IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017 ISSN: 2320-1363

DESIGN OF FIXTURE TO OPTIMISE PROCESS PLAN OF AEROSPACE COMPONENT

*DURGA BHAVANI, **G. VENKATESH

*PG SCHOLAR, **ASSISTANT PROFESSOR

DEPARTMENT OF MECHANICAL ENGINEERING, HYDERABAD INSTITUTE OF TECHNOLOGY

ABSTRACT

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-to-surface and air-to-surface (ballistic, cruise, anti-ship, 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

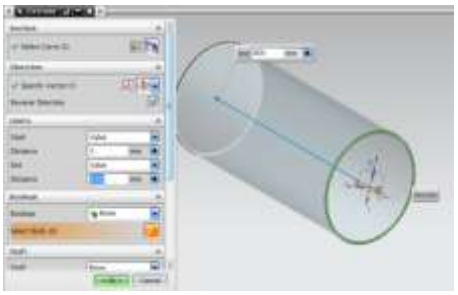


Fig. sketch and extrude of shield

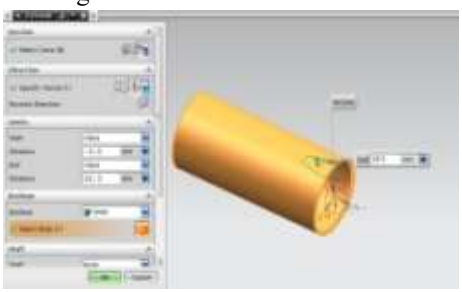


