

PART NESTING USER DOCUMENT

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This document explains the nesting process in brief, features of Part Nesting software and user interaction for Part Nesting Software.

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Nest Session

All data required for nesting is managed within a nest session. Nest session manages the nest components, nest blanks and nesting process.

Nesting Session Form

<input type="checkbox"/>	name	nest1
<input type="checkbox"/>	class	general
<input type="checkbox"/>	type	
<input type="checkbox"/>	comp tactics	tact1
<input type="button" value="accept"/> <input type="button" value="reset"/> <input type="button" value="clear"/> <input type="button" value="delete"/>		
Browse		
<input type="button" value="←-prev"/>	#1 of 1	<input type="button" value="next->"/>
<input type="button" value="stage"/>	<input type="button" value="blank"/>	<input type="button" value="comp"/>
<input type="button" value="InterActiveNest"/>		
<input type="button" value="AutoNesting"/>		

name

select the name of nest session by clicking on name If current CAM plan has any nest session, it will show the list of nest sessions. Select the name from the list. or enter the name of session in text window.

class

it is not being used currently. default is set as general

type

it is not being used currently. default is set as general.

comp tactics

select the name of tactics for component definition. Click on comp tactics button displays the list of tactics in plan and in nest session. User may add or remove tactics.

accept

Creates new nest session or modifies existing nest session.

reset

Retrieves the all parameters for the nest session.

clear

clears the name and browser fields in the form.

delete

deletes entire nest session (components and blanks). To undelete - user should use undo option.

Browse**<- prev**

Activates the previous nest session. sequence number of the currently active nest session is shown in browse field (e.g. #1 of 2). If plan has only one nest session, this key has no effect.

-> next

Activates the next nest session. sequence number of currently active the nest session is shown in browse field (e.g. #2 of 2). If plan has only one nest session, this key has no effect.

stage

After nest session is created or modified, to read in the nest components, user is required to stage the components. This reads in the new or modified tactics for current active nest session. corresponding to each operation (toolpath) one nest component is created. component name is the feature name specified in the tactic manager. For new component some default parameters are set. (explained later). After successful staging, all staged components are displayed in the graphics window.

Blank

blank is a raw material used for nesting of the staged component. Since output of nesting is toolpath, user is expected to specify the process name to which all output toolpath will be written. Process definition has set-up information, which inturn defines the blank geometry and clamps. click on this button pops up nesting blank form. The other parameters for blank definition are material, thickness, web offset and grain direction.

Nesting Blank Form

<input type="checkbox"/>	name	blnk1
<input type="checkbox"/>	material	steel
<input type="checkbox"/>	thickness	0.25
<input type="checkbox"/>	webOffset	0.25
<input type="checkbox"/>	grain dirn	no
<input type="checkbox"/>	clamps	
<input type="checkbox"/>	process	proc2
<input type="button" value="accept"/> <input type="button" value="reset"/> <input type="button" value="clear"/> <input type="button" value="delete"/>		
Browse Blanks		
<input type="button" value="<-prev"/> <input type="text" value="#1 of 1"/> <input type="button" value="next->"/>		

process

click to see listing of all processes in the plan. select the process. This reads in set-up information and form is updated. name of first cam component of type=part is displayed in the name field. Under this name nesting blank is saved. If set-up has any cam components of type=clamp, these are displayed against clamps buttons.

material

default is set as "steel" for new blank. User may change either by clicking on material button (this shows the material list) or by entering the text widget.

thickness

default is set as "0.25". User may change this value either by clicking on thickness button (this shows the thickness list). or by entering the value in the text widget. User is expected to enter numeric value.

web offset

this value is used being nesting process as clearance (stock) between two component. By default is set as "0.25". User may change this value by either by clicking on web offset button (this shows the web offset list). or by entering the value in the text widget. User is expected to enter numeric value.

grain direction

Default is set as "no" that means no preference for grain direction. User may define grain direction by clicking on grain dirn button. This pops-up list of values. One of option is vector. If user selects "vector" user is asked to select two points. Using these points grain direction angle is computed and displayed in the text widget. Currently grain direction definition for blank is ignored and default is taken as X-axis (or 0), if grain direction is defined for any of the component.

accept

Creates new nest blank or modifies existing nest blank.

reset

Retrieves parameters for the blank name specified in the name widget.

clear

clears the name and browser fields in the form.

delete

deletes blank (and nested components, if any, on the blank). To undelete - user should use undo option.

Browse

<- prev

Activates the previous nest blank. sequence number of the currently active nest blank is shown in browse field (e.g. #1 of 2). If nest session has only one nest blank, this key has no effect.

