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## DESIGN OF FIXTURE TO OPTIMISE PROCESS PLAN OF AEROSPACE COMPONENT

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### ABSTRACT

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The main aim of this project is to optimize process plan and creating 3D model using Unigraphics software. Generating NC program of missile shield using NX-CAM software which is exclusively CAM software used to generate part program by feeding the geometry of the component and defining the proper tool path and thus transferring the generated part program to the required CNC machine with the help of DNC lines. The operator thus executes the program with suitable requirements. The project deals with optimizing process plan by specifying appropriate tools, developing tools design if demanded.

### **INTRODUCTION**

A missile is a self-propelled guided weapon system. Missiles have four system components: targeting and/or guidance, flight system, engine, and warhead. Missiles come in types adapted for different purposes: surface-tosurface and air-to-surface (ballistic, cruise, antiship, anti-tank), surface-to-air (anti-aircraft and anti-ballistic), air-to-air, and anti-satellite missiles. The missile shield protects the missile by covering the entire body. Missile shield is aero space component it requires accurate machining and high finishing.

# **3D MODELLING OF MISSILE SHIELD**



Fig. sketch and extrude of shield



Fig. sketch and extrude of slots around shield



Fig. sketch and extrude of slots around shield



Fig. circular array of slots around shield





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Fig. counter sunk holes



Fig. sketch and extrude



Fig. sketch and extrude



Fig. 3Dmodels of missile shield

# COMPUTER AIDED MANUFACTURING





Set\_up\_1 tool path generation



Fig. FACING operation on missile shield



Fig. OD\_Rough operation on missile shield



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Fig. ID\_Rough operation on missile shield **Set\_up\_2** 



Fig. FACING operation on missile shield



Fig. OD\_Rough operation on missile shield



Fig. Groove operation on missile shield







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Fig. ID\_Rough operation on missile shield **Milling operations** 



Fig. Raw material for milling



Fig. planar mill operations





Fig. face mill area operations



Fig. planar mill operations



Fig. planar mill operations





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Fig. planar mill operations



Fig. planar mill operations



Fig. planar mill operations



Fig. Drilling operations





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Fig. Drilling operations





Fig. Drilling operations



Fig. Final part after operations

# DESIGNING FIXTURE FOR MISSILE SHIELD



Fig. sketch and extrude of fixture part1



### Fig. sketch and extrude of fixture part1



Fig. sketch and extrude of fixture part1





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Fig. 3D model of fixture part1



Fig. sketch and extrude of fixture part2



Fig. sketch and extrude of fixture part2



Fig. sketch and extrude of fixture part2



Fig. 3D model of fixture part2



Fig. sketch and extrude of clamp stud



Fig. sketch and extrude of clamp stud



Fig. 3D model of clamp stud **Fixture assembly** 





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Assembly of fixture after completing turning operations



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#### <u>RESULTS</u>

## Manufacturing of missile shield without fixture

Time taken to manufacture a single component without fixture on CNC machine = 13hr 41min 34sec=822min

If the time in seconds is above 30 then it is taken as 1min, if it is below 30 then it is exception

Manufacturing cost of CNC machine per hour = 1200rs/hr

Manufacturing cost of single missile shield = (1200/60)\*822= 16440rs

Direct Labour Cost = Tm \* Man Hour Rate Rs.

Man Hour Rate = 500 Rs.

Tm= machining timeTm = (822/60) hrs= 13.7hrs

Direct Labour Cost = 13.7\*500= 6850 Rs.

Total cost of part =raw material cost + labour cost +manufacturing cost =

1040+6850+16440= 24330rs

#### Manufacturing of Missile shield with fixture

Time taken to manufacture a single component with fixture on CNC machine = 8hr 51min 59sec=532min

If the time in seconds is above 30 then it is taken as 1min, if it is below 30 then it is exception

Manufacturing cost of CNC machine per hour = 1200rs

Machining cost per piece (machining cost per min x machining time in min) = (1200/60)\*532= 10640rs

Manufacturing cost of single missile shield= 10640rs

Direct Labour Cost = Tm \* Man Hour Rate Rs.

Man Hour Rate = 500 Rs.

Tm= machining timeTm = (532/60) hrs= 8.9hrs

Direct Labour Cost = 8.9\*500=4450 Rs.

Total cost of part =raw material cost + labour cost +manufacturing cost =

1040+4450+10640= 16130rs

Graphical representation



#### CONCLUSION





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- It is difficult to manufacture missile shield with 3-jaw chuck because it cannot hold the part rigidly for machining slots around the missile shield. More number of parts is rejected.
- Manufacturing time, labour cost, manufacturing cost where reduced Using designed fixture.
- Inspection charts are shown in report
- Graphical representation of reduction of time and cost are in and shown in results.
- There is a drastic reduction of reworks and rejection rate using designed fixture.

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