

# DEMETER PROJECT

## PRODUCTION OF ROVER PART BY MACHINING UNIT



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Erasmus+ Programme  
of the European Union

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## Unit 4: Production of rover parts by machining

In this unit, students will make parts of the rover by machining. To achieve this, they will have to use the tools and machines available in the workshop. The 1st step is to establish the manufacturing process (machining method). After the teacher has validated the process proposed by the students, the latter will be able to establish the programs for each stage of the parts manufacturing.

After validation of the programs by the teacher, the next step is to manufacture the parts. This step is very important, and requires a lot of vigilance, because during the manufacture of the 1st part, we can encounter various problems. After manufacturing the part, the last step is to check the part. If the part is flawed, it will be necessary to make corrections on the machine or to review the manufacturing process.

Teachers/Subjects:

Machining methods, NC programming, Machining shop, and Metrology

## Material / resources

- Computer with CAM software (computer-assisted manufacturing).
- Machining shop (turning machine, milling machine, air tapping unit, etc...)
- Metrology room

Objectives and skills:

The students must manufacture the machined parts of the rover. This work will be divided into 4 stages (establishing the process, carrying out the programs, manufacturing the part, and checking it) and will mobilize the following skills:

Read drawings, establish a machining process, choose tools and cutting parameters, develop a program with CAM software, install the production environment, implement a means of production, establish a control procedure, control a part.

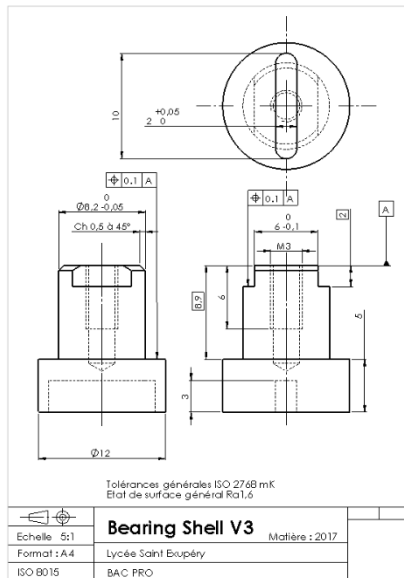
### Lesson 1: Establish a manufacturing process for a machined part (planning office).

Time: 4 hours

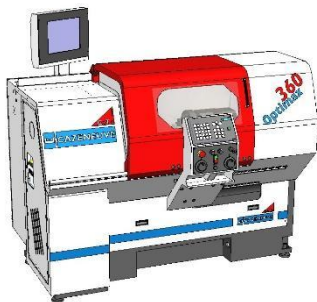
This activity is aimed at students in their final year of vocational training in machining (age of students: 17-18 years old). It requires knowledge of machining processes.

This part consists in establishing a machining process, the student must first determine which machines will be used to manufacture the part. For each machine, they must identify the machined surfaces on the part. The last step of this part consists in drafting the machining range as well as the corresponding phase contracts.

a) Using the definition drawing of the "Bearing shell" part and the machine park of our workshop

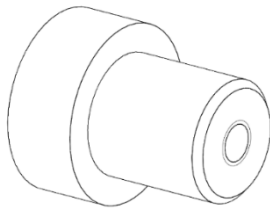


The students must determine the machines that will generate the shapes of the part: turning machine, milling machine, air tapping unit, etc...

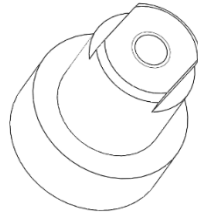


b) For each of the machines used, the students must group the surfaces machined on the part by phase.