Fig. sketch and extrude of slots around shield

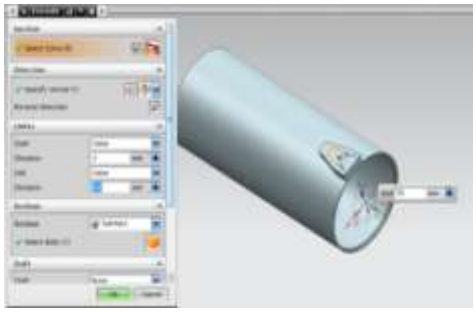


Fig. sketch and extrude of slots around shield

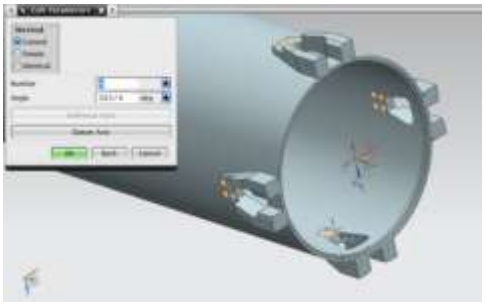


Fig. circular array of slots around shield

IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017

ISSN: 2320-1363

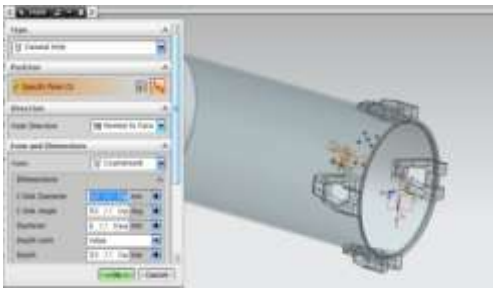


Fig. counter sunk holes

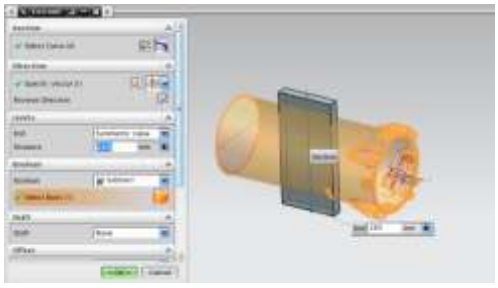


Fig. sketch and extrude

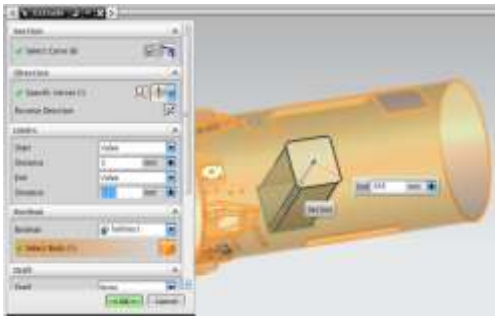


Fig. sketch and extrude

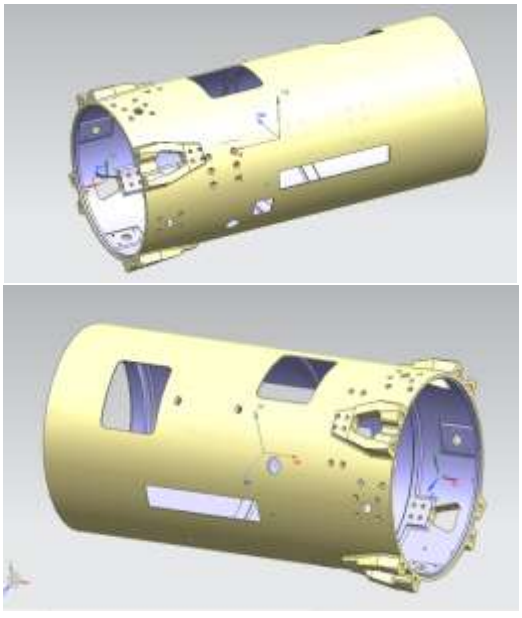


Fig. 3Dmodels of missile shield

Set_up_1 tool path generation

