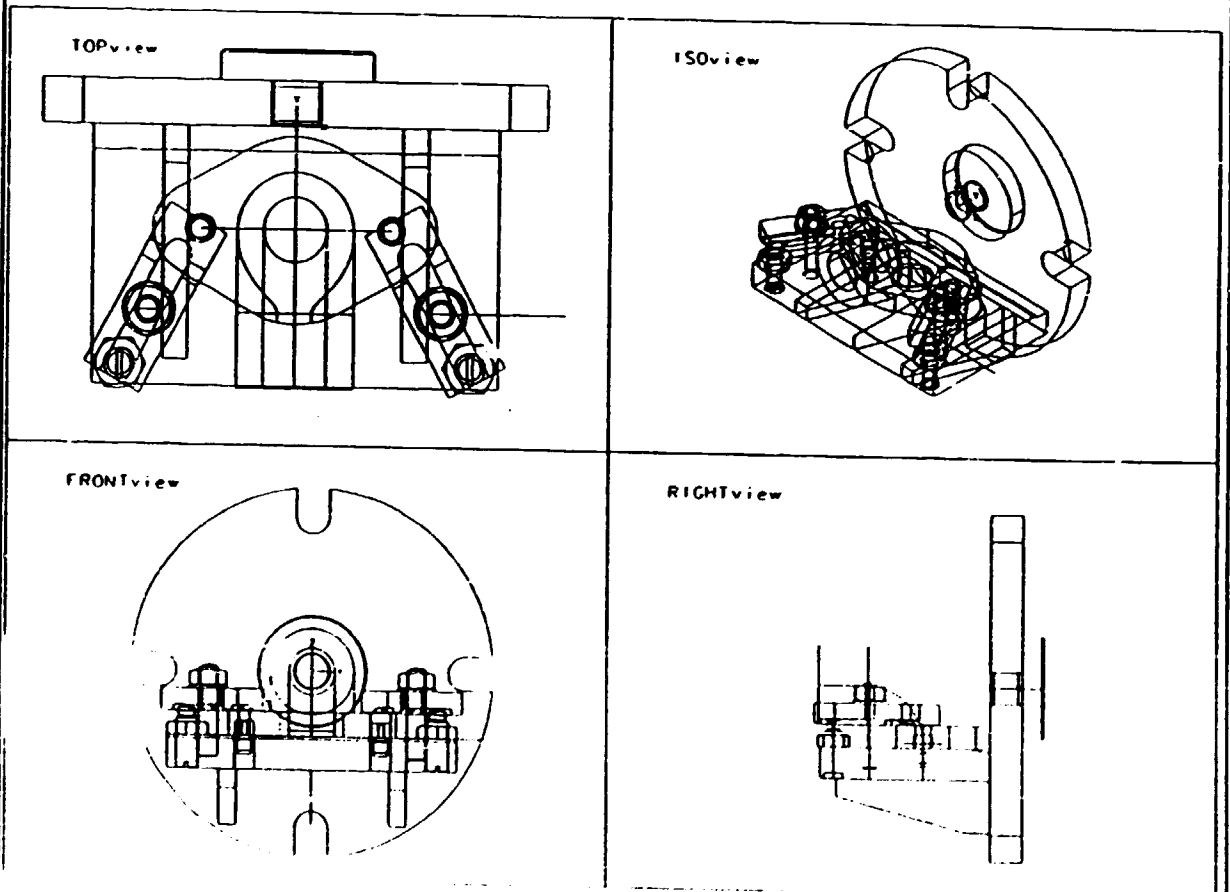


Figure - 2

This drawing was made on Sun Workstation and laser printed through a CGM file conversion option available in WPS.



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INTRODUCTION

- 1- This has reference to UNIDO Contract No. 94/040 in regard to Project No. DP/PAK/84/012, for provision of consultancy services by Computer Vision Corporation relating to the Computer Vision Software Operation, Integration, and Application of the software installed under Contract No. 92/210.
- 2- The present report is in compliance with clause 4(a) of the aforesaid contract and cover the work performed by CV consultant in connection with the two week of consultancy of CADDSS CVWare Parametric Design software.
- 3- The Consultancy was given by K.S. Tam CV, Singapore .In this consultancy, consultant taught the engineers in both Tool Design Department and Design Office Department of PMTF about the concepts of useful UNIX Commands, CADDSS Explicit & Parametric Commands and some C Program Development techniques for interfacing CADDSS Parametric environment with UNIX.
- 4- The system used in PMTF is :
2 x SUN SPARC IPX machine with 32M RAM
SUNOS 4.1.3
CADDSS Rel 2 Rev 2.1.1

Summary of the useful commands and important concepts

5- UNIX

- * General review on different versions of UNIX system, e.g., AT&T systems and BSD 4.2 systems.

- * Important setup files for running UNIX C-shell (/bin/csh). This is the shell which CADDSS is running on.

.login	: execute when the user login in to the system.
.logout	: execute when the user login out to the system.
.cshrc	: execute when a new C-shell is invoked.

- * use id command to identify the user.

e.g.,
UNIX_prompt > id

- * change permission mode by using chmod command

e.g.,
UNIX_prompt > chmod 777 file1
The above command will give no protection to the file *file1*.

- * change ownership by using chown command

e.g.,
UNIX_prompt > chown pmfusr file1
The above command will change the ownership of the *file1* to *pmfusr*.

- * use finger command to check how many users are logged in to the system

e.g.,
UNIX_prompt > finger

- * set the history record by using the variable history
e.g.,

```
UNIX_prompt> set history = 50
```

The above command in UNIX means to record the most current 50 commands.

- * how to use UNIX on-line help
e.g.,

```
UNIX_prompt> man ls
```

The above command will show the on-line help for the UNIX command *ls*.

- * some special characters in UNIX C-shell

!! : execute the previous command again

!\$: the symbol for the last argument of the previous command

& : submit a job as a background process

^ : command argument substitution.

e.g.,

```
UNIX_prompt > ^123^abc
```

The above command will substitute the argument *123* in the previous command by *abc*.

- * C program development in UNIX environment
e.g.,

```
UNIX_prompt> cc -o test.exe test.c -lm
```

The above command compiles the source file *test.c* and links with the mathematics library to an executable file called *test.exe*.

- * debugger in UNIX environment
e.g.,

```
UNIX_prompt> dbxtool test.exe
```

The above command invokes the debugger to debug an executable file called *test.exe*. In order to use the debugger, the C source file(s) must be compiled with *-g* option.

e.g.,

```
UNIX_prompt> cc -o test.exe -g test.c -lm
```

6. CADD55

(6.1) General:

- * different curves/surfaces used in CAD modelling systems have been explained. Common types are listed as follows:

- (a) Bezier curves/surfaces
- (b) B-Spline curves/surfaces
- (c) NURBS curves/surfaces

- * How to start and stop the feature data base server?
Suppose there is a data base called db2,

start data base server with the command:

```
UNIX_prompt> ldmserv db2 start
```

stop data base server with the command:

```
UNIX_prompt> ldmserv db2 stop
```

These two commands can be placed in .login and .logout file respectively so that the starting and stopping processes will be executed automatically.

CADD55 users may use the following commands to stop the feature data base server by checking whether it is being activated or not. The following commands are highly recommended for PMTF to use.

```
UNIX_prompt> if ("ps -ax | grep LDMSERV | cut -c48-50" ) == "db2") then  
UNIX_prompt> ldmserv db2 stop  
UNIX_prompt> endif
```

- * how to create demonstration screen images

capture the whole screen image:

```
UNIX_prompt> screendump -x0 -y0 -X1151 -Y899 filename
```

redisplay the whole screen image:

```
UNIX_prompt> screenload -x0 -y0 -X1151 -Y899 filename
```

In the above commands, *filename* is name of the file to store SUN raster format data. The values after the arguments -x -y -X -Y specify the monitor resolution

The raster file can then be converted from 8-bit deep to 1-bit deep. This is useful for creating monochrome image.

e.g.,

```
UNIX_prompt> rasfilter8to1 8bitfile 1bitfile
```

* Plot drawing to a plotter through Novell Network

A shell script (called *cgmplot*) modified by me has been given to PMTF to plot CGM (Computer Graphics Metafile) files to the HP DraftPro Plus/HP DraftPro DXL plotters which accept HP-GL/2 and HP-GL languages respectively. The script is in */usr2* directory so that all the users can access to it.

CGM files can be created by using the CADDSS5 command *put cgm*.

e.g.,

```
Command:Put Cgm Name cgm_filename Scaleto A4
```

The above command will create a A4 size CGM file called *cgm_filename* which can then be used to generate HP-GL/2 or HP-GL files.

e.g.,

```
UNIX_prompt> /usr2/cgmplot -Pgl2a1 -xoffset -yoffset cgm_filename
```

where

gl2a1 is one of the printer names in file */etc/printcap*,
xoffset is the x-coordinate offset,
yoffset is the y-coordinate offset.

The above command is to convert CGM file *cgm_filename* to HP-GL/2 file (A1 size) by using the script *cgmplot*. The HP plot file is stored in directory */usr/tmp*. The HP-GL/2 file can then be sent to the plotter from the SUN workstation directly (please refer to next section) OR transfer it to the Novell network PCs first and then uses the Novell "nprint" command to send it to the network printer.

e.g.,

```
DOS_prompt> nprint hp_filename /q=LASER
```

The above command will print the file *hp_filename* to the network printer called LASER.

- * send files to HP plotters and HP Laserjet 4 printers from SUN workstations directly.

File */etc/printcap* has been modified to connect all printers and plotters

e.g.,

```
UNIX_prompt> lpr -Phpa4 filename
```

The above command will send the file *filename* to printer *hpa4*. Users may look at the file */etc/printcap* to find out the settings of *hpa4*.

Users may use the following command to display the queue of printer jobs of printer *hpa4*.

```
UNIX_prompt> lpq -Phpa4
```

Users may use the following command to remove a job from print queue.

```
UNIX_prompt> lprm -Phpa4 job 11
```

The above command removes a print job number 11 for printer *hpa4* from the print queue.