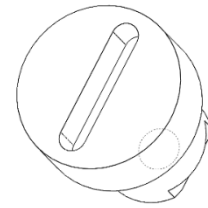
Exterior contouring  
and drilling



Shoulders

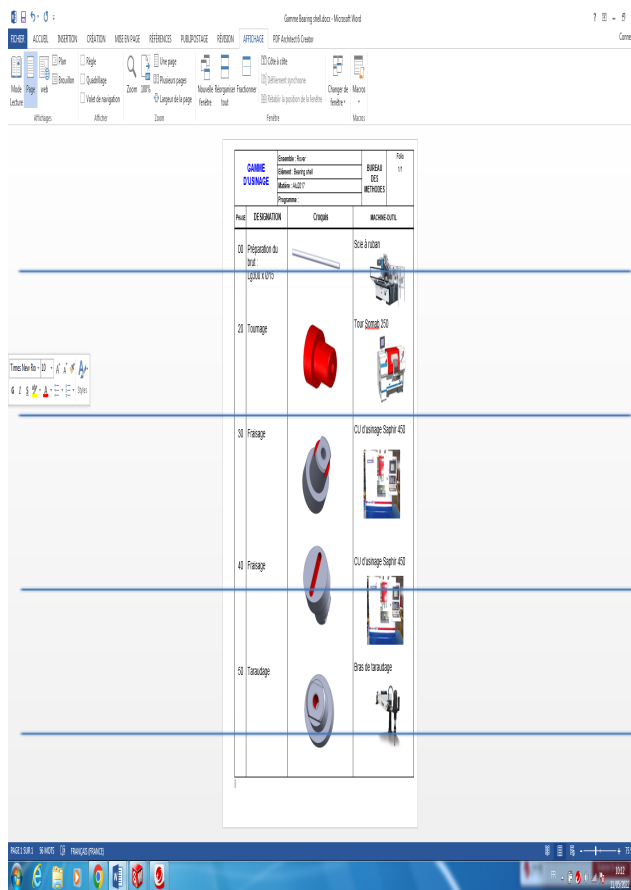



Slot



- c) Write the manufacturing documents (machining schedule and phase contract) that will be used by the operator who will machine the part. The work plan is a summary of the manufacture of the part. The phase contract precisely details all the operations carried out on the same machine.

It is a necessary document for the technician who will carry out the program and the operator who will machine the part.



CONTRAT DE PHASE 00	Devisé :	Nom :	Prénom :	
Ensemble : CHAR MEI	Programme : %c3b666			
Pièce : <b>Bearing shell ph10</b>	Dossier :		Folio : 1 / 1	
Matière :	Doc Usinage : Bearing shell ph10			
Série : Nb Pièces	Etabli par : TEST		le : 08/02/2021	
Machine Outil : SOMAB - SOMAB 250 2 axes				

Tolérances générales +/- 0.05

BRUT STANDARD				Cylindrique		Mise en Position :			Porte-Pièce :		
LX	LY	Lg. Scie	Ø	MIP					PPL		
LbrutX	LbrutY	LbrutZ	DbrutX								
Désignation des opérations				Outils de coupe		n° Pot	n tr/min	Vc	f	Vt	Ap
						T		m/min	mm/tr	mm/min	
1	Ebauche paraxiale			Ø8 Rhombique Gauche Tournage extérieur r 0.8 IC 12.7		T 1.2	0	220	0.15	5	0.50
2	Primitive de perçage			Foret à fond plat D3 L35 S23		T 6.1	0	14	0.01	30	-
3	Contournage			V35 Rhombique Gauche Tournage extérieur r 0.4 IC 12.7		T 2.2	0	220	0.05	3	0.50
4	Tronçonnage			L-Gorge rectangulaire extérieure Gauche L3 R10 R10		T 3.2	0	400	0.01	10	-





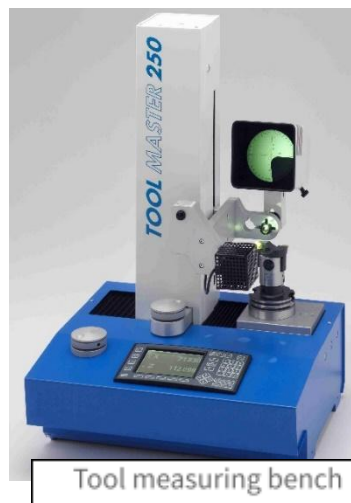
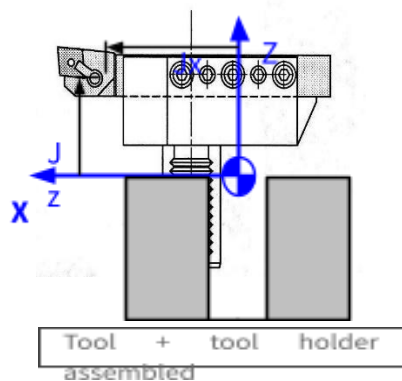
### Lesson 3: Produce a part on a CNC lathe

[Click on a blue link below to see the bearing shell CAM simulation https://youtu.be/bpp0xA7Wurl](https://youtu.be/bpp0xA7Wurl)

This activity is aimed at students in their middle year of vocational training in machining (age of students: 16-17 years old). It requires knowledge of pilotage machining.