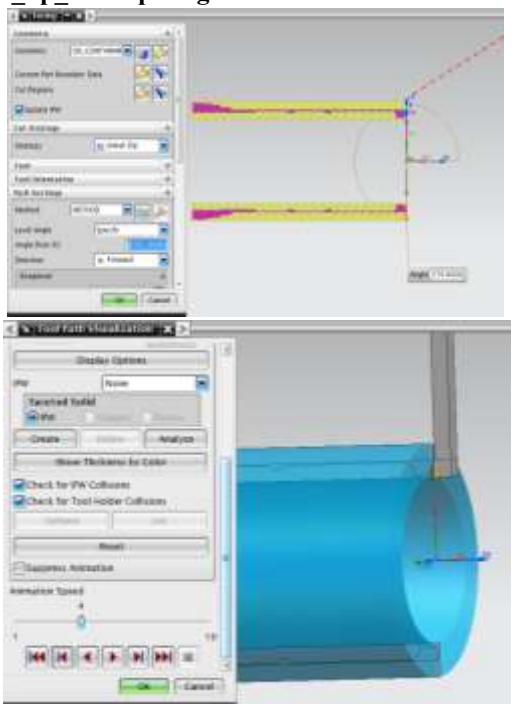


Fig. FACING operation on missile shield

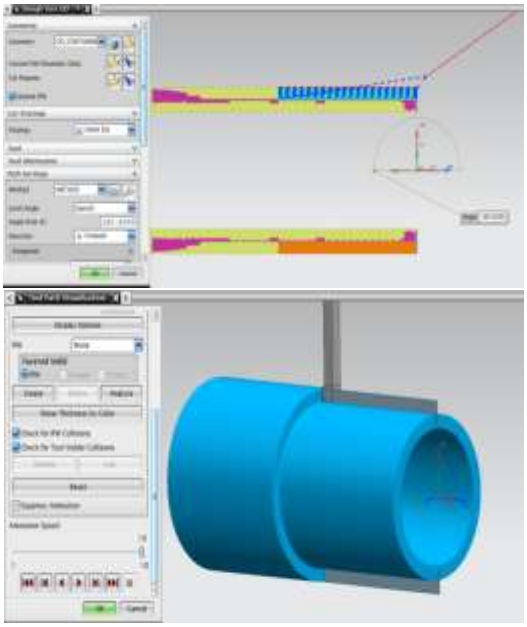


Fig. OD_Rough operation on missile shield

COMPUTER AIDED MANUFACTURING

IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017

ISSN: 2320-1363

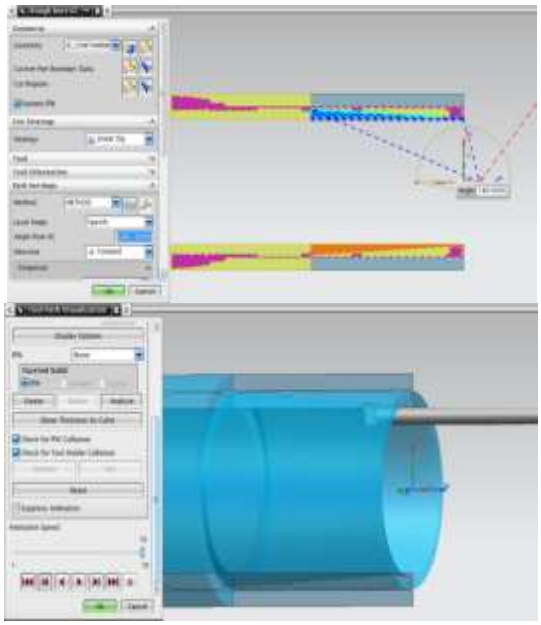


Fig. ID_Rough operation on missile shield

Set_up_2

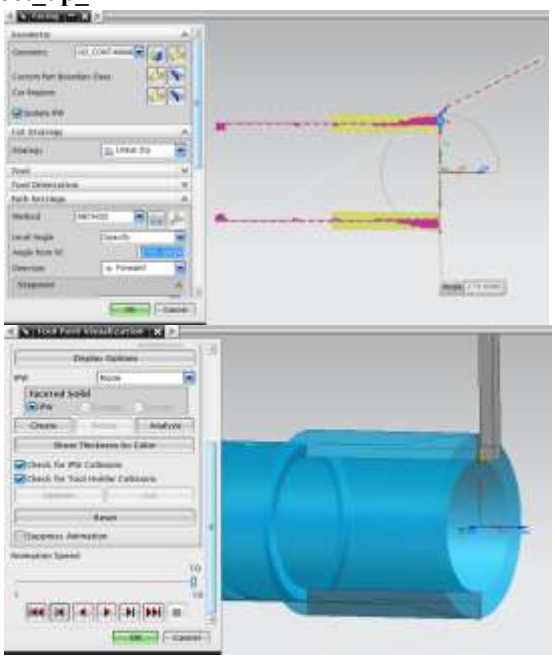


Fig. FACING operation on missile shield

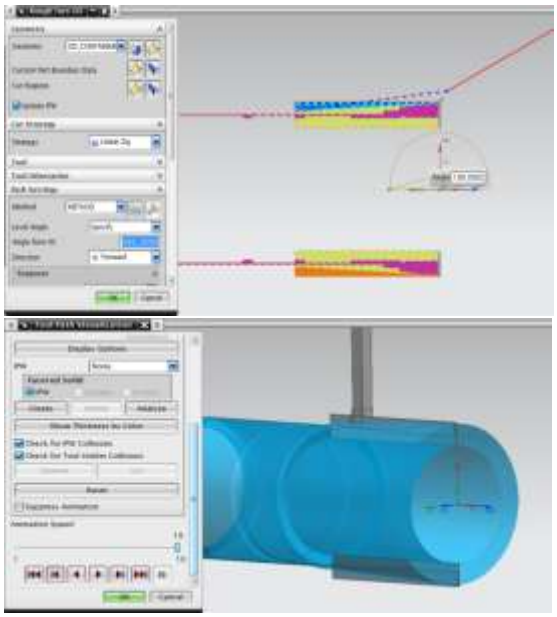


Fig. OD_Rough operation on missile shield

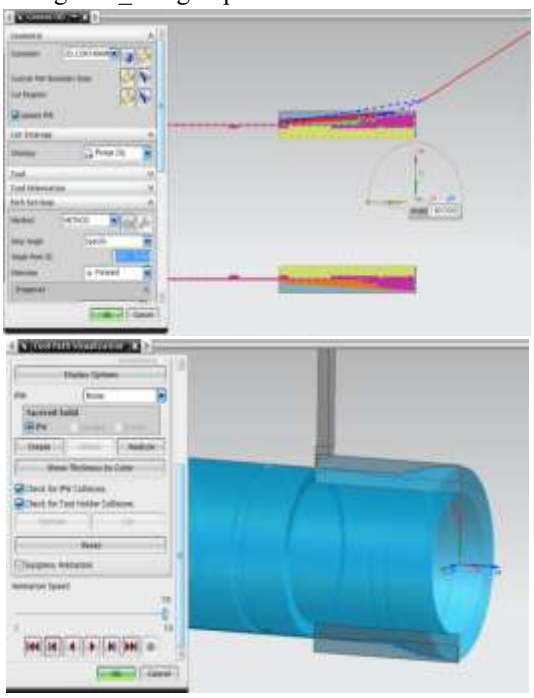
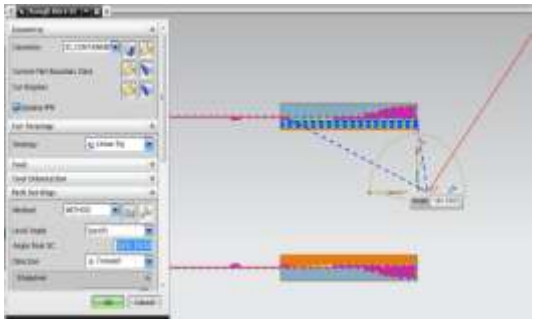