6.2- Explicit:

* General view on CADDSS command structure and punctuation

The command structure is as follows:

[Verb] [Noun] [Modifier] : system prompt

e.g.,

INSert LINE HOR : MODEL loc

INSert CIRcle RADius 1.5 : MODEL loc

INSert ARC DIAMeter 3 : MODEL loc

Because CADDSS punctuation is standardized, punctuation marks retain the same meaning throughout all commands. The following table lists the various command punctuation:

punctuation

use

blank	Used optionally between keywords.
.	Used between explicit coordinates, items in a list, and groups of numbers.
:	Used between clauses, as in switching modes from identification to digitizing on location.
	Used to enter coordinate input, or reenter the same command without re-issuing the verb-noun combination

When used to re-issue the command, the colon terminates the input, executes the command and then reenters the same command for new coordinate input, thus preserving all modifier selections from the previous command specification.

return "<CR>" Used to terminate the current command input and execute the command.

*** Zooming Techniques**

The following commands are useful for fitting the model image on the computer screen.

#01# zoom view all:
#01# zoom view wir:
#01# set view:

*** create assembly in explicit mode with different orientation.**

#01# insert part [partname] figplane ["front"] : model loc
#01# insert part [partname] AX [angle about x-axis] AY [angle about y-axis] AZ [angle about z-axis] : model loc

*** show the drawing in CADDs drawing window**

#01# zoom draw ALLDRAW

The above command will update the CADDs drawing window.

6.3-Parametric:

*** how to create a parametric helix**

The procedures are as follows:

- (1) Create a new parametric part and drawing
- (2) Change to the view Cplane to ISO.
- (3) Insert a vertical construction line with a given length, say 30.
- (4) Insert nine six-sided construction polygons along the construction line. Each polygon is circumscribed within an imaginary circle whose diameter will control the diameter of the helix.

e.g

Command Insert Polygon Sides 6 Circumscribed 2.0
Uconstruction Along 7Nooffset [-0.085,0.069,0.155, TOPview]

(5) Insert an Nspline (Non-Uniform Rational B-spline) by selecting a side of each polygon in succession, rotating clockwise from top to bottom, to determine how many control/through points will be used to define the Nspline.

(6) If desired, change the height of the helix to regenerate the model.

* Use of tagname

The entities in CADDSS parametric environment can be associated with a unique tagname. Users can then refer to the entities by using the tagname instead of digitizing.

e.g.,

Command : Insert Line Pair utag abc * *

Command : Delete Entity tagname abc

The above commands insert a line with the tagname *abc* and then delete it by referring to its tagname *abc*

* customizer in CADDSS

The customizer can be activated by pressing the menu as

UTILITY => CUSTOMIZER

The techniques to create a user-defined interface were taught. The icon editor was also illustrated. It is an object-based graphics utility. By combining lines, arcs, circles and rectangles, users can create icons for use in the user interface menus.

Customizer Action Example 1:

/ comments */*

Insert Line Free <END>

Customizer Action Example 2:

/ comments */*

Read Commandfile Name -USR2.PMTFUSR.PARTS.PMTF1

/ comments */ <END>*

C program interface with CADD55 parametric environment

7- create a complex parametric curve with a given equation in CADD55 without CVMAC.

Suppose there is a CAM profile with the following equation.

$$x = r * \cos(a)$$

$$y = r * \sin(a)$$

$$z = 0$$

$$r = a * (R1-R2)/A + R2$$

where

(x,y,z) are the coordinates of the CAM profile,

R1, R2 and A are constants,

r and a are parameters to define the planar curve.

In this case, (r,a) are the polar coordinates.

The following program will create a CADD55 command file to draw the parametric curve with 51 data points on it. The command file can then be executed in CADD55 parametric environment. Here is the program listing:

```

#include <stdio.h>
#include <math.h>
#define pi 3.141592654

void main()
{
double theta;
double A,R,R1,R2,x,y,z=0;
FILE *stream;
char filename [100];

printf("please input the filename to store the data : ");
scanf("%s",filename);
stream=fopen(filename,"w");
printf("please input A (in degree) : ");
scanf("%lf",&A);
A=A*pi/180;
printf("please input R1 : ");
scanf("%lf",&R1);
printf("please input R2 : ");
scanf("%lf",&R2);

fprintf(stream,"Insert Nspline");

```

```

for (n=0;n<=50;n++) {
    theta=A*n*50;
    R=theta*(R1-R2)/A + R2;
    x = R*cos(theta);
    y = R*sin(theta);
    fprintf (stream, " Loc [%2lf,%2lf,%2lf]",x,y,z);
}

fprintf(stream, " Go \n");

fclose (stream);
}

```

* numerical method

Newton's method was taught to find a root of a complicated equation which may appear during a CAM or gear design.

Suppose the equation is given in the form $f(x)=0$, then a better approximation of the solution is given by:

$$x(n+1) = x(n) - f(xn)/f'(xn) \tag{1}$$

where $x(n)$ is the current approximation and $x(n+1)$ is the solution of the next iteration. This equation can be applied successively until the difference between $x(n+1)$ and $x(n)$ is small enough which means the required accuracy has been achieved.

* create an involute profile for gear design

The involute profile equation is given by:

$$\text{inv}(x) = \tan(x) - x \tag{2}$$

We need to solve for x when $\text{inv}(x)$ is given, say a constant c . In this case, we need to rewrite the equation in the following form:

$$f(x) = \tan(x) - x - c = 0 \tag{3}$$

Then we can apply equation (1) to solve for x . Equation (1) will become

$$x(n+1) = x(n) - [(\tan(x(n)) - x(n) - c)/(\sec^2(x(n)) - 1)] \tag{4}$$

A sample c program was provided to PMTF staffs as a reference. Please refer to section (A1) for compilation of C programs in UNIX. Here is the program listing

```

#include <math.h>
#include <stdio.h>

#define eps 1e-6
#define MAX_ITER 1000

double fcn();
void fcn1();

void main()
{
double xn1;

fcn1(&xn1);
printf("The answer is %.12lf\n",xn1);
} /*end main()*/

void fcn1(xn1)
double *xn1;
{
double xn,c;
int count=0;

printf("please input the number c : ");
scanf("%lf",&c);

printf:"please input the initial guess (xn) : ";
scanf("%lf",&xn);

do {
*xn1 = xn - fcn(xn,c);
if (fabs(*xn1-xn) < eps) break;
xn=*xn1;
printf(".");
count++;
if (count > MAX_ITER) {
printf("Cannot find solution\n");
break;
}
} while (1);
} /*end fcn1()*/

double fcn(x,c)
double x,c;
{
double tmp;

```

```
tmp=1./(cos(x)*cos(x));  
return ((tan(x)-x-c) / (tmp-1));  
}
```

Review of the consultancy project at PMTF

- 8- Some useful and common UNIX commands were shown.
- Feature base problems of their existing systems were solved.
 - HP laser printers and plotters were connected to SUN workstations successfully. Commands were also given to PMTF's staffs to control the UNIX printing utilities.
 - The procedures to use Customizer in CADDSS were demonstrated.
 - Some useful techniques for using CADDSS explicit and parametric environment were taught.
 - C program development in UNIX were explained in details.
 - Interfacing C programs with CADDSS parametric environment were clearly shown.
 - The procedures for preparing good quality documents and screen demonstration shows were taught.
 - Detailed investigation was taken to their CNC workshop. PMTF has several 2-axis CNC lathes and one 4-axis Mandelli milling machine with pallet changer. The machine can select either as a vertical or horizontal machine. However, there is no RS232 serial interface in the machine controller. Therefore, operators need to input the NC programs manually.
 - Detailed studies were carried out to their metrology laboratory. Some suggestions were given to explain how to connect the CMM machine (Model number is Digital Electronic Automation Diamond IOTA 2203) to the existing ethernet network.

comments on the technical skills of the engineers at PMTF

- 9- The engineers at PMFT have good experience in product design and tool making but they lack of enough computer knowledge to computerize their jobs systematically. Therefore, they need more CAD/CAM training and practices. However, there are a few engineers who can pick up the knowledge very fast.
- 10- The engineers should not rely only on training. Instead, they should try to learn the concepts and commands by reading more manuals and experimenting with CADDSS software



Recommendation

- 11- CAM software packages should be installed so that manufacturing data can be generated directly after design stage. In order to have a practical and successful CAD/CAM environment, they need complete CADDSS options for Drafting, Explicit & Parametric environment, CVNC and CVMAC
- 12- Their hardware systems also need updating, a practical solution is to upgrade the slow IPX machines to fast SPARC 20 machines. CADDSS 5 should also be upgraded to Rel 5. The present version is Rel 2 Rev 2.1.1.
- 13 - The 4-axis Manuelli NC machine need to add an DNC option so that NC programs can send from the PCs to the machine directly.

Conclusion

- 14 - In our opinion the consultancy services was given in good condition with the entire satisfaction of PMTF 's Engineers/Participants.

Appendix - G

Personal Designer

&

3D Surfacing

Consultancy

Mr. B.H. THONG	18th March to 31st March 1995
----------------	----------------------------------

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TITLE

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INTRODUCTION

- 1- This has reference to UNIDO Contract No. 94/040 in regard to Project No. DP/PAK/84/012, for provision of consultancy services by Computer Vision Corporation relating to the Computer Vision Software Operation, Integration, and Application of the software installed under Contract No. 92/210.

- 2- This is a summary of the of two (2) weeks consultancy provided by Mr B. H. THONG commenced from 18th March 1995 until 31st March 1995 at PMTF in Karachi.

- 3- Before his arrival, there were a number of problems sent to Chartered System Network Ptd Ltd, Singapore to the expert via fax which is enclosed herewith as Annex 'A' . During the two weeks, most of the questions faxed were dealt with both theoretically and practically except the PD5-CMM interface. Participants were not able grab a hand-on on the PD5-CMM interfacing practically as CMM machine were not available.

- 4- However the structure of PD5-CMM data format has been conveyed to personnel of PMTF. Once the problems in the CMM has been solved, personnel of PMTF will be able to interface PD5 and CMM practically.