-> next

Activates the next nest blank. sequence number of the currently active nest blank is shown in browse field (e.g. #1 of 2). If nest session has only one nest blank, this key has no effect.

Component

To edit the nest component definition for the staged components, click on comp button. User is prompted to select the component. Selected component is highlighted by showing box around component display. Also "nesting component" form pops-up.

Nesting Component Form

<input type="checkbox"/>	name	comp_11
<input type="checkbox"/>	material	steel
<input type="checkbox"/>	thickness	0.25
<input type="checkbox"/>	quantity	2
<input type="checkbox"/>	x flip	yes
<input type="checkbox"/>	y flip	yes
<input type="checkbox"/>	nest holes	no
<input type="checkbox"/>	grain dirn	no
<input type="checkbox"/>	rotation	any
<input type="checkbox"/>	tool radius	5
<input type="button" value="accept"/> <input type="button" value="reset"/> <input type="button" value="clear"/> <input type="button" value="delete"/>		
Browse Components		
<input type="button" value="<-prev"/> <input type="text" value="#11 of 11"/> <input type="button" value="next->"/>		

name

Name is the name of the CAM feature corresponding to toolpath (feature name is selected at the time of tactic definition). Do not edit this field.

material

Default is set as "steel" for new component. User may change either by clicking on material button (this shows the material

list) or by entering the text widget.

thickness

default is set as "0.25". User may change this value either by clicking on thickness button (this shows the thickness list). or by entering the value in the text widget. User is expected to enter numeric value.

quantity

Default is set as "1". User may enter any positive integer value.

x flip

Default is set as "yes" that means during nesting process, component flip about X-axis is permitted. If X-flip is not to be allowed, user may select the flip flag from the list by clicking on x flip button or by entering "yes" in the text widget. Any string other than "yes" or "no" is treated as "yes".

y flip

Default is set as "yes" that means during nesting process, component flip about Y-axis is permitted. If Y-flip is not to be allowed, user may select the flip flag from the list by clicking on y flip button or by entering "yes" in the text widget. Any string other than "yes" or "no" is treated as "yes".

nest holes

Default is set as "no" that means do not use the holes (void space) in the component. To utilize the holes by any other component, the flag from the list by clicking on nest holes button or by entering "yes" in the text widget.

x flip

Default is set as "yes" that means during nesting process, component flip about X-axis is permitted. If X-flip is not to be allowed, user may select the flip flag from the list by clicking on x-flip button or by entering "yes" in the text widget. Any string other than "yes" or "no" is treated as "yes".

grain direction

Default is set as "no" that means no preference for grain direction. User may define grain direction by clicking on grain dirn button. This pops-up list of values. One of option is vector. If user selects "vector" user is asked to select two points. Using these points grain direction angle is computed and displayed in the text widget. A grain direction vector is shown at center of component's bounding box. This constraint is considered during nesting process.

rotation

Default is set as "any" that means no restriction on angle of placement for a component. To restrict the component rotation, select the value from list by clicking on rotation button or by entering preferred rotation values separated by comma (",", example : 30,45,60). Autonesting process tries to utilize these values if defined by user. If "any" is defined to restrict the computation time -it attempts only 4 values (0,90,180,270).

tool radius

Default is set from the tool definition data used for that particular component (tool path). This value is used as stock (offset) for the nesting process. Normally user should not be editing this value.

accept

Modifies existing nest component.

reset

Retrieves parameters for the component specified in the name widget.

clear

clears the name and browser fields in the form.

delete

deletes component. To undelete - user should use undo option.

Browse

<- prev

Activates the previous nest component. sequence number of the currently active nest component is shown in browse field (e.g. #1 of 2). If nest session has only one nest component, this key has no effect.

-> next

Activates the next nest component. sequence number of the currently active nest blank is shown in browse field (e.g. #2 of 2). If nest session has only one nest component, this key has no effect.

Interactive Nesting

During this, user generates and edit the nest interactively. click on "InterActiveNest", following menu pops up.



blank

text widget shows the currently active nest blank. click on "blank" button to select any blank.

Browse Blanks

<- prev

Activates the previous nest blank. sequence number of the currently active nest blank is shown in browse field (e.g. #1 of 2). If nest session has only one nest blank, this key has no effect.

-> next

Activates the next nest blank. sequence number of the currently active nest blank is shown in browse field (e.g. #1 of 2). If nest session has only one nest blank, this key has no effect.

PlaceComp Form

Name	[comp_11]
Rotation Angle	0
X Flip	no
Y Flip	no
Count X	1
Count Y	1
Locate	

This option is meant for placing the component on blank. Once clicked on "PlaceComp" button user is prompted to select the component. If nest constraints are satisfied, selected component is highlighted and "Place Component" form pops- up.

