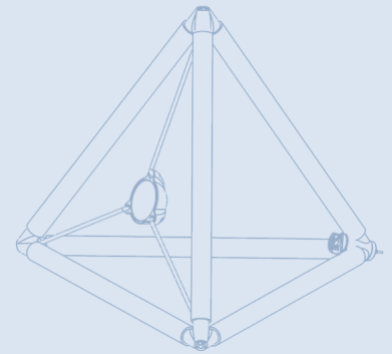





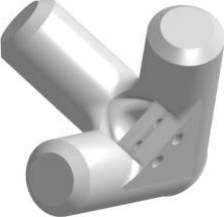
SMART SERVO GUIDES: BALL LAUNCHER

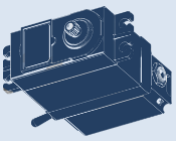
The Tetrahedron (Tennis) Ball Launcher, is a good project to start with before designing adapted physical education equipment that will be used by people with disabilities. This guide will cover the basics of assembly and recommend next steps for thorough testing and improved design considerations.



PART 1a: Preparing - 3D Printed Materials

The following parts will need to be printed on a 3D Printer.

Cup		Approx. 32 g of Print Material Each	Print 1 For Each Project	Link to STL File	Link to CAD File
Corner		Approx. 32 g of Print Material Each	Print 3 For Each Project	Link to STL File	Link to CAD File
Plug		Approx. 1 g of Print Material Each	Print 6 For Each Project	Link to STL File	Link to CAD File
4 th Corner		Approx. 32 g of Print Material Each	Print 1 For Each Project	Link to STL File	Link to CAD File
		< \$3.50			



SMART SERVO GUIDES: BALL LAUNCHER






PART 1b: Preparing - Ordered Material

The following will need to be purchased for each project. (There will likely be spare material.)

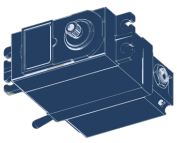
Latex Tubing		Cut into 3, 22" lengths	Amazon Order Link	\$17 (\$3.56)
1" PVC Pipes		Cut 2, 10' pipes into 6, 40" lengths	Lowes Order Link	\$17
Smart Servo		Add double Arm Servo Horn	Smart Servo Order Link	\$75
Nylon String		Will need approximately 4"	Number-1 Braided Nylon Mason Line	\$9 (\$0.01)
Mounting Screw		Will need 2	Nylon Plastic Socket Head Screw M5 x 0.8 mm Thread, 20 mm Long	\$18 (\$0.36)

PART 1c: Preparing – Recommended Tools*

It is recommended to have the following tools available

Scissors		For cutting and trimming string and latex tubing.	Amazon Order Link	\$3
Pipe Cutter		For safely cutting PVC pipes	Amazon Order Link	\$10
M5 Tap		Used to create M5 x 0.8 threads in 3D printed parts.	Amazon Order Link	\$9
M5 Tap Handle		Provides leverages for M5 Tap	Amazon Order Link	\$9
4mm Allen Wrench		Provides leverage when inserting M5 mounting screws.	McMaster Order Link	\$2

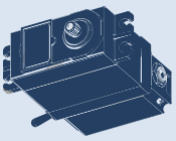
* These tools are part of the Smart Servo Marker Space



SMART SERVO GUIDES: BALL LAUNCHER

PART 2: Assembling the TBL

1. Assemble components. 	2. Thread tube through corner piece. 	3. Fold back 1/4" of tubing. 
4. Insert plug. 	5. Fold back tubing. 	6. Pull tight through corner. 
7. Insert same tubing through cop. 	8. Insert plug. 	9. Fold Back and pull tight. 
10. Repeat for all three corners. 	11. Add PVC pipe to corner. 	12. Complete side as shown. 
13. Add two more PVC pipes as shown. 	14. Pull together with third corner. 	15. Add PVC pipes and forth corner. 

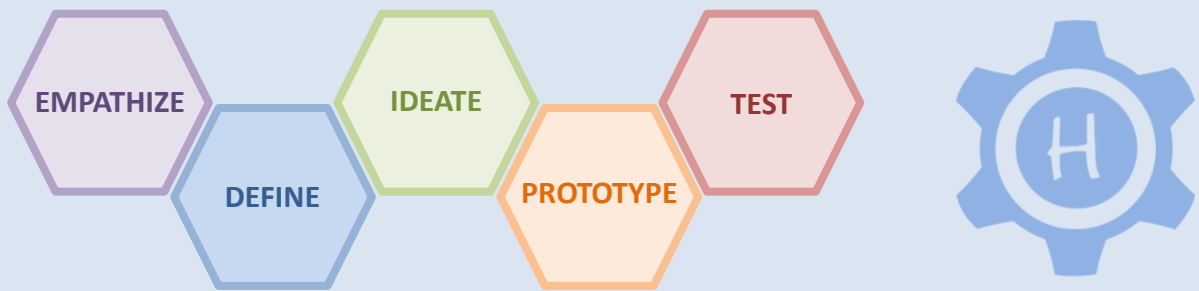


SMART SERVO GUIDES: BALL LAUNCHER

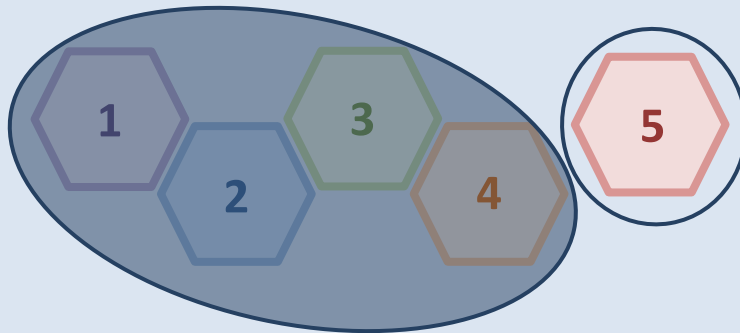
UPDATES ARE COMING!
You can support this work by purchasing Smart Servos.

PART 3: Preparing and attaching the Smart Servo to the TBL

PART 4a: Guide to leveraging the Human Centered Design process to provide Universal access and engagement with the TBL.