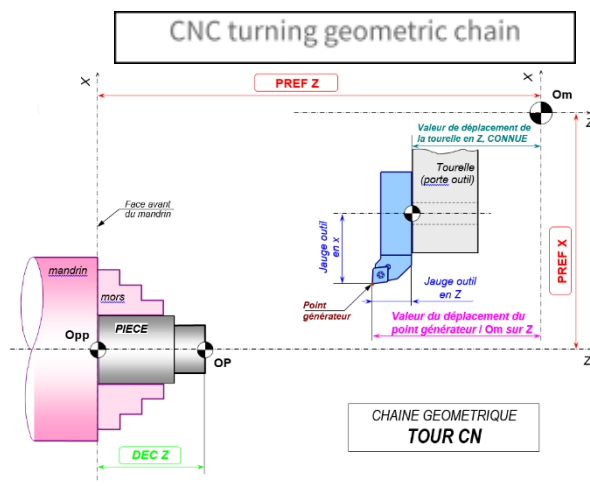
This part consists of implementing a mass production machine, then ensuring the production of the parts.

- The student will have to select the tools in the workshop store that will allow the machining operations to be carried out
- He will then have to measure the tools on a presetting bench and enter the tool dimensions into the machine.



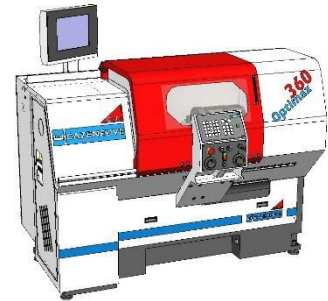
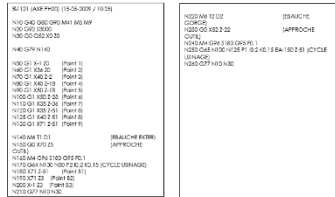
JAUGES OUTILS									
D	1	X+	100.635	Z+	30.953	R+	0.3	C1	
D	2	X+	195.457	Z+	24.982	R+	0.2	C1	
D	3	X+	158.756	Z+	29.003	R+	0.3	C1	
D	4	X+	148.95	Z+	32.025	R+	1.2	C1	
D	5	X+	0.	Z+	0.	R+	0.	C0	
D	6	X+	0.	Z+	0.	R+	0.	C0	
D	7	X+	0.	Z+	0.	R+	0.	C0	

- Set the position of the part in the machine.

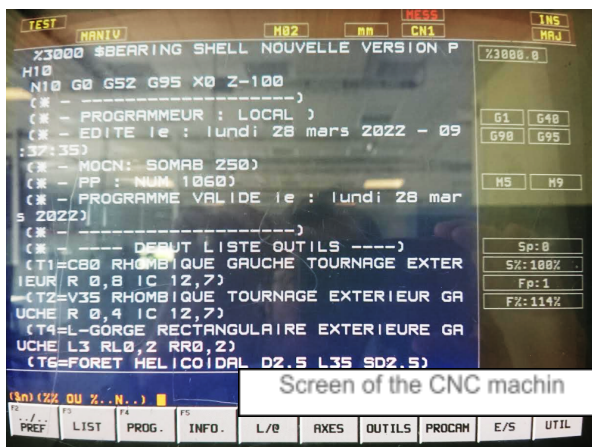


Screen of the CNC machine									
ECHELLE: E 1000/1000									
		PREF	DEC1		DEC3				
X	-	600.685+	100.	+	0.				
Z	-	211.364+	230.	+	0.				
C	+	0.	45.	+	0.				

- ## Program transfer

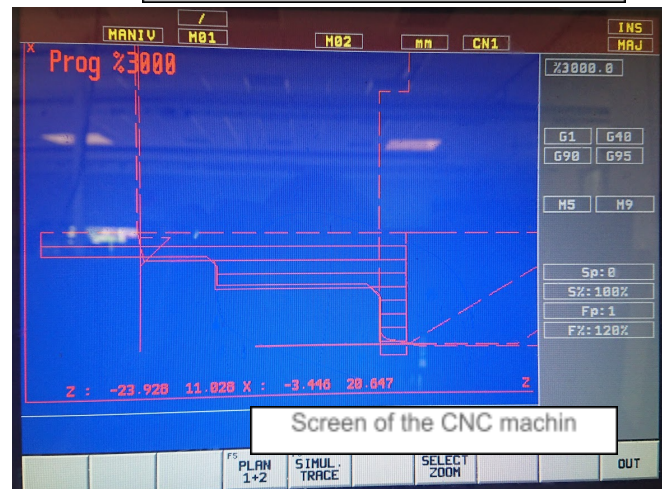


- |                     |
|---------------------|
| Test program syntax |
|---------------------|



Screen of the CNC machine

Visualization of tool trajectories
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Screen of the CNC machine

During this stage the operator must be vigilant, during the use of the 1st part, in case of incident, he must be able to intervene at any time in order to stop the machine.