Name

Displays the name of selected component.

Rotation Angle

Enter value or select from the list.

X flip

Select from the list "yes" or "no"

Y Flip

Select from the list "yes" or "no"

Count X

Number of components along X-direction

Count Y

Number of component along Y-direction Click on "locate" button. The component placement parameters are read and echo is displayed. User is prompted to pick the location point. If user wishes to change component parameters, he may go back "Place Component" form. After the parameters are changed, click on "locate" will show new echo for the latest placement parameters. After point is picked component is placed at specified location and it's toolpath is transformed and added to the process (specified for blank).

MoveComp Form

Name	[comp_11_#_3735]
Ref Point	PNTS#1384
Dest Point	PNTS#1387
Accept	

To relocate the nested component, use this option. Click on "MoveComp" button pops up form "Move Component"

Name

Click to select the component to be moved.

Ref Point

Click to specify the reference point

Dest Point

Click to specify the destination point

Accept

Click to accept the move parameters. Component is moved to new location (Toolpath is re-transformed)

CopyComp Form

Name	[comp_11_#_3735]
Ref Point	PNTS#1384
Dest Point	PNTS#1387
Accept	

To make a copy of the nested component, use this option. Click on "CopyComp" button pops up form "Copy Component"

Name

Click to select the component to be copied

Ref Point

Click to specify the reference point

Dest Point

Click to specify the destination point

Accept

Click to accept the copy parameters. Component is copied.

FlipComp Form

Name	comp_11_#_3735
X Flip	yes
Y Flip	no
Accept	

To flip the nested component about X and/or Y axis , use this option. Click on "FlipComp" button pops up form "Flip Component"

Name

Click to select the component to be flipped

X Flip

To flip about X-axis enter "yes"

Y Flip

To flip about Y-axis enter "yes"

Accept

Click to accept the flip parameters. Component is flipped and component's toolpath is re-transformed.

RotateComp Form

Name	comp_11_#_3735
X Flip	yes
Y Flip	no
Accept	

To rotate nested component, use this option. Click on "Rotate Comp" button pops up form "Rotate Component"

Name

Click to select the component to rotate.

Ref Point

Click to specify the reference point for rotation

Rotation Angle

Click to select the rotation angle for component. +ve values for CCW rotation, -ve for CW rotation

Accept

Click to accept the rotation parameters. Component is rotated. Component's toolpath is re-transformed.

DeleteComp Form

Name	[comp_11_#_3735]
Accept	

To delete nested component, use this option. Click on "DeleteComp" button pops up form "Delete Component"

Name

Click to select the component to delete

Accept

Click to delete selected component. Component is deleted. Component's toolpath is deleted.

SmartEdit Form

This is an attempt to bring all editing options (move, copy, rotated, flip and delete) into one form. Click on "SmartEdit" to explore it further. Selected component is highlighted.

Name

Displays the selected component for editing, by default is a last component you edited. To select any other component click on "Name" button. User is prompted to select component.

Delta X

Used for move. Default is set to 5 units

Delta Y

Used for move. Default is set to 5 units

Delta Angle

Used for rotation. Default is set to 5 degrees. While copying the component, (X and Y distances are calculated from component bounding box).

Move/Copy Btns

Center button shows the mode. To toggle the mode click on the center button.

U-L

Move/Copy to Up and Left relative to component's current position.

U

Move/Copy to Up relative to component's current position.

U-R

Move/Copy to Up and Right relative to current component's position.

L

Move/Copy to Left relative to component's current position.

R

Move/Copy to Right relative to component's current position.

D-L

Move/Copy to Down and Left relative to component's current position.

D

Move/Copy to Down relative to component's current position.

D-R

Move/Copy to Down and Right relative to component's current position.

Flip Btns

X-Flip

Flip the component about X-axis relative to component's current position.

Y-Flip

Flip the component about Y-axis relative to component's current position.

Rotate Btns

CW

Rotate Clock wise. User is prompted for reference point for rotation.

CCW

Rotate Counter Clock wise. User is prompted for reference point for rotation.