Fig. Groove operation on missile shield



IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017

ISSN: 2320-1363

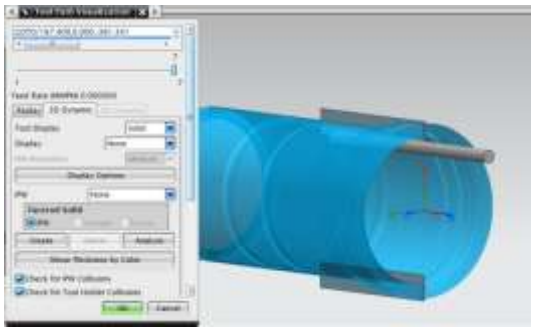


Fig. ID_Rough operation on missile shield

Milling operations

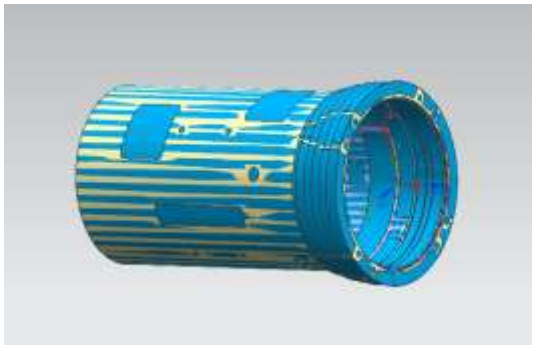


Fig. Raw material for milling

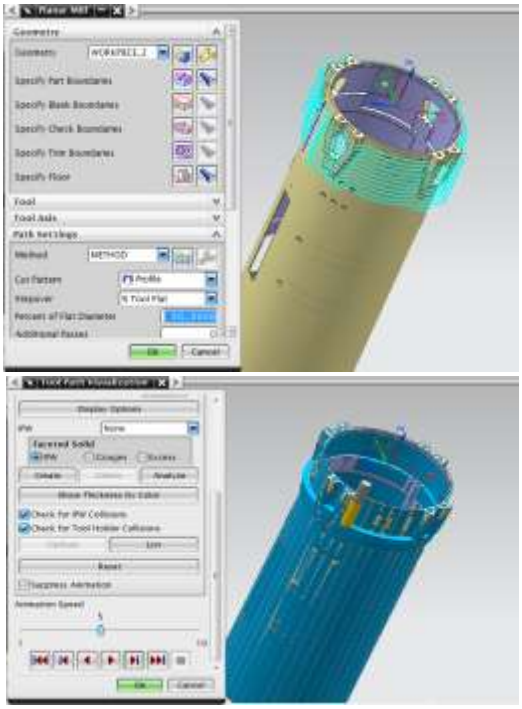


Fig. planar mill operations

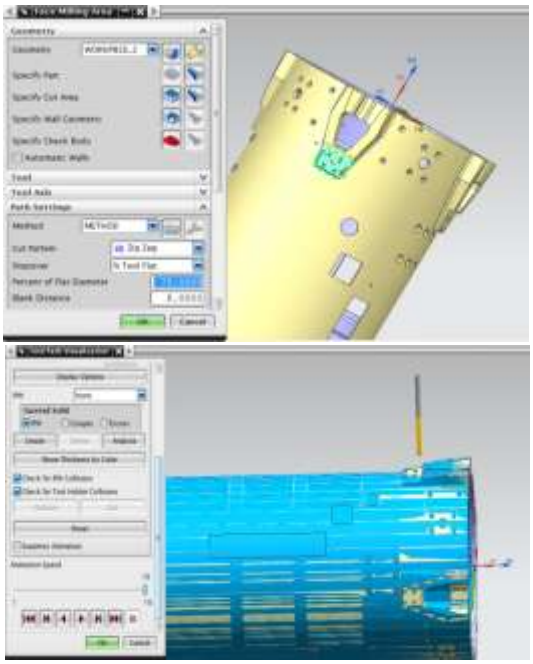


Fig. face mill area operations

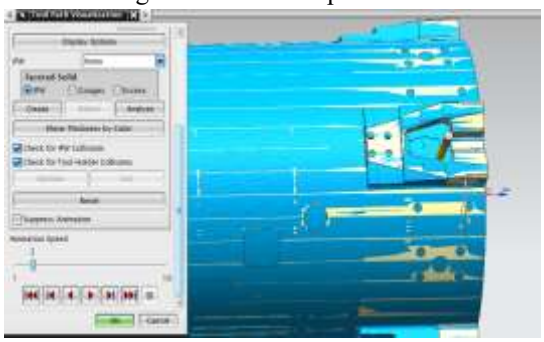