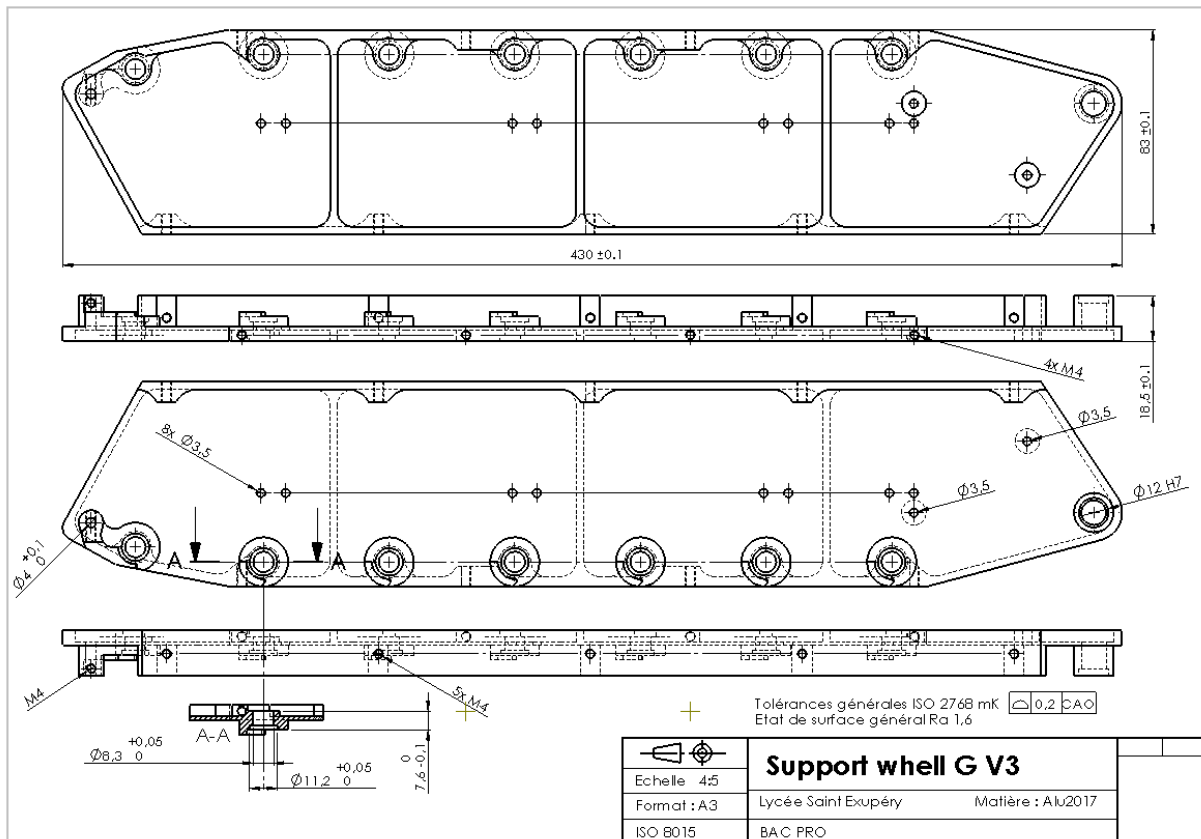


## Lesson 4:

Check a part with manual means (caliper, micrometer, height gauge, indicator, etc...)

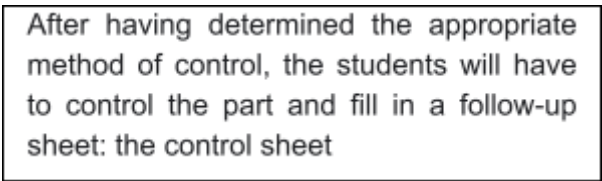
Time: 2 hours


This activity is aimed at students in their middle year of vocational training in machining (age of students: 16-17 years old). It requires knowledge of part measure.



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In



<b>- FICHE DE CONTROLE -</b>						 Académie de la Haute-Normandie	
Etablie par : _____ Date : _____							
Pièce : _____ Phase : _____ Programme : _____							
VERIFICATION DIMENSIONNELLE							
Cote nominale	IT	Cote maxi	Cote mini	Cote moyenne	Instruments de mesure	Cote lue	Décision
VERIFICATION GEOMETRIQUE							
Type de tolérance	Intervalle de tolérance	Cote lue	Décision				



## Results and outputs

The students were very involved in this project. Establishing the entire machining process and implementing it was a challenge. Usually, students only work on one of the 4 stages of the manufacturing process. Even though this required support, this project allowed them to gain confidence, particularly for the development part of the process. The rover was assembled by students from another curriculum, which was a first (Automation and Industrial Maintenance). The work, which was carried out in collaboration with Automation and Industrial Maintenance students allowed not only an exchange of skills, but made the students' training even more meaningful.