Delete Btns

Deletes the selected component and name field reset

Nest Report

part id	Test_1	options	
programmer	PKA	session	nest1
file name	Test1.rpt	blank	blnk1
generate nest report			

Report

```

----- Part Identification : Test_1
----- Programmer          : PKA
----- Start of Nest Report -----

----- Begin Nest Session = nest1 -----

Component = comp_1
  Qty = 5   Material = steel   Thickness = 0.25   Area = 6021.68

Component = comp_2
  Qty = 6   Material = steel   Thickness = 0.25   Area = 6257.25

Component = comp_3
  Qty = 8   Material = steel   Thickness = 0.25   Area = 2850.00

Component = comp_4
  Qty = 5   Material = steel   Thickness = 0.25   Area = 11050.00

Component = comp_5
  Qty = 4   Material = steel   Thickness = 0.25   Area = 98375.48

Component = comp_6
  Qty = 6   Material = steel   Thickness = 0.25   Area = 40750.00

Component = comp_9
  Qty = 12  Material = steel   Thickness = 0.25   Area = 7650.96

Component = comp_7

```

To generate the nest utilization report click here.

session

Displays the name of active nest session.

blank

Displays the name of active nest blank.

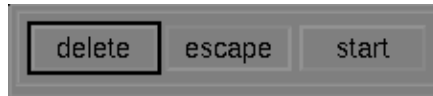
generate nest report

click to generate report. Firstly component data is listed followed by blank data. For each blank, component details (name and number of each component, total component, total area) percent utilization and percent wastage is listed.

AutoNesting

After nest component and blanks are defined, it is ready for autonesting process. click on "Autonesting" button. No further user inputs are required. This process reads all blank definition, component definition, performs the nesting process using the parameters defined for blank and component. If any errors occurs during the process, user is notified. After successful autonesting process, nest report is generated for currently active session.

AutoNesting Manager Form



delete

Deletes all nested components from all blanks in an active nest session.

escape

Currently this has no effect. In near future, user would be able to interrupt Autoneesting process.

start

Starts the Autoneesting process.

END OF DOCUMENT

Sample AutoNest Outputs

1. Sample Staged Components

[View Staged Components](#)

2. AuotNest Sample 1

[View AutoNest Sample Output 1](#)

[View AutoNest Sample Report Output 1](#)

3. AuotNest Sample 2

[View AutoNest Sample Output 2](#)

[View AutoNest Sample Report Output 2](#)

4. AuotNest Sample 3

[View AutoNest Sample Output 3](#)

[View AutoNest Sample Report Output 3](#)

5. AuotNest Sample 4

[View AutoNest Sample Output 4](#)

[View AutoNest Sample Report Output 4](#)

6. AuotNest Sample 5

[View AutoNest Sample Output 5 Blnk 1](#)

[View AutoNest Sample Output 5 Blnk 2](#)

[View AutoNest Sample Report Output 5](#)

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Definition

Nesting is basically an operation of fitting the profiles/shapes (called as component) within a stock profile (call as raw material or blank). Components to be nested can be any closed shape and size. Component can have only one peripheral boundary and may/may not have single/multiple hole boundaries.

Objective

Objective of the nesting process is to achieve the layout of desired components on a blank so that these can be manufactured the way user would like. Ease of Manufacture and maximum utilization of blank are the most important criteria in addition to user inputs (nesting parameters) such as count of components.

Methods

This result may be achieved by manual method (**Interactive Nesting**), wherein user indicates which component(s) to nest, then places it on blank. Since it is a manual process and user makes decisions (such as where to place, how to orient, etc.) based on visual feedback he gets from system, he must have some tools to verify the output of his actions. Hence, utilities like interference checking, statistics of process are must.

Other method is automatic (**AutoNesting**), wherein software makes intelligent decisions, based on inputs parameters specified by user to achieve end objective. Once nest is generated user may modify or inquire the nest.

Before beginning of nesting process or during nesting process, user may decide to form a group of two or more component(s) and like that to be treated as one component (this process may be called as cluster definition or sub-nest operation).

Generally interactive nesting process gives better results with skilled operator, but obviously it lacks repeatability and consistency. On the other hand automated nesting is more likely to give consistent results. Efficiency of process depends on algorithms and also on input parameters. As a result in many a times user ends up using both methods.

Some Application Areas :

- Sheet Metal Fabrication Industry
- Body/Ship Building Industry
- Textile Industry
- Leather Industry

- Paper Industry
- Lumber Industry
- Glass Industry

What is **STAGING**

This is basically preparing the existing geometry and toolpath for nesting operation. User defines the blank (raw material) geometry and component (toolpaths to be nested) and relevant parameters useful in nesting process.

For blank user defines the shape (brings in existing geometry), thickness, material, grain direction vector, manufacturing constraints (clamps), web offset (minimum clearance between two nested components), output process (to which nested toolpath are written).

Component definition parameters includes shape (existing toolpath) and other nesting parameters (such as quantity, thickness, material, x and y flip flags, permitted rotation angles , grain direction, island nesting flag).