LIST OF PARTICIPANTS

5- The following is a list of participant from both Tool Design and Product Design Department of PMTF,

Mr AFTAB IQBAL Tool Design

Mr ASIM FAZAL CHOHAN

Mr MAAZ-UL-MASAIID

Mr MAQSOOD AHMED KHAN

Mr MOHAMMED MOIZ ALVI Product Design

Mr SHOUKAT ALI KHOWAJA

Mr KAMAL UDDIN SHEIKH

Mr MUSTAQ AHMED JAVED

Mr NUSRAT ALI

SOFTWARES & RELEASE

6- The following is a list of MS-DOS based softwares by Computervision available in the PMTF both in Tool Design and Product Design Department,

. Personal Designer Rev 5

. Personal Microdaft Rev 5

. Personal DXF Rev 5

. Personal Data Extract Rev 5

. Designview Rel 2

SUMMARY OF THE CONSULTANCY

7. CHANGING ARROWHEAD SIZES:

The arrowhead sizes for Dimension and " Insert Arrow " commands can be selected either from Pd5 ' config ' file (externally) or from "SELECT" option of " DIM " (internally) . The Arrowhead size of a dimension can be changed by CHANGE " option of " DIM ", whereas the Arrowhead size obtained by " Insert Arrow " can be changed by " SCALE".

8. LINE TYPE (LINE FONTS):

The sizes of line fonts depend upon the selection of either 'SOFT' or 'HARD' fonts. For printing purpose it is advisable to select the " SOFT " font. The sizes of " SOFT " font type can be changed by changing the sizes as defined in PD5 "config" file.

9. HIDDEN LINE REMOVAL (HRL):

There are two ways to get a 3-D view with hidden lines removed.

A) By using " QHIDE " command (Internally i.e. by remaining inside Pd5 environment.)

B) By using " HIDE " option (Externally i.e. from outside Pd5 environment.)

A) " QHIDE "

- i) Make the surfaces.
- ii) Click " QHIDE " and " MESHONLY " and other available options (if required).
- iii) System will prompt " ent " .Select the surfaces to appear on screen leaving other surfaces and press " Enter " .
- iv) The full view will again appear on screen with " REPA " command i.e. by using " Qhide " we can temporarily remove the hidden lines.

B) " HIDE "

- i) Make the surfaces.
- ii) Make a shade file by clicking " PUT SHADE " , the system will ask for the " SHI " file name.
- iii) Type any name other than names for which " DRW " file already exists
This is required because " Hide " option creates a " DRW " file with the given name
- iv) Exit to Do

- v) C:\PD5> HIDE SHIfilename <CR>
- vi) A file with .DRW extension will be created that can be viewed in PD5 with hidden lines removed.

Note: By using "HIDE" option, the hidden lines are permanently removed.

10. SHADING OF PD5 SURFACES:

- i) Make the surfaces
- ii) Click "PUT SHADE" from '3D'. Type the shading file name and press <CR>. A file with the specified name and SHI extension will be created e.g. Test.shi.
- iii) Exit to Dos.
- iv) C:\PD5> Shade <CR>
- v) A Screen window will appear showing "Personal Designer Shaded Picture"

- Type the shaded file name (e.g. Test)
- Type the output shaded picture file name or simply press <CR> to take the same name as SHI file
- Select S or F (usually 'S')
- Type screen pixel horizontally (1024) and vertically (768) and press F10.
- Type other parameters if required and press F10.
- Press <CR> to appear the shaded image on screen.

11. DISPLAYING SHADE FILE ON SCREEN:

The shade file (with the extension of SHP) can be displayed on screen as
C:\PD5 > display filename.shp <CR>
Press <CR> to make the shaded file to disappear and type 'cls' to get the prompt back to screen.

12. SLIDES OF SHADED FILES:-

To display the shaded files on screen to appear one by one, a file starting with '@' and with extension 'EXT' is required to be created as :

- i) C:\PD5> Edit @filename.ext <CR>

```
0 0 xyz.shp
cls
0 0 abc.shp
cls
0 0 test shp
```

Note Here 0 0 indicates the position of the screen for the shaded file

- ii) Save and exit to DOS

- iii) Display the slide as:
C:\PD5> Display -s temp.pic @filename.ext <CR>
Note: We can make a batch file for this long command
- iv) Press <CR> and type cls.

13. DISPLAYING PD5 SCREEN IMAGES:

- i) Open the PD5 drawing file
- ii) >>save screen (press spacebar) filename <CR>
- iii) A file with the specified name will be formed that can be displayed as
C:\PD5 > Display filename<CR>
- iv) Press <CR> and type 'cls'.
- v) We can make the slides of the screen images for demonstration purpose as mentioned earlier under the topic "slides of shade files".

14. USE OF MVIEW.SGX FILE:

If we are not using "MVIEW" for 3D surfacing and surfaces are formed by using only one view and if it is required to put the other views on screen then we can use "MVIEW.SGX" file as

>>Execute (press spacebar) mview <CR>

The four views will appear on the screen. Copy of Mview.sgx file is enclosed as Annex 'A'.

15. USE OF SIMA (Save Image) and RIMA (Restore Image):

SIMA and RIMA are useful options for a user to access quickly at a particular portion of drawing specially when the drawing is very large and complicated. The steps are as follows:

- i) Zoom the required portion of the drawing to appear fully on the screen.
- ii) Click "SAVE" from "IMAGE" the system will prompt as
Save Image (Type the image No)
- iii) The saved image can be displayed on the screen as

>> Restore Image (Type image No. to restore)

- iv) The SIMA and RIMA options can be used as a modifier from "GDATA" to access quickly at the required positions of drawing.

16. USE OF MACRO:

We can replace the function of any PD5 icon in which the name of icon remains same but function is replaced with defined option. For example we can replace the function of 'CPL' with 'UNDO' on PD5 screen in which CPL appears on screen but it will do UNDO operation. The procedure is as follows

- i) >> Type 'Edit menu' and press spacebar. The system will ask for "Pick menu box to change"
- ii) Click the menu box to change e.g. 'CPL' box.
- iii) Press 'C' for command. The system will show old cmd and ask for entering new cmd.
- iv) Type the new cmd e.g. UNDO #13#
- v) Press "End" from key board and press <CR> to go to command prompt
Notice that 'CPL' appears on screen but function is replaced with 'UNDO'.

17. DEFINING MACRO BY PD_MAC.DEF FILE:

In PD5 a pd_mac.def file is available to define macros for permanent use. The undefined macros' options are available in the file starting with two dashes (--), the dashes indicate that it is a comment. The procedure for defining macros is as follows:

- i) C:\pd5>edit pd_mac.def <CR>
- ii) Decide and locate the available option line in the file. For example :
-- Macro "#0##36" "#10#--Alt J--> ^J
- iii) Remove the two dashes shown at the start.
- iv) Type the command in " " in place of "#10"
(other fields should remain as it is) for example "#13#INS LINE:"
The line will now appear as
Macro "#0##36" "#13#INS LINE:"--Alt J--> ^J
- v) Save the file and exit to DOS.
- vi) compile the file as
C:\PD5> bldf pd_mac <CR>
Now whenever we will press Alt+J in PD5 environment, we will get the command "INS LINE:"

Note The "INS LINE " command is available on first screen of pd5 menu and the other line options are available on next screen by clicking line' option provided on first screen. We can make a macro so that by pressing the defined keys we get the command as well next screen as
Macro "#0##36" "\M-14 M-24 #13#INS LINE" --Alt J--> ^J

Where M indicates Menu and 14 & 2 indicate the group number of the menu. Negative sign tells the system to remove the group no. menu from screen and positive sign tells the system to bring the group no. menu on the screen.

18. INSERTING DIMENSIONS IN ISO VIEW:

We can insert the dimension in ISO view (view #7) according to the sides (CPL). The procedure is as under:

- i) Click 'SELECT' from 'DIM' and then click "VIS ALL VIEWS"
- ii) Save the setting by clicking "END SETTINGS".
- iii) Select view #7 and required 'CPL'.
- iv) Insert the horizontal or vertical dimension from "INSERT" options of "DIM".

Notice that the dimension line is inserted always from the selected depth. To insert the dimension at the required location we have to select the depth from the origin. The procedure is as under:

- i) Click "Z DEPTH" from '3-D' and type the value of new depth or dig by using modifier as:
>>SEL DEPTH <.: system will show 'end'
Click the point where the depth is required to be shifted.
- ii) Now, the dimension will be inserted at new position (depth).

19. DATA FILE FOR PD5:

We can make our own data files to execute in PD5 environment. The Data files are made in the editor and contains x,y,z coordinates. At the beginning of the file we have to specify the entity type e.g., 1 or 5 where 1 is the entity type for lines and 5 is entity type for the points. The procedure is as under:

- i) CAPD5> edit filename.dat <CR>

1
35 35 0
70 35 0
- ii) >> ins df (press spacebar) name filename <CR>

20. PRINTING OF PD5 DRAWINGS THROUGH "PRINTGL":

The available printers are listed under 'PLOT' menu on menu screen in PD5 environment. If any one of the listed printers is available then we can take the printout directly to the printer provided the driver is installed. If we have a printer other than defined in PD5 e.g. IBM Star or HP Paintjet then we can take the printout of PD5 drawings externally

through "PRINTGL". For this first of all we have to convert the PD5 drawing format into ASCII codes. The procedure is as under:

- i) Open drawing in PD5
- ii) >> PLOT DEV HPDP SIZE A ZALL FILE filename <CR>
A file with the given name will be created.
- iii) C:\PD5 >ren filename filename.plt <CR>
- iv) C:\PD5 >printgl <CR> A screen menu will appear
- v) Select the plotfile and press <CR>
The cursor will go to the list of files, Press <CR>. The system will show the list available 'plt' files.
- vi) Select the file and press <CR>.
- vii) Press <CR> again to go to selection mode.
- viii) Select the 'plot page', 'origin /rotate', 'window / margins' etc according to requirement.
- ix) Select "destination" and press <CR>.
Cursor will move to the available options. Select the proper destination e.g., "continuous flow LPT: --- 1" (For IBM or Laser Printer) and press <CR>.
- x) The cursor will move to the selection mode. Select "output format" and press <CR>.
- xi) The cursor will move to available option. Select the proper printer e.g. "IBM 9 2 pass" and press <CR>.
- xii) The selected parameters can be saved for permanent use by selecting "save configs" and pressing <CR>.
- xiii) Select "Run Printgl". Printing will start.

NOTE:

- i) We can take the printout from any printer, whether the printer is directly connected to PC or through network.
- ii) To take the printout on printer when directly connected to PC we do not have to connect with server.
- iii) To take the printout on printer when connected to server we have to select the proper "queue". eg.,
Ppollter for plotter
Plaser for laser printer
Lprinter for IBM printer etc.

These printers must be define in the " pconsole " and a batch file is to be required to made.

