

Academic Integrity:

Copying anything from fellow students and representing it as your own and/or communicating with others about the test-out is a breach of academic integrity and will not be tolerated. Please review the University's policy on academic integrity if you have any questions: <http://www.president.umd.edu/policies/iii100a.html>

This test-out is valid for the Spring 2023 term only. Passing this test-out does not exempt you from future test-out, if you retake the class.

Please note the test-out is not a pass or fail assignment. The score you receive on your test-out is the score that will be entered as your final lab grade for the lab section.

Test-out Task:

Download the ENAE200-Testout.zip from <https://umd.box.com/v/ENAE200-Class>

Included in the Test-out zip archive is this document, one Leonardo Aerial Screw assembly manual, and two drawings: one of the Mast and one of the Mast Collar.

Your task is to recreate the Leonardo Aerial Screw kit in one of the following CAD software packages: **Autodesk Inventor, Solidworks, or Siemens NX**. This kit is made by Pathfinders Design and Technology.

Please refer to page 2 of the Leonardo Aerial Screw assembly manual for part names. A list of parts with partial dimensions is provided. Unless specified, only the outer diameter is given. *Make educated guesses on missing feature(s) and/or feature(s) placement on each part, if any.*



Part Name	Quantity	Dimensions	Ref. PART#
Base	1	160 mm x 190 mm x 7 mm Main shaft diameter: 6.5 mm Platform support dowel pin diameter: ____ mm	
Platform supports	2	15 mm x 19 mm x 115 mm	7
Platform supports - crankshaft	2	15 mm x 19 mm x 115 mm Crankshaft diameter: ____ mm	
Platform support dowel pins*	8	Diameter: ____ mm, Length: 15 mm	21
Small gears	2	Diameter: 48 mm, Thickness: 7 mm	3
Small gear dowel pins*	8	Diameter: ____ mm, Length: 40 mm Main shaft diameter: 6.5 mm	2
Large gear	1	Diameter 88 mm, Thickness 7 mm	6
Large gear dowel pins*	16	Diameter: ____ mm, Length: 25 mm Crankshaft diameter: 5 mm	5
Crankshaft	1	Diameter: 5 mm, Length: 170 mm	9
Crankshaft spacer	1	Diameter: 18 mm, Height: 20 mm	15
Main shaft	1	Diameter: 6.5 mm, Length: 175 mm	10
Main shaft drive holder	1	Diameter: 16 mm, Height: 7 mm Main shaft diameter: 6.5 mm	14
Handle	1	10 mm x 10 mm x 35 mm Handle dowel pin diameter: ____ mm	18
Handle dowel pin	1	Length: 30 mm, Diameter: ____ mm	18
Plastic Spacer	1	Diameter: 7 mm, Height: 4.5 mm Crankshaft diameter: 5 mm	19
Lower platform	1	Diameter: 155 mm, Thickness: 7 mm Main shaft diameter: 6.5 mm Platform support dowel pin diameter: ____ mm	

*Note: Select an appropriate dowel pin diameter from the dowel pin diameter size table.

Part Name	Quantity	Dimensions	Ref PART#
Ring	1	Outer diameter: 155 mm Inner diameter: 108 mm Thickness: 5 mm	
Inner Platform	1	Diameter: 96 mm, Thickness: 7 mm Main shaft diameter: 6.5 mm	
Pushing drum	1	Diameter: 30 mm, Thickness: 29 mm Main shaft diameter: 6.5 mm	12
Pushing drum dowel pins*	4	Diameter: ____ mm, Length: 35 mm	13
Mast***	1	Diameter: 15 mm, Length: 181 mm Main shaft diameter: 6.5 mm Canopy support dowel pin diameter: ____ mm	20
Mast collar	1	Diameter: 46 mm, Thickness: 5 mm Mast diameter: 15 mm	16
Mast support***	3	Thickness: 4.5 mm	17
Canopy rim**	1	Width: 10 mm, Thickness: 3 mm	4
Canopy**	1	Thickness: 0.5 mm The sweeping width of the canopy is constrained by the length of the canopy support dowel pins.	
Canopy support dowel pins*		Diameter: ____ mm	11
	1	Length: 85 mm	
	2	Length: 105 mm	
	1	Length: 115 mm	
	1	Length: 120 mm	
	2	Length: 130 mm	
Screw eye	4	Outer diameter: 10 mm, Height: 20 mm, 2 mm diameter rod	8

*Note: Select an appropriate dowel pin diameter from the dowel pin diameter size table.

**Note: Both canopy and canopy rims can be modeled together as one part.

***Note: A 3-View Drawing is provided for this part.

Dowel Pin Diameter Size Table

4.0 mm
4.5 mm
5.0 mm
5.5 mm
6.0 mm
6.5 mm
7.0 mm

Select an appropriate size dowel diameter for the application/part.

For example, the main crankshaft is 6.5 mm, make sure all the parts the main crankshaft passes through has a 6.5 mm diameter hole. One part that is missing this dimension is the pushing drum. Since the main crankshaft passes through this part, it needs a 6.5 mm hole throughout.

Working units: mm(millimeter)

Grading Rubric:

Parts	36 points	All parts modeled with required features
	4 points	Canopy and canopy rim
	<u>40 points</u>	
Assembly	30 points	Only ONE fixed constraint is permitted. You may not use Bond or any Joint/Coupler constraints.
	10 points	Rotation degree of freedom is permitted on parts connected to the main shaft and the crankshaft. All dowel pins can have rotational degree of freedom. Everything else must have no degree of freedom.
	10 points	The entire assembly must be interference free. Interferences caused by the canopy and canopy rim are excluded.
	<u>50 points</u>	
<p>You are not required to make the crankshaft spin the main shaft. However, the dowel pins in the small and large gears should NOT interfere with each other in your assembly for interference analysis. Arrange them accordingly.</p>		
Drawing	Arrowheads, text, and dimension values must be large and legible!	
	Autodesk Inventor Drawing type: ANSI(mm).idw	
	Solidworks/Siemens Drawing type: NX: A0(ISO)	
	5 points	Create a dimensioned, 3-view orthographic projected drawing, of the Mast support, Part# 17. All views must be projected and linked to the front view. Include the front view, top view, right view.
	5 points	Create a dimensioned, 3-view orthographic projected drawing, of the Mast collar, Part# 16. All views must be projected and linked to the front view. Include the front view, top view, right view.
	<u>10 points</u>	
Bonus	5 points	Model all 4 strings connecting the canopy dowel pins to the screw eyes. You may not use joint/coupler constraints. Strings may not cause interference with other parts. Bonus points is all or nothing and cannot exceed a maximum score of 100 points.

YouTube videos:



[Building Leonardo Da Vinci's flying screw | Do you think it can fly? - YouTube](#)
[Crimson Spin: A New Take on da Vinci's "Aerial Screw" - YouTube](#)

Test-out Submission – For all students!

Do all your work in one folder. Submit the entire work folder by compressing it with Zip or 7zip. Examine the file size of your zip/7zip archive, if the zip/7zip archive is over 25 MB, your submission will be rejected with no error messages. Your submission should be under 20 MB in size.

Name the part, assembly, and drawing files according to the list. **DO NOT rename part files after they have been assembled together! Any missing or renamed files causing errors in your assembly or drawing files will be penalized. Double check your submission before you submit.**

Follow the file naming convention for your submission: **ENAE200-LastName-UID.zip**

E-mail your 7z/Zip archive to:

ENA200.zaf8c4ymsfdz3xro@u.box.com

Make sure you receive a successful upload confirmation from Box.com