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Features of Part Nesting Software

Blanks

- Supports Regular (Rectangular) as well as irregular shapes.
- Supports Holes within a blank.
- Supports Fixtures/Clamps.
- Supports manufacturing constraints (grain direction, web-offset/clearance)

Components

- Supports Holes within a Component,
- Supports manufacturing constraints such as grain direction, X and Y flip control, rotation control, material, thickness, order quantity requirement, island nesting control.

AutoNesting Process

- Based on Heuristic Approach.
- Performs Nesting based on true shape.
- Supports Multiple sheet Nesting. Respects holes and clamps during nesting process.
- Component's best orientation and flips flags are calculated (considering minimum enclosing rectangle, and minimum wastge).
- Components are prioritized in the decreasing order of area, utilisation factor etc.
- Begins nesting from lower left corner of blank.
- Supports Island Nesting (Holes of a larger component occupied by smaller components.)
- Attempts for multiple component nesting within Island (Component Holes).
- Attempts to utilize void spaces (area between two or more nested components).
- Component Packing

After component location and orientation is determined based on shapes of previously nested component and nested portion of a blank, applies component packing mechanism to obtain tighter nest.

Packing distance is calculated by looking at visible edges of the nested components. Only visible components are scanned to get visible edges. Most

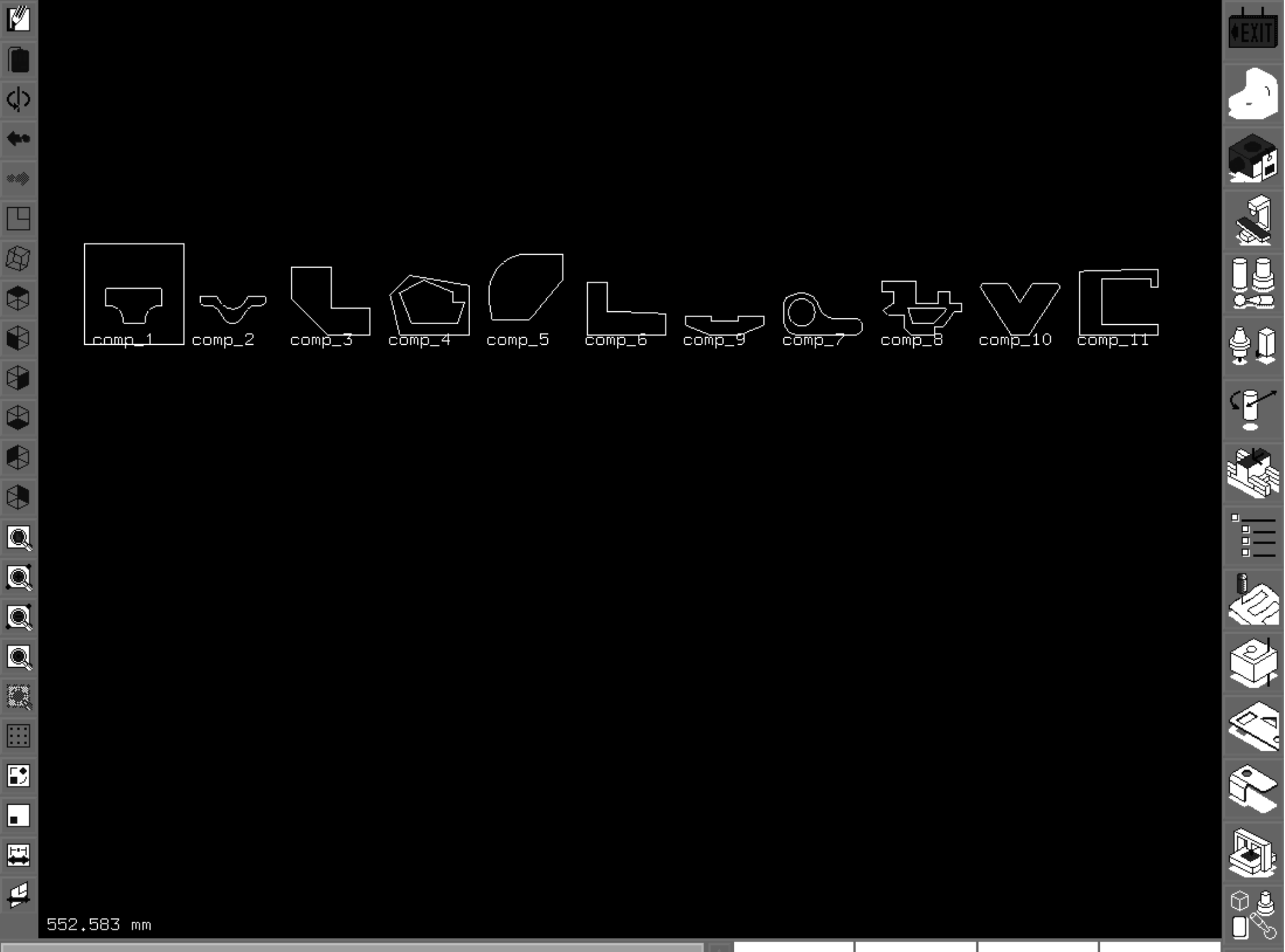
of the scanning is based on BndBox. This helps to reduce processing time drastically. Component is packed till tightest fit within webOffset (minimum clearance) is obtained.