Fig. planar mill operations

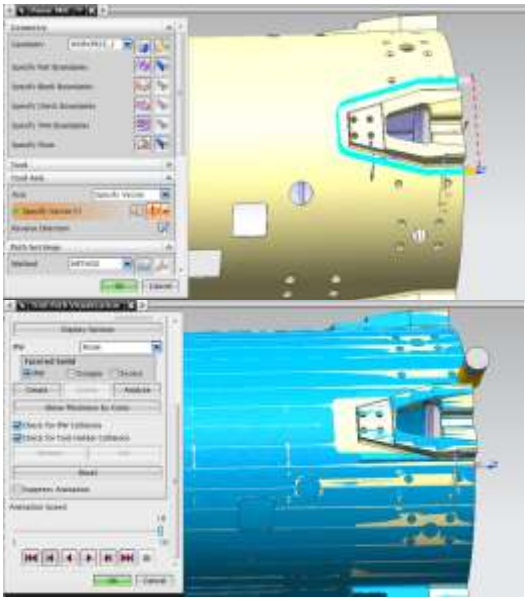


Fig. planar mill operations

IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017

ISSN: 2320-1363

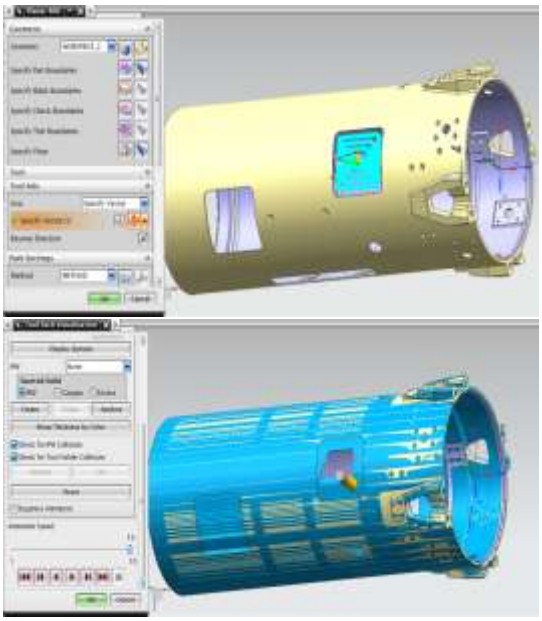


Fig. planar mill operations

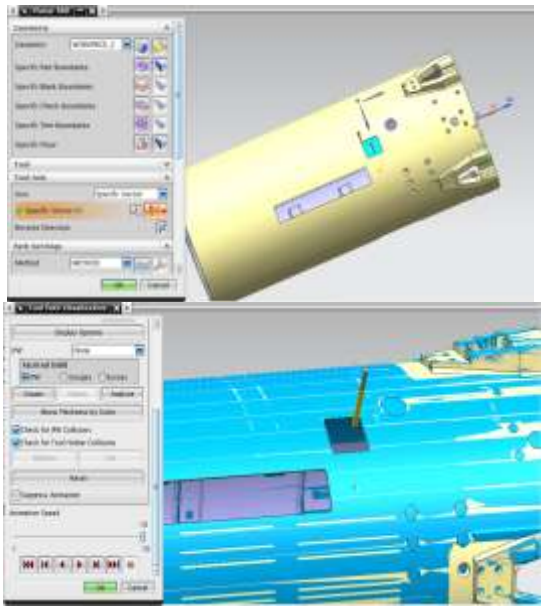


Fig. planar mill operations

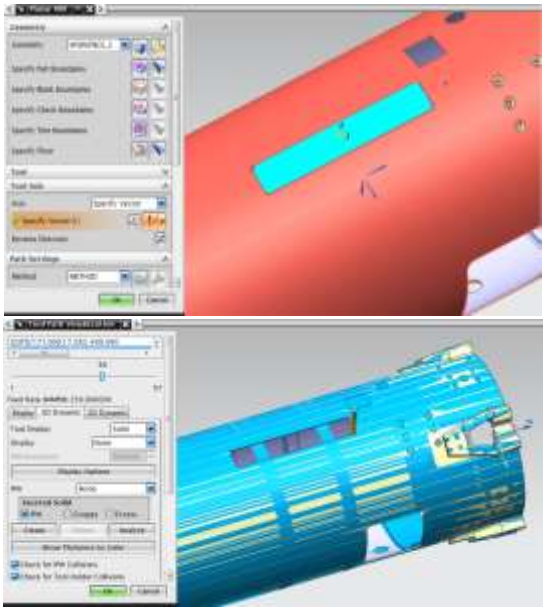


Fig. planar mill operations

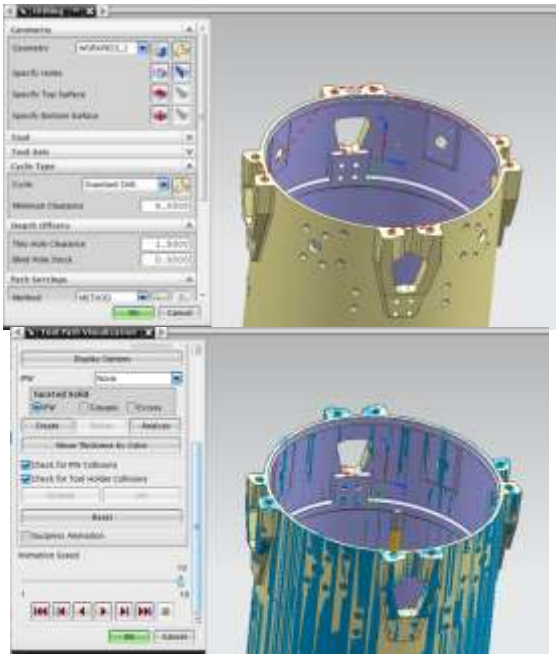


Fig. Drilling operations

IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017

ISSN: 2320-1363

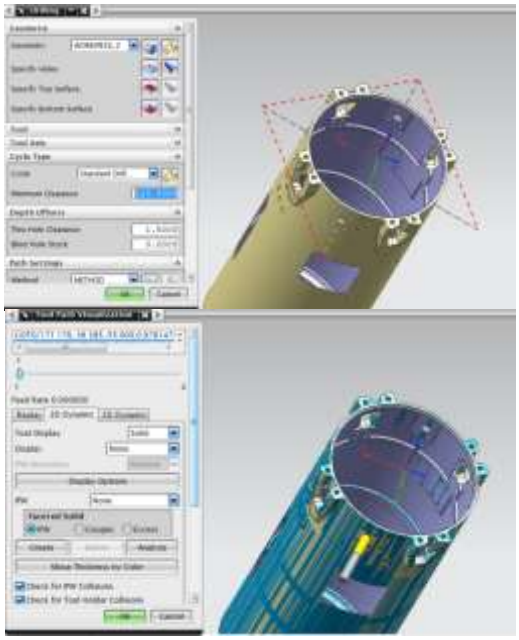


Fig. Drilling operations

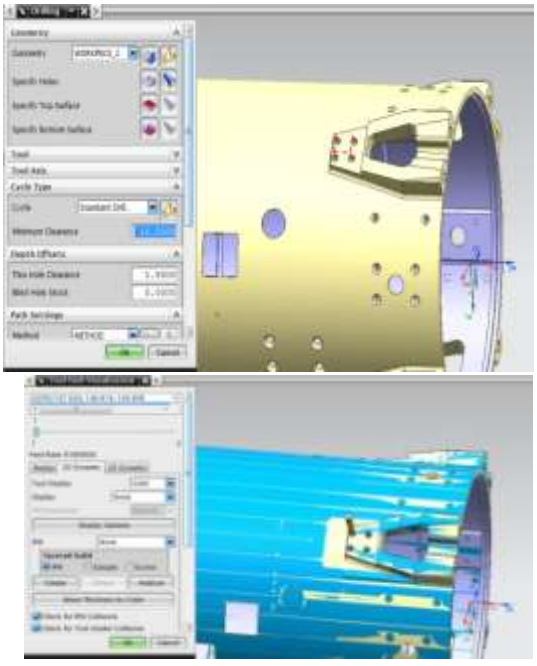


Fig. Drilling operations

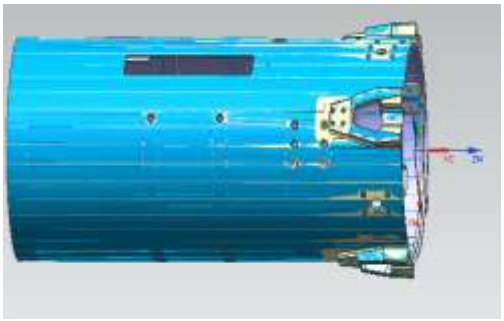


Fig. Final part after operations

DESIGNING FIXTURE FOR MISSILE SHIELD

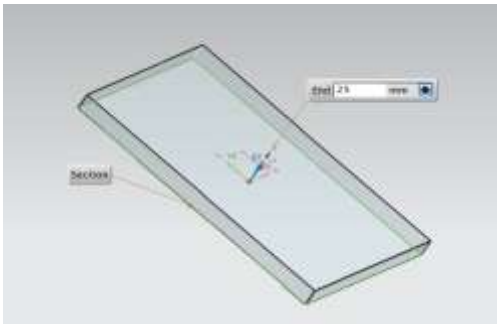


Fig. sketch and extrude of fixture part1

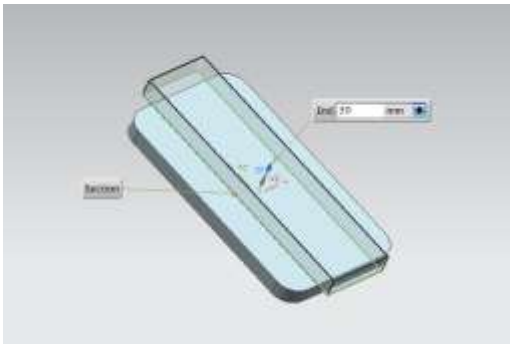
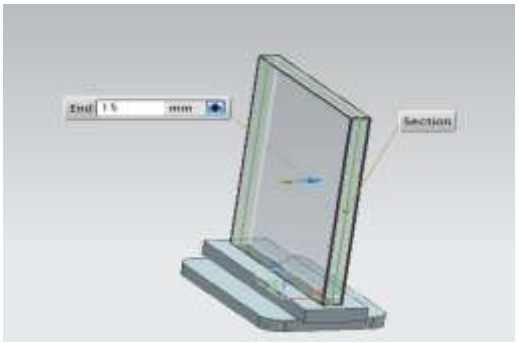


Fig. sketch and extrude of fixture part1



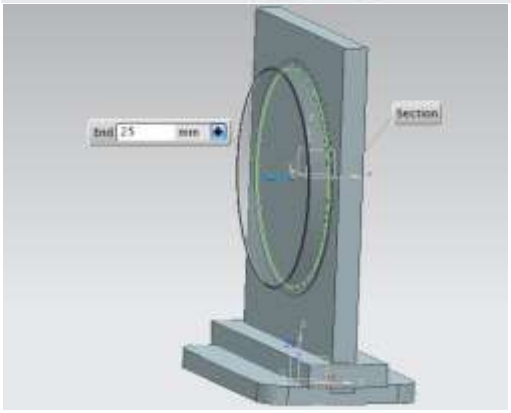


Fig. sketch and extrude of fixture part1

IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017 ISSN: 2320-1363

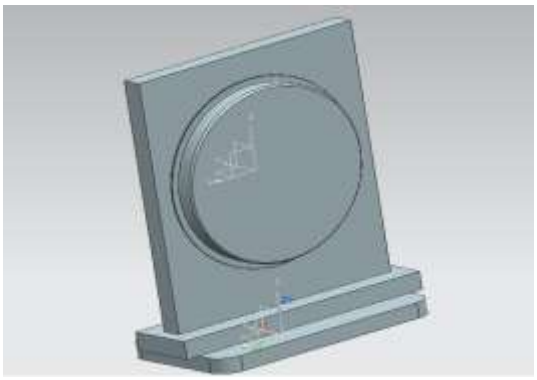


Fig. 3D model of fixture part1

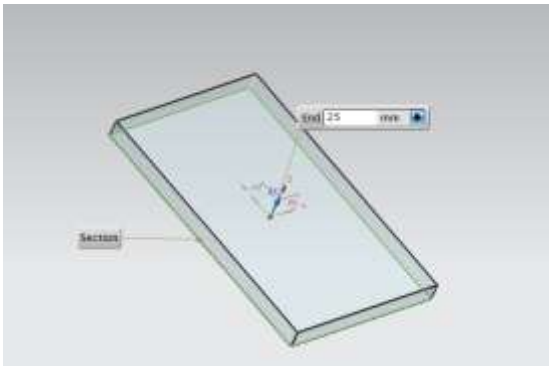


Fig. sketch and extrude of fixture part2

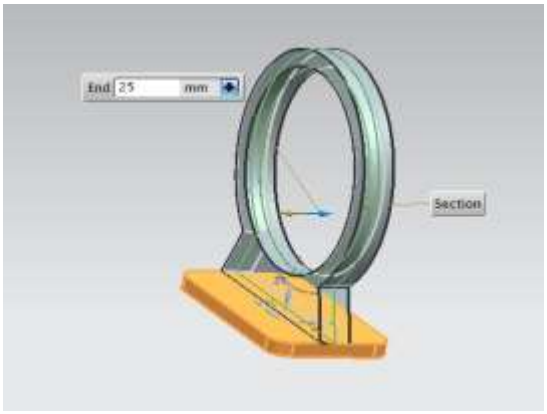


Fig. sketch and extrude of fixture part2

Fig. sketch and extrude of fixture part2

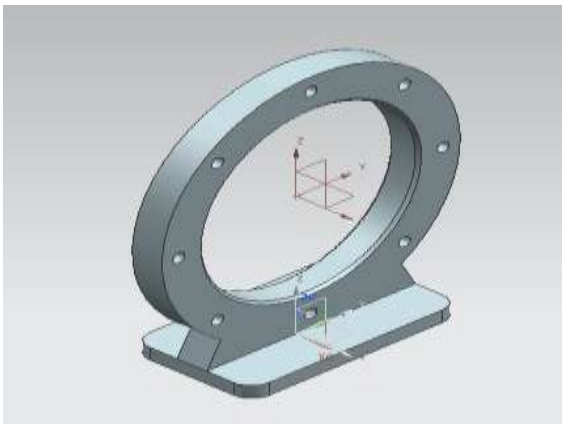


Fig. 3D model of fixture part2

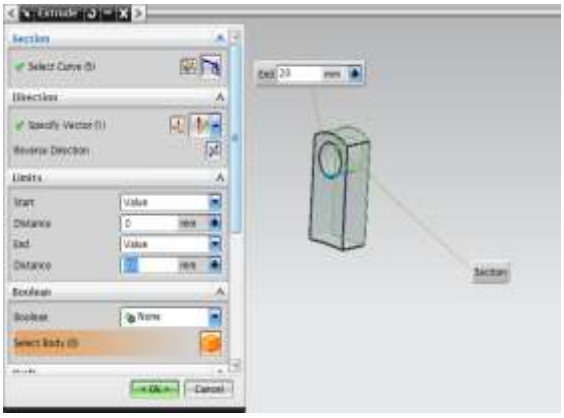


Fig. sketch and extrude of clamp stud

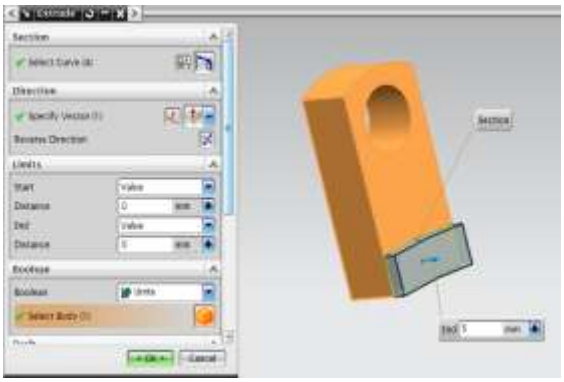


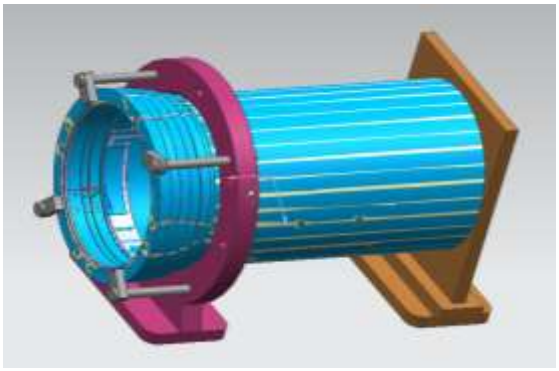
Fig. sketch and extrude of clamp stud

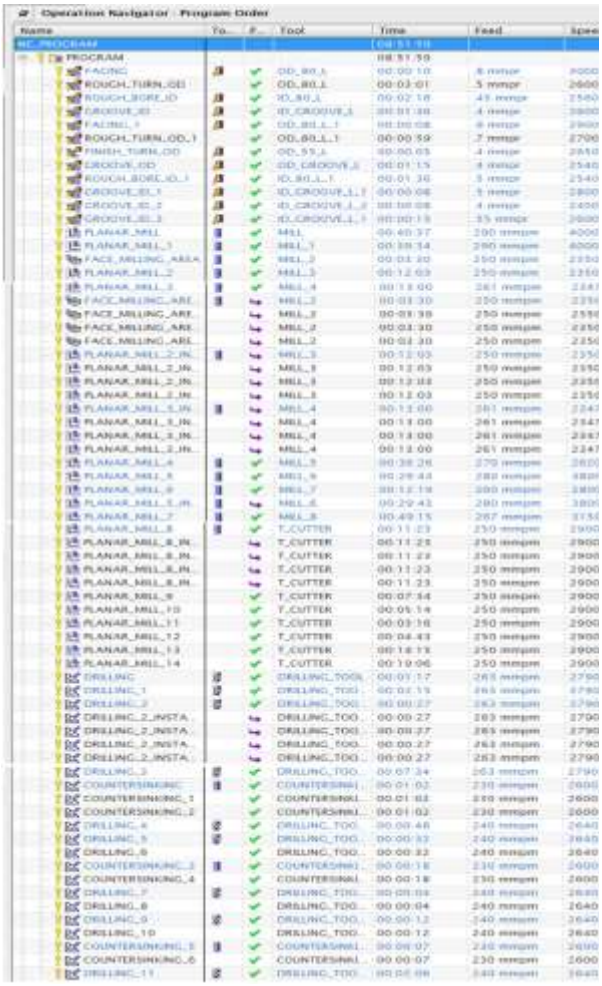
Fig. 3D model of clamp stud

Fixture assembly

IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017 ISSN: 2320-1363

Assembly of fixture after completing turning operations





RESULTS

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.

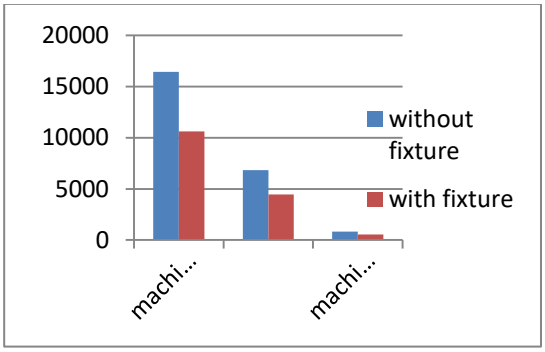
Tm= machining timeTm = (532/60) hrs= 8.9hrs

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

IJMTARC – VOLUME – V – ISSUE - 18 – JUNE , 2017 ISSN: 2320-1363

- 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.

BIBLIOGRAPHY

1. A book of tool design by Pollack, Publisher: Reston Pub. Co, 1976
2. ERROR BUDGETING AND THE DESIGN OF LARGE AEROSTRUCTURES, R. Odi, G. Burley, S. Naing, A. Williamson, J. Corbett School of Industrial and Manufacturing Science, Cranfield University, UK