- iv) The IBM printer is connected to the cpu by inserting the cable on the security keys, whereas laser printer is connected to the port available on Server.
- v) The printgl document file is available which can be read by
c:\pd5>type printgl.doc |more <CR>

21. USE OF TABLET (DIGITIZER) ON PD5:

The Summagraphics Tablet is available to use in PD5 or Windows as an alternative input device for mouse.

To use tablet in Windows we have to type as
C:\> tablet <CR>

To use table in PD5 , the procedure is as under:

- i) Mount the tablet cord to COM1 in place of mouse or at COM2
- ii) C:\PD5 > config <CR>
- iii) Select "Install / Re-install Computervision Supported Hardware Devices" and press <CR>
- iv) Select "Digitize / Mouse" and press <CR>
- v) Insert PD5 driver disk in drive A , and press <CR>
- vi) Select the appropriate device e.g. "Summa Sketch tablet" and press<CR>
- vii) Notice that the tablet device is installed .
To use mouse repeat the above procedure and this time select "Microsoft Serial Mouse"
- viii) While using tablet we have to edit some of the parameters as
 - Digitizer Comport Number ----- 1 or 2 according to connection.
 - Number of buttons on stylus ----- 2
 - Digitizer input wait loop counter ----- 4000
 - Parity ----- 1
- ix) Save data and Escape to C: \ Pd5 >

22. USE OF MOUSE OR TABLET WITHOUT DRIVER DISK:

We can use Mouse or Tablet as an input device without editing Pd5"config" file and driver disk. The driver disk will be required once just to copy two files to C:\Pd5 directory i.e., Summa.def and msoftmse.def.

The procedure is as under:

- i) Insert the driver disk (disk #3) into driver A
- ii) Check the directory list and change directory to " def " as
A : \ cd def < CR >
- iii) A : \ DEF > copy summa.def C: \ Pd5 < CR >
A : \ DEF > copy msoftmse.def C: \ Pd5 < CR >
- iv) A : \ DEF > C : < CR >
- v) C : \ Pd5 > edit summa.def < CR

Change the parameters according to required settings e.g
Digitizer no of button on stylus (2 for two button)
comport to use (2 for com2 and 1 for com1)

- odd parity (1 to enable tablet)
- vi) Save the file and exit to C : \Pd5
- vii) Compile the file as
C : \Pd5 > bldf summa < CR >
No Error should be detected and a file summa.dif will be created in C \ Pd5
- viii) Similarly we can edit and compile msoftmse.def file if required
- ix) C \Pd5 > copy input dif mmouse.dif < CR >
- x) To use Tablet copy Summa.dif as input.dif as
C : \Pd5 > copy Summa dif input.dif < CR >
- xi) To use Mouse copy mmouse.dif as input.dif as
C : \Pd5 > copy mmouse.dif input.dif < CR >

NOTE:-

Once the steps (i) to (ix) has been carried out in any PC then we do not need to repeat these steps every time. We just have to use either step (x) or (xi) according to the requirement.

23. SHADING PRINTOUT OF PD5 DRAWING:

Once the shading file (.shp) has been created with shade option of PD5 drawings, we can take the printout of this file by the method described below. Note that any file with .shp extension can be printed by this method.

- i) Link the PC with the server and set the queue as C:\plaser <CR>
This will not be required if the printer is directly connected to PC via serial port or parallel port. (It is better to use the parallel port)
- ii) C:\pd5 > shprint A screen menu will appear
- iii) Type the shp file name in response to "Display file"
- iv) Select the printer and press <CR> in response to "Printer"
- v) Select the resolution and press <CR> in response to "Printer resolutions"
(Higher resolution gives good result but small size printout)
- vi) Select the paper size e.g. A4 in response to "Paper Size"
- vii) Select methods e.g. Floyd unidirectional in response to "Printing Method"
- viii) Select the orientation e.g. Portrait in response to "Image Orientation"
- ix) Select the Position of printout to be appear on paper e.g. , Centre in response to "Image location"
- x) Select the adjustments of light e.g. 10% in response to "Light Compensation". Higher value gives brighter appearance of printout and vice versa
- xi) Select the Intensity of background shade e.g. white in response to "Background Shade"
- xii) Select the option e.g. compression in response to "Options"
- xiii) Select the output port e.g. LPT1 in response to "Output to"

- xiv) Type no. of copies e.g. 1 in response to "Number of copies "
- xv) Press any key to start the printing.

Note: See Annex 'B' for some example of shading printout from HP Laser Jet

RECOMMENDATION

After spending two weeks in PMTF, based on their present facilities and requirements, following advise were given by expert to PMTF engineers.

- 24. The servers in Product Design and Tool Design Deptt have softwares Personal Microdraft and UPL. The primary task of server is to communicate among PCs as well as workstation, it should generally not be treated as a PC for designing purposes, since such use will restrict other users from other stations to gain access to the server for printing or plotting.
- 25. It was recommended to engineers of PMTF to make use of PD5 more other than CADD5 for 3D designing as there is no CAM package available in CADD5, but available in PD5. Also shaded figures generated from PD5 can be printout thru HP Laser printer.

CONCLUSION

- 26. Both the Tools Design & Product Design engineers are well versed in their scope of operation in use of Personal Designer software. There are a number of UPL programs in PMTF which both the departments are using in their daily calculations and design especially for gears and dies.

WORK PLAN FOR THE EXPERT OF "PERSONAL DESIGNER"

The "Personal Designer" software has been utilized mostly in Tool Design/Department for the drafting of various drawings of Jigs & Fixtures, Cutting tool, Gauges, Dies, Equipments etc. This software has been found very helpful in making templates' drawings of intricate shapes e.g. casting dies of various parts. The accurate geometry and dimensions of the templates' drawings are very helpful in tool manufacturing.

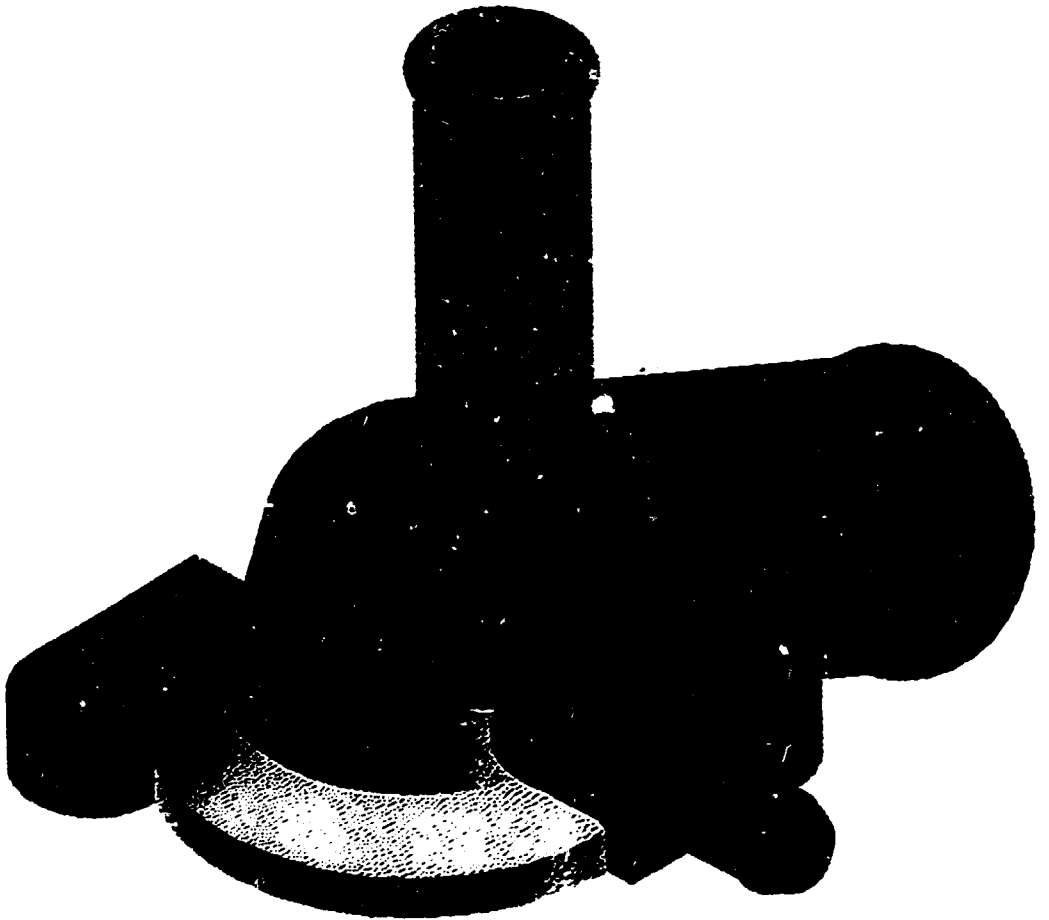
Following are the practical problem for which we need the solution.

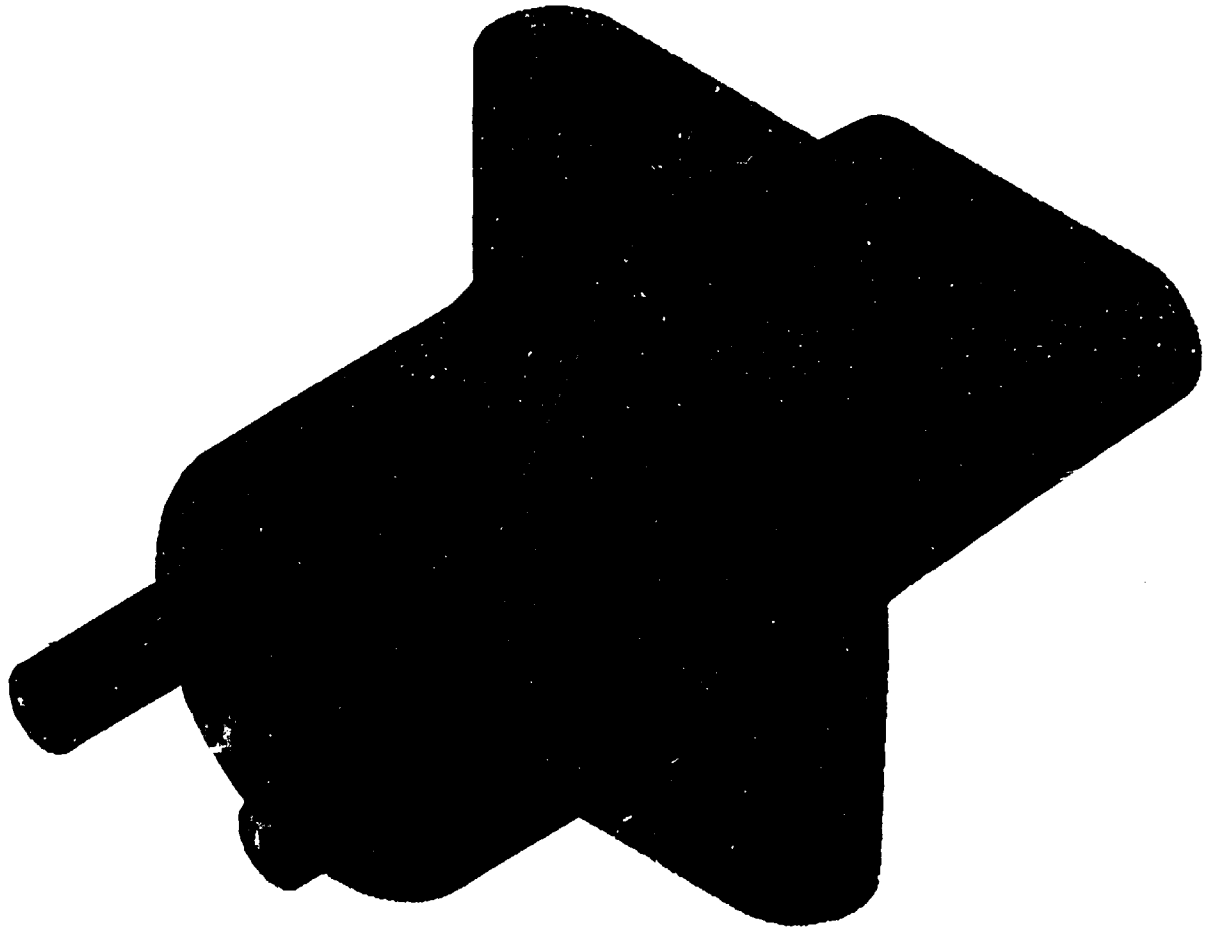
(1) 3D- SURFACING:

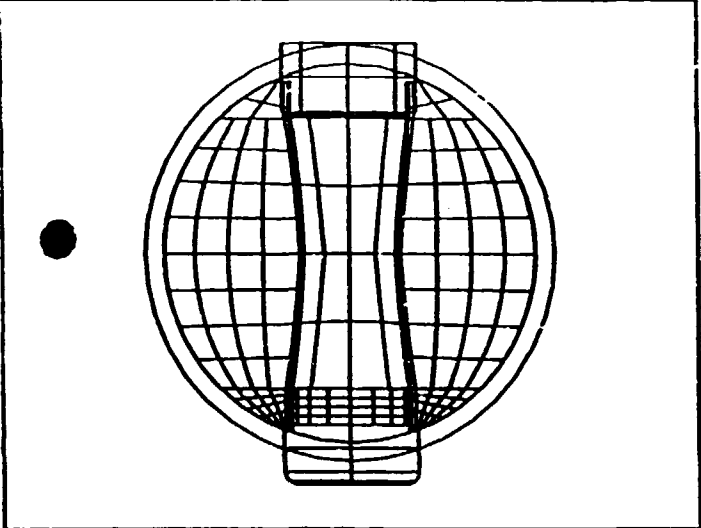
Making an impression die block of a pressure die cast part, its detailing (Sectioning by split command and dimensioning) and tool path generation for CNC machine.

- (2) Sectioning (Splitting) of a Cadd5 drawing in PD5 environment.
- (3) Making libraries of standard parts.
- (4) Use of icon menu to generate repeatative work e.g, assembly making.
- (5) Use and importance of various icon (not so far used)e.g ,SEMA,REMA etc.
- (6) How to use "HIDE" command.
- (7) PD5 interface with CMM.
- (8) User programming language (UPL).
 - (i) Data base format.
 - (ii) Executing data base file for UPL program.
 - (iii) Advance user commands.
- (9) Arrow head size to be modified.
- (10) Size of dashed line not working.
- (11) Transfer of file from PD5 to Design view/Page maker.
- (12) Macros keys/Functions to be explained.
- (13) Up-dating of post processors of: (i) Mandelli (ii) Galaxy (iii) Ab 7340.
- (14) Problems in application of milling commands for machining center.

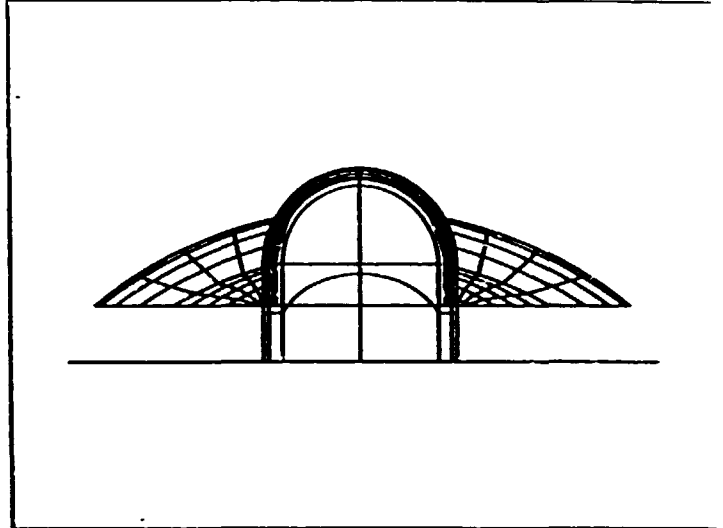
D. ...
DGN 11



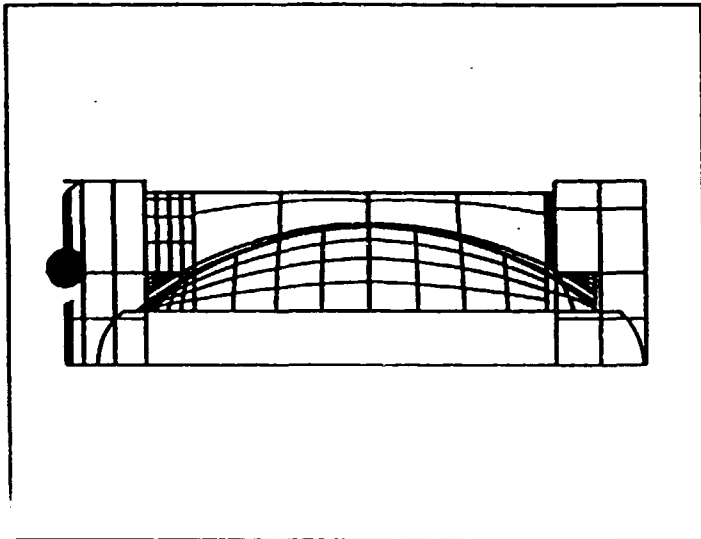




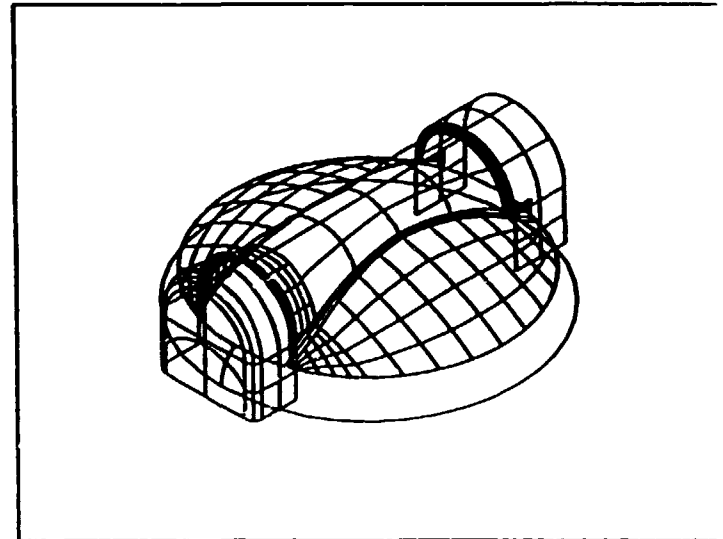
MV: 2 - CPL: 1 - SCL: 1.21359



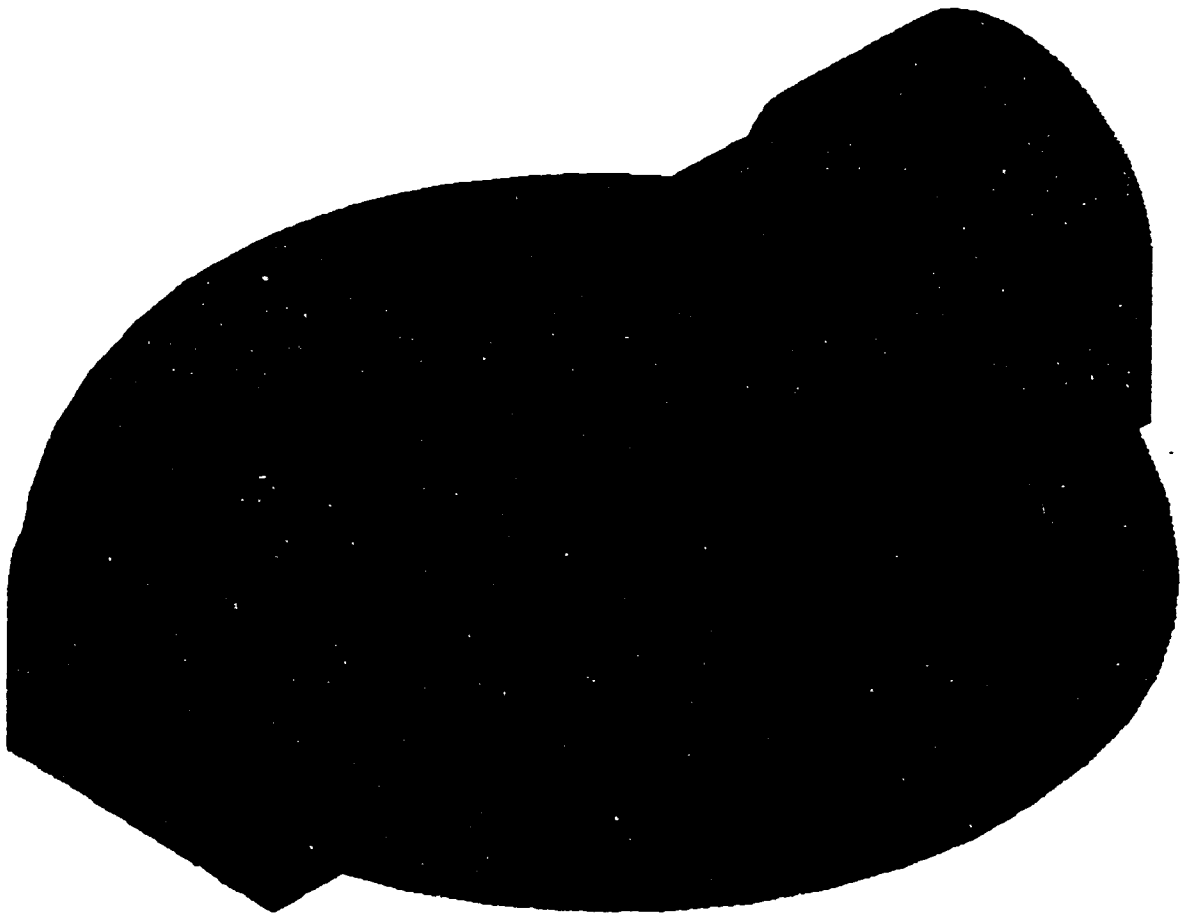
MV: 3 - CPL: 2 - SCL: 1.71821

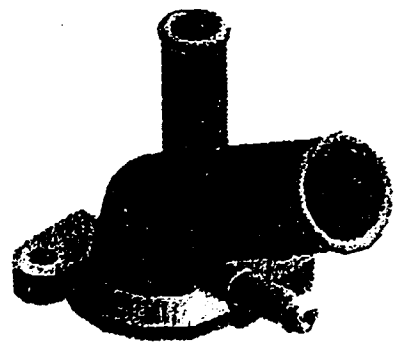
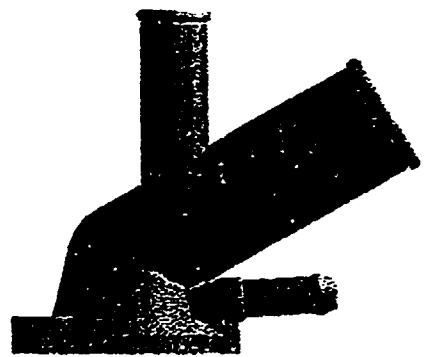
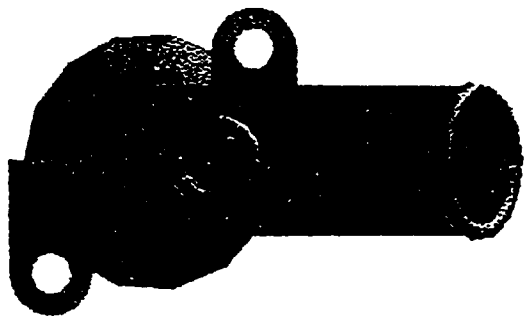


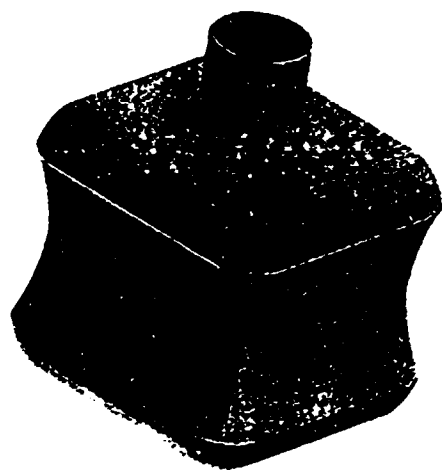
MV: 4 - CPL: 3 - SCL: 1.61812



MV: 5 - CPL: 7 - SCL: 1.21496







Appendix - H

Personal Machinist

&

***Post Processor
Consultancy***

Mr. M.S. TONG	20th May to 1st June 1995
---------------	------------------------------

CONTENTS

TITLE

PARAGRAPHS

- Introduction	1 - 4
- List of Participants	5
- Softwares & Release	6
- Summary of the Consultancy	7 -8
- Recommendation	9 - 11
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INTRODUCTION

- 1- This has reference to UNIDO Contract No. 94/040 in regard to Project No. DP/PAK-84/012, for provision of consultancy services by Computer Vision Corporation relating to the Computer Vision Software Operation, Integration, and Application of the software installed under Contract No. 92/210.

- 2- This is a summary of the of two (2) weeks consultancy provided by Mr. M.S. TONG commenced from 20th May 1995 until 1st June 1995 at PMTF in Karachi.

- 3- Before his arrival, there were a number of problems sent to Chartered System Network Ptd Ltd, Singapore to the expert via fax which is enclosed herewith as Annex 'A'. During the two weeks, most of the questions faxed were dealt with both theoretically and practically.

- 4- The Standard Post Generator in Personal Machinist basically for normal 2-Axis & 3-Axis machining. Due to the different of various machine tools manufacturer and configuration, additional customization is require.

LIST OF PARTICIPANTS

5- The following is a list of participant from both Tool Design and CNC Shop of PMTF.

Mr AFTAB IQBAL	Tool Design
Mr MAAZ-UL-MASAID	
Mr MAQSOOD AHMED KHAN	
Mr MANZOOR HUSSAIN	CNC Shop

SOFTWARES & RELEASE

6- DOS-Platform of Personal Designer / Personal Machinist Rev. 5 from COMPUTERVISION, Bedford, USA.

SUMMARY OF THE CONSULTANCY

7. PROBLEM RELATED TO TURNING CENTRES:

The problem related to points (i) and (ii) of Annex 'A' were further elaborated as

- a) The tool path creates small radii on each corner. These radii appear in the NC2 file and thus make the file lengthy and also difficult for editing on the machine.
- b) Repeatability of blocks after circular interpolation in NC2 files.
- c) Each command occupies separate block while in manual programming we can combine some command in one block.

The problem of formation of lengthy NC2 file due to the reasons mentioned above has been partially solved by solving somewhat the problem as mentioned at point 'c' only by editing the post processor file of Galaxy (Not for AB7340). The sample of NC2 files created by using original and edited post processor file are enclosed as Annex 'B' and 'C'.

- d) A long line having very small taper angle becomes straight after Trimming or Intersectioning.

This problem is related with the accuracy of the software and may not be found in upgrade versions.

The problem listed at point (iii) of Annex 'A' has been solved by editing the post processor file.

8. PROBLEM RELATED TO MACHINING CENTRE:

The problem mentioned at point (ii) of Annex 'A' has been solved only for machine cycles (M Cycles) by creating a separate post processor file. The sample of NC2 files created by using original and edited post processor file are enclosed as Annex 'D' and 'E'.

To solve the problem listed at point (ii)b Annex 'A' we have to do the following.

- i) Rotate the drawing according to the required CPL.
- ii) Edit NC2 file manually by entering Angle of table and Origin of each face.

Besides the above some other problems have also been discussed e.g., While using 'Gen Seq' command we were getting duplication of NC2 files with one empty file. This problem has been solved by adding "Job Name" in the "Insert Tool Path" command as a parameter.

Regarding the 3D Machining Commands, the command sequences and required parameters for Rough and Finish machining of Internal and External surfaces of 3D models are enclosed as Annex 'F'.

RECOMMENDATION

The present facilities and equipments in CNC Shop consider well establish for production job but hardly amenable to quantification in cost terms due to the

9. CNC machine which actually run-out of accuracy are needed to recondition for minimizing the collision of machining part.
10. Manual inputing NC program instead of DNC (Distributed Numerically Control) from computer cause time and mistake.
11. Defination of Mould & Die making is basically more on paper and traditional matter without go through the computer aids manufacturing (CAM) due to the absence of suitable CNC Milling machine with feature such as DNC.

CONCLUSION

12. Good team work of Tool/Product Designer and CNC programmer, final output is still depend on the type of machine available.

WORK PLAN FOR THE EXPERT OF "PERSONAL DESIGNER/PERSONAL MACHINIST"

PMTF CNC Machine Shop is using "Personal Machinist" mostly for their Turning Centres and has generated/manufactured a number of components. There has been some difficulty in successfully utilizing "Personal Machinist" for our Turning Centres and Machining Centre (Mandelli) due to the reasons mentioned below and need to be sorted out during the visit of Expert from Computervision:-

1. For Turning Centres:

i) Updating of Post Processor for :

a) Galaxy b) Ab 7340

Some of the parameters are required to be changed/modified according to the requirements.

ii) The files (nc2) created after post processing are found to be lengthy as compared to our manual programmes which of course require large memory of machine control.

iii) The nc2 files show errors and not created for more than six tool paths generated for one component.

2. For Machining Centre:

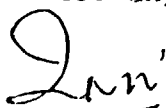
i) Updating of Post Processor for Mandelli machine.

ii) We are facing following problems in the generation of nc2 files.

a) Post processor does not convert axes according to the axes of machine.

b) In a component if we require to machine for example five faces in one setting then the axis should be shifted with respect to each face whereas it is not the case with available Post Processor and each time the origin for each surface machining is taken from the origin of the drawing.

3. Expert should assist PMTF engineers in writing of Post Processor for any CNC machine and its practical application during his stay.



Qazi Muhammad Aslam
Dy General Manager (Engrg)

ANNEX 'B'

(Original Post Processor Galaxy)

%

N5GG28
 N10T101M06
 N15G96S180M3 (SSL, 1500)
 N20GZ5.0X120.0
 N25M08
 N30M03
 N35Z1.154X68.0
 N40G1X58.306F0.3
 N45Z-63.7
 N50X62.0
 N55GX62.6
 N60G1X52.013
 N65G1X52.013
 N70Z-62.035
 N75G2Z-63.7X58.0I2.494K1.035
 N80G1X58.306
 N85GZ1.154
 N90G1X47.719
 N95Z-14.425
 N100Z-18.35X52.252
 N105G3Z-19.0X52.6I-1.126K-0.65
 N110G1Z-61.0
 N115G2Z-62.035X53.013I2.7K0.0
 N120GZ1.154
 N125G1X42.426
 N130Z-13.7
 N135X45.381
 N140G3Z-14.35X47.633I0.0K-1.3
 N145G1Z-14.425X47.719
 N150GZ1.154
 N155G1X37.132
 N160Z-1.728
 N165Z-2.081X37.838
 N170G3Z-3.0X38.6I-0.919K-0.919
 N175G1Z-12.0
 N180G2Z-13.7X42.0I1.7K0.0
 N185G1X42.426
 N190GZ1.154
 N195G1X31.838
 N200Z0.919
 N205Z-1.728X37.132
 N210GX68.0
 N215Z1.154
 N220Z5.0X120.0
 N225GG53X (SSL, 100)
 N230T202M06
 N235G58G96S200M3 (SSL, 1800)
 N240GZ5.0X120.0
 N245M08
 N250Z2.0X66.0
 N255X20.0
 N260G1Z0.8F0.25
 N265X30.0
 N270G3Z0.566X31.131I0.0K-0.8
 N275G1Z-2.434X37.131
 N280G3Z-3.0X37.6I-0.566K-0.566
 N285G1Z-12.0
 N290G2Z-14.2X42.0I2.2K0.0
 N295G1X45.381
 N300G3Z-14.6X46.767I0.0K-0.8
 N305G1Z-18.6X51.386
 N310G3Z-19.0X51.6I-0.693K-0.4
 N315G1Z-61.0
 N320G2Z-64.2X58.0I3.2K0.0
 N325G1Z-64.2
 N330X6.0
 N335GZ-61.0
 N340X66.0
 N345Z2.0
 N350Z5.0X120.0

N350M06

(Edited Post Processor Galaxy)

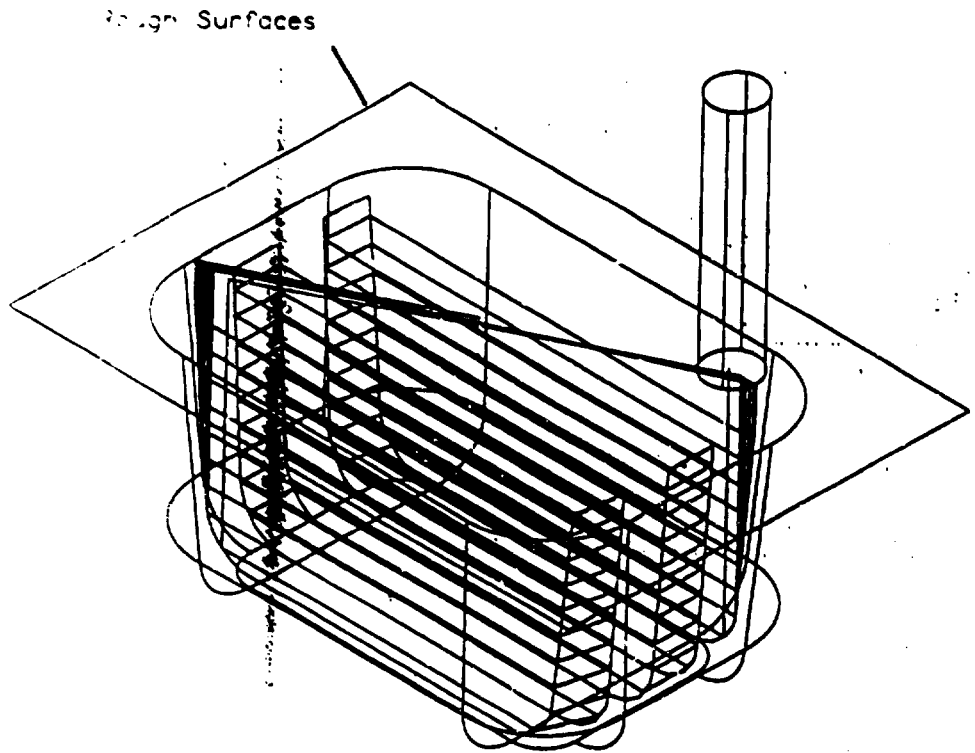
‡
 T101M06
 GG28G96S180M8M3 (SSL, 1500)
 GZ5.0X120.0
 Z1.154X68.0
 G1X58.306F.3
 Z-63.7
 X62.0
 GX63.6
 Z1.154 G1X53.013
 Z-62.035
 G2Z-62.035X58.013I2.7K0.0
 G1X58.306F.3
 GZ1.154
 G1X47.719
 Z-14.425
 Z-18.35X52.252
 G3Z-19.0X52.6I-1.126K-0.65
 G1Z-61.0
 G2Z-62.035X53.013I2.7K0.0
 GZ1.154
 G1X42.426
 Z-13.7
 X45.381
 G3Z-14.35X47.633I0.0K-1.3
 G1Z-14.425X47.719
 GZ1.154
 G1X37.132
 Z-1.728
 Z-2.081X37.838
 G3Z-3.0X38.6I-0.919K-0.919
 G1Z-12.0
 G2Z-13.7X42.0I1.7K0.0
 G1X42.426
 GZ1.154
 G1X31.838
 Z0.919
 Z-1.728X37.132
 GX68.0
 Z1.154
 Z5.0X120.0
 GG53X (SSL, 100)
 T202M06
 G58GG28G96S200M8M3 (SSL, 1600)
 GZ5.0X120.0
 Z2.0X66.0
 X20.0
 G1Z0.8F.3
 X30.0
 G3Z0.566X31.131I0.0K-0.8
 G1Z-2.434X37.131
 G3Z-3.0X37.6I-0.566K-0.566
 G1Z-12.0
 G2Z-14.2X42.0I2.2K0.0
 G1X45.381
 G3Z-14.6X46.767I0.0K-0.8
 G1Z-18.6X51.386
 G3Z-19.0X51.6I-0.693K-0.4
 G1Z-61.0
 G2Z-64.2X58.0I3.2K0.0
 G1Z-64.2
 X62.0
 GZ 65.0
 X66.0
 Z2.0
 Z5.0X120.0
 T101M06

ANNEX 'D'
(Original Post Processor Mandelli)

%

N10B-9002XYZG10B
N20G00B-9002BG10B
N30G00X400Y300Z300
N40T1M06
N50S1000M03M08
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N80T2M06
N90S900M03M08
N100G86<PP=84.805><QP=52.992><RP=10.0><EL=-50.0><RR=10.0><RA=10.0>F250.0
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N120T3M06
N130S800M03M08
N140G86<PP=34.805><QP=152.992><RP=7.0><EL=-99.0><RR=7.0><RA=7.0>F200.0
N150G00X400Y300Z300
N160T4M06
N170S900M03M08
N180G86<PP=-260.0><QP=0.0><RP=-60.0><EL=-139.0><RR=-60.0><RA=-60.0>F250.
N190G00X400Y300Z300
N200M30

%
N10B-9002XYZG10B
N20X10.0Y0.0
N30G00B-9002BG10B
N40G00X400Y300Z30002XYZB
N50T1M06
N60G00X10.0Y0.0Z300.0S1000M03
N70XC.0M06
N80G86<PP=0.0><QP=0.0><RP=10.0><EL=-320.0><RR=10.0><RA=10.0>F300.0
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N110G00X400Y300Z30002XYZB
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N130G00X10.0Y84.805Z300.0S900M03
N140X84.805Y52.992M08
N150G86<PP=84.805><QP=52.992><RP=10.0><EL=-50.0><RR=10.0><RA=10.0>F250.0
N160X84.805Y52.992
N170G00X7.0Y34.805
N180G00X400Y300Z30002XYZB
N190T3M06
N200G00X7.0Y34.805Z300.0S800M03
N210X34.805Y152.992M08
N220G86<PP=34.805><QP=152.992><RP=7.0><EL=-99.0><RR=7.0><RA=7.0>F200.0
N230X34.805Y152.992
N240G00X-260.0Y0.0
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N260T4M06
N270G00X-260.0Y0.0Z300.0S900M03
N280G86<PP=-260.0><QP=0.0><RP=-60.0><EL=-139.0><RR=-60.0><RA=-60.0>F250.
N290G00X400Y300Z300
N300M30

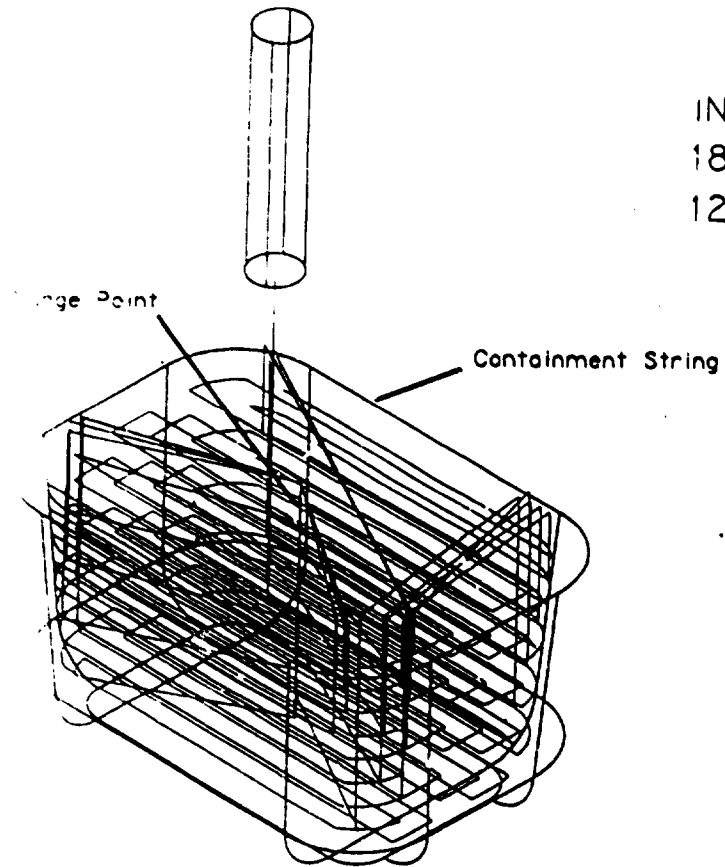


INS TOOL BORDEROFF MAT CONS MAXZ 10 ZIG
STEP 18 AUTOZON CHT 0.5 STOCK 1 FLATM
TOOLD 20 SPE 1200B FEE 200 JOBN P020E

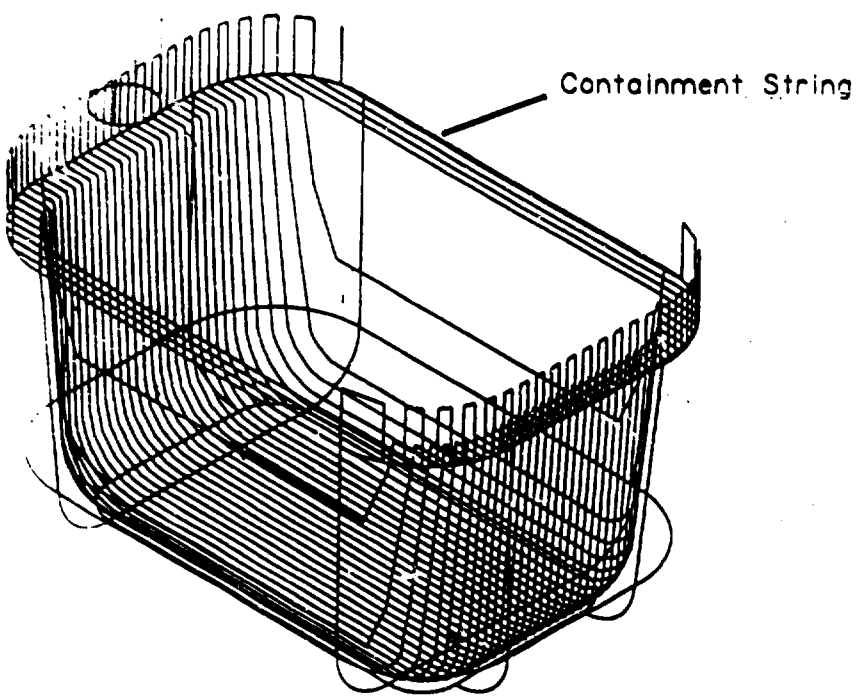
Constant Offset 3D Roughing

ANNEX F.

INS TOOL STRCONT ZROUGH MAXZ 10 ZIG STEP
18 AUTOZON CHT .5 STOCK 1 FLATM TOOL 20 SPE
1200 FEE 200 JOBN PP20E

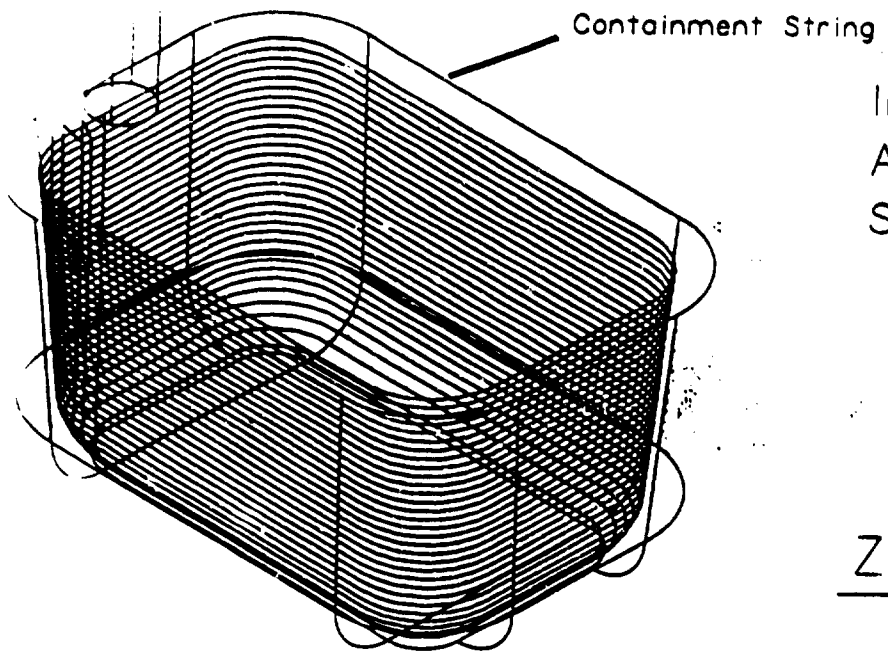


Z-Axis 3D Roughing



INS TOOL STRCONT ZIG STEP 3
AUTOZON CHT 0.5 FLATM 100LD 20
SPE 2000 FEE 200 JOBN 1020E

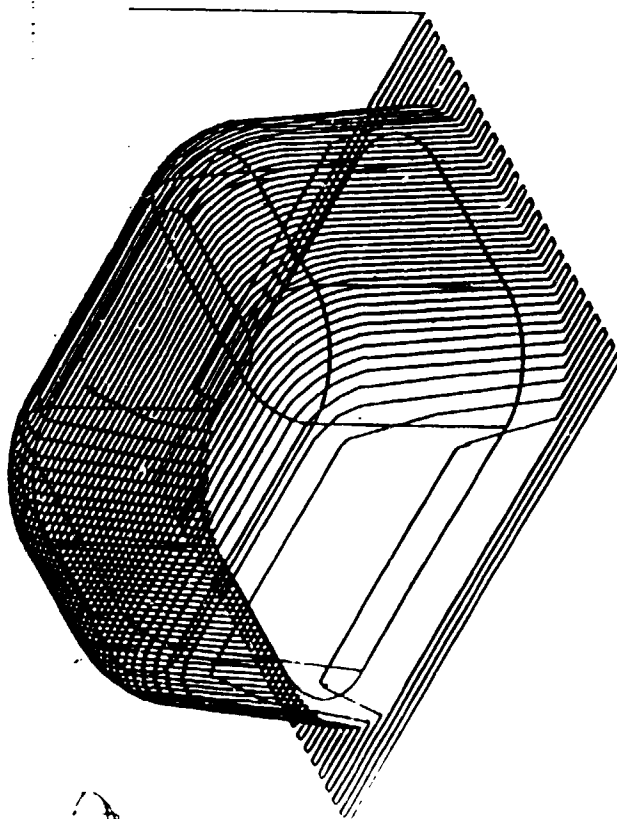
Zig-zag 3D Finishing



INS TOOL STRCONT ZIG STEP 3
AUTOZON CHT 0.5 FLATM MOOLD 20
SPE 2000 FEE 200 JOBN PR20E

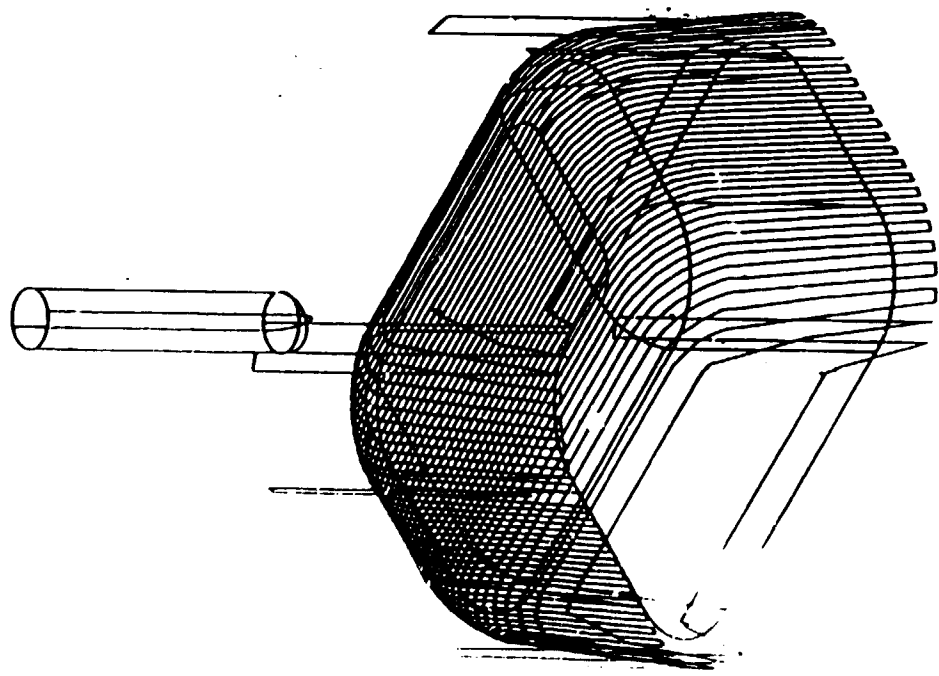
Zprofile 3D Finishing

INS TOOL BORDERON ZIG STEP 3 W/ 0.100N
CHT 0.5 BALLM TOOLD 20 SPE 120
FEE 200 JOBN PF20B

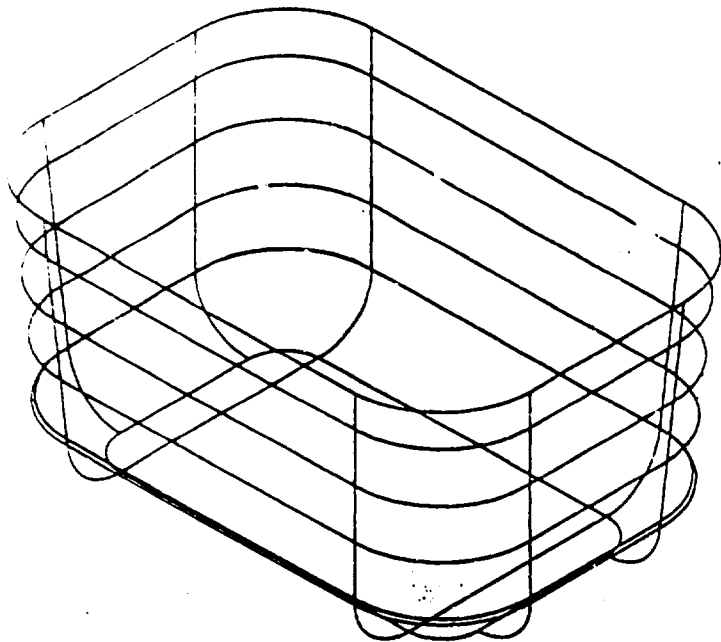


Zig-zag 3D Finishing with BorderOn

INS TOOL BORDEROFF ZIG STEP 3 CZON
CHT 0.5 BALLM TOOLD 20 SPE 120
FEE 200 JOBN PP20B



Zig-zag 3D Finishing with BorderOff



Using ZPROFILE toolpath for 2D POCKET milling

STEPS:

1. Insert tool path by "Z Profile" as described on page 4/7 taking step value according to the required depth for 2D pocket milling.
2. Insert a point as a starting point of tool.
3. Generate tool path for each step for 2D pocket milling keeping the same job name as

INS POCKET START IN FLATM TOOLD
 20 SPEED 1500 FEED 250 MAGPOS 1
 JOBN SAMPLE