- Nest Report
Generates Utilization report for each nested blank. Also component and blank statistics are reported.
hints user about smaller blank size.
- User may interrupt autonesting process any time.

Interactive Nesting

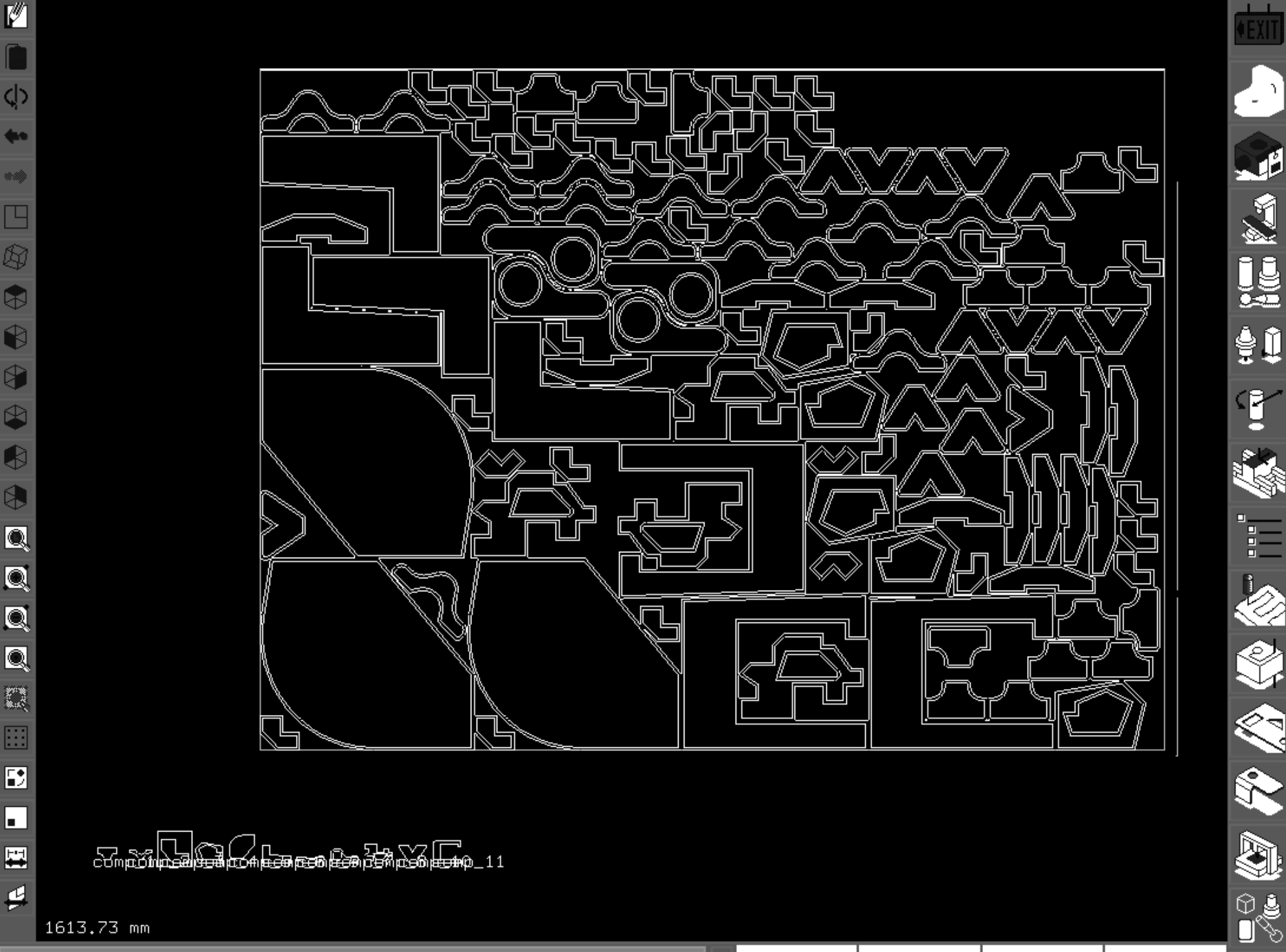
- Functions available are
Place Component (one component or array of component)
Edit Component (Move, Copy, Rotate, Flip, Delete).
- Hints user about placement parameters (permitted rotation angles, flip, order quantity, grain direction control)
- Has individual form for each edit functionality. Or user may use "SmartEdit" form .. an attempt to combine all edit functions in one form.
- Supports Component groups
User may pick one or more component to form a group. Component groups are also staged by the side of staged components.
While editing component groups, user may edit individual member.
- Interference Checking
Notifies interference of component with blank, clamps and other components.
- Toolpath resequencing
By default toolpaths are in the nesting order. User can resequence toolpaths.
Respects the manufacturing constraints while resequencing

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Select component



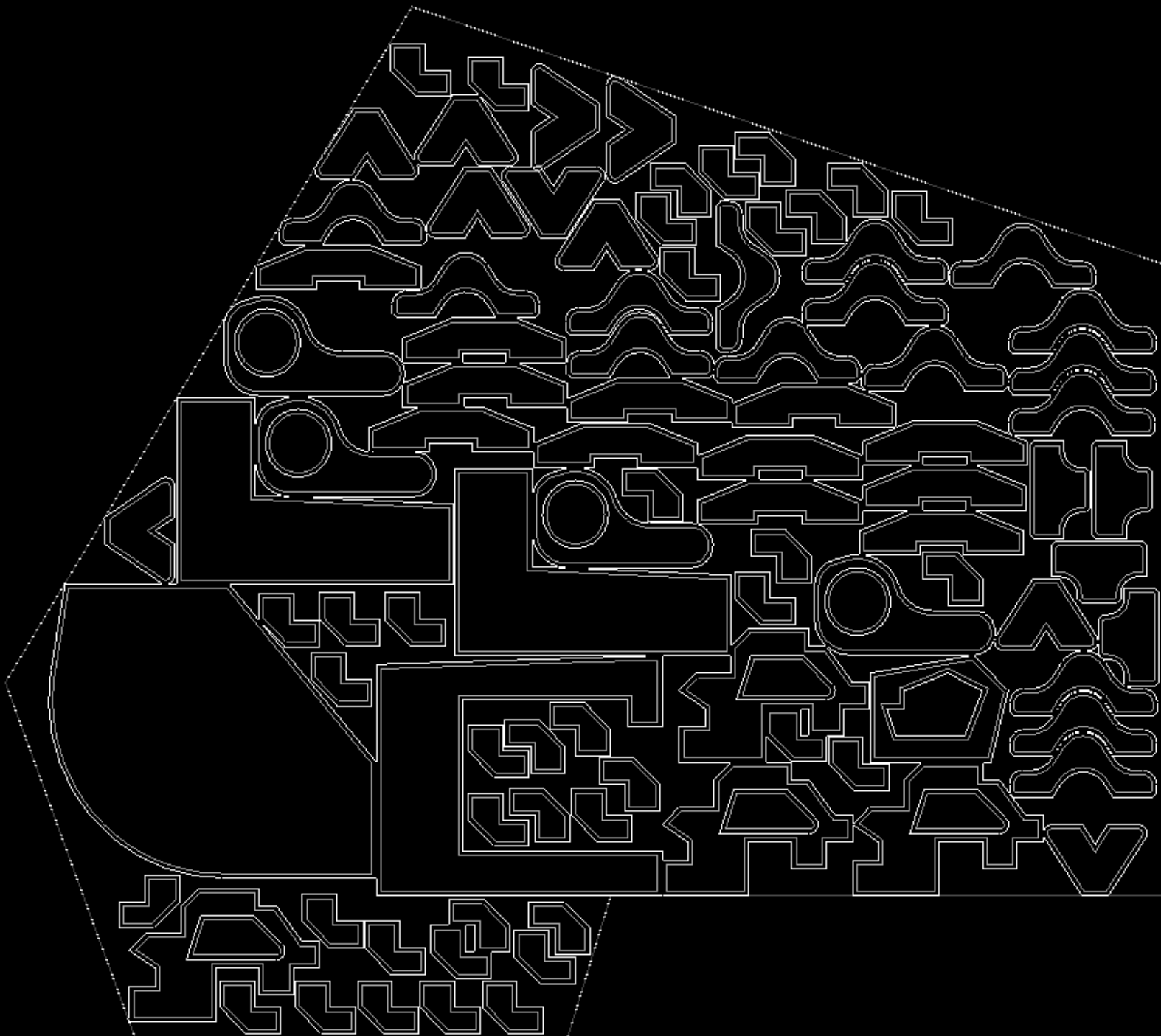


1613.73 mm

LVXSession.VXJ saved successfully.