3. A literature survey of fixturedesign automation, J. C. Trappey, C. R. Liu The International Journal of Advanced Manufacturing Technology, August 1990, Volume 5, Issue 3, pp 240-255
4. Design & Development of Fixture for CNC – Reviews, Practices & Future Directions, N. P. Maniar, D. P. VakhariaInternational Journal of Scientific & Engineering Research Volume 4, Issue 2, February-2013.
5. Mr. A.H. Nalbandh and PROF. C. C. Rajyaguru, “Fixture design optimization using genetic algorithm a review”, Journal of information, Knowledge and Research inMechanical Engineering.
6. A.D.Kachare, G.M.Dahane and Dipti D. Kachare, “First Operation Machining Fixture”, International Journal of Engineering and Innovative Technology (IJEIT), Volume 2, Issue 4, October 2012.
7. Amar Raj Singh Suriand A.P.S. Sethi, “Development of Gear Hobbing Fixture Design for Reduction in Machine Setting Time”, International Journal of Scientific and Research Publications, Volume 2, Issue 10, October 2012, ISSN 2250-3153.
8. Research, Industrial Systems (2002-05-20). "Manufacturing and Investment Around the World: An International Survey of Factors Affecting Growth and Performance".
9. P.Maheandera, Dr.K.P.Padmanaban, R.Rajasekar, R.Devaraja Vignesh, Dr.S.Navaneetha santhakumar, “Scatter Search Optimization for Multi Node Machining Fixture Layout”, The International Journal of Engineering and Science (IJES), Volume-3, Issue-01, Pages 30-37, 2014, ISSN (e): 2319 – 1813, www.theijes.com, The IJES Page 30