Global_2

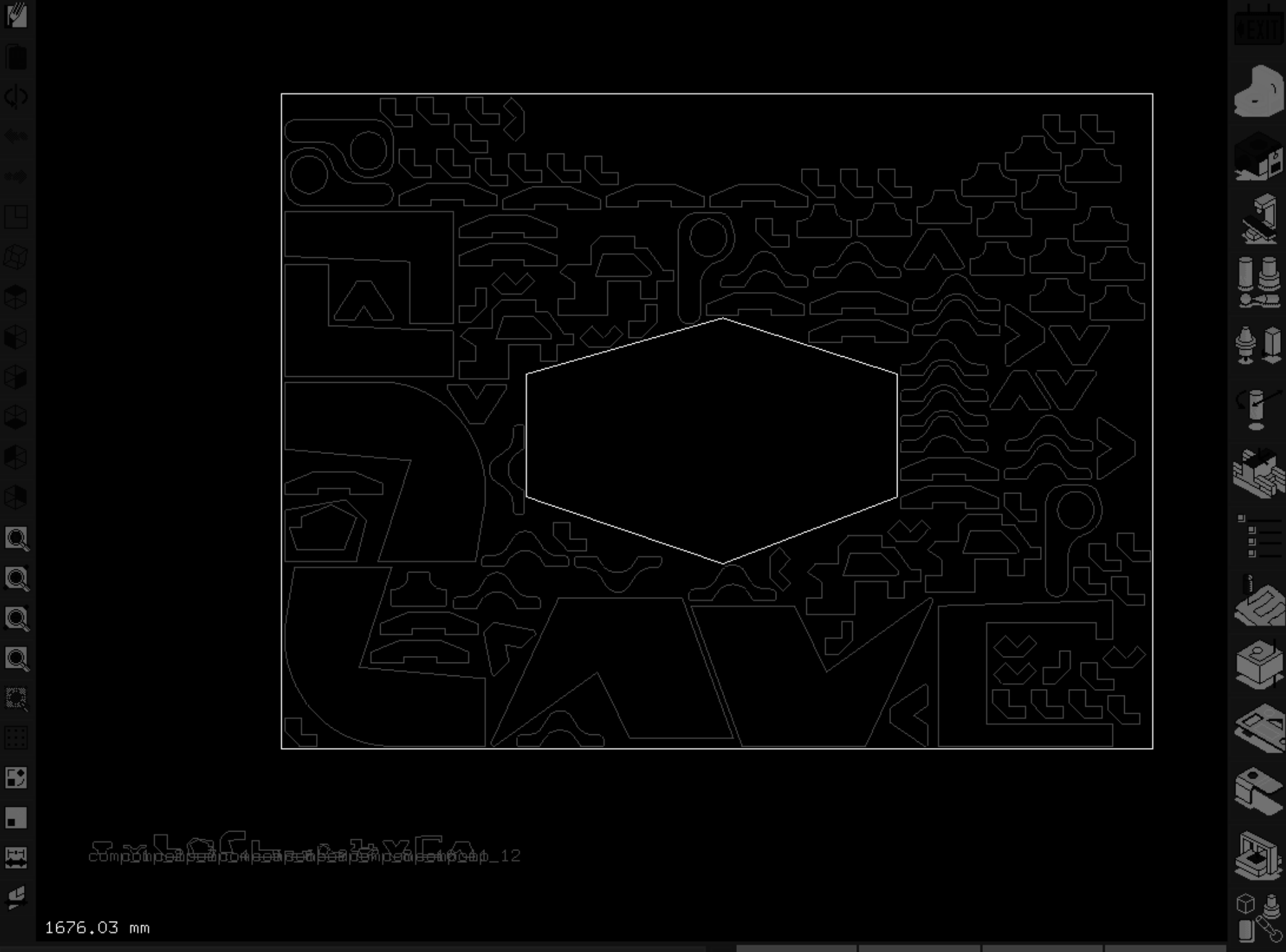




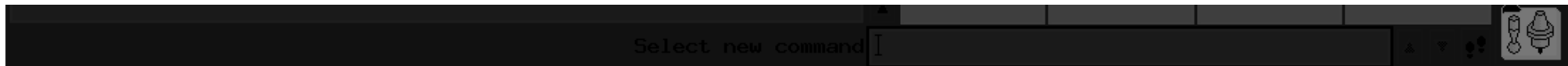
1202.06 mm

Select component to copy





1676.03 mm





1442.89 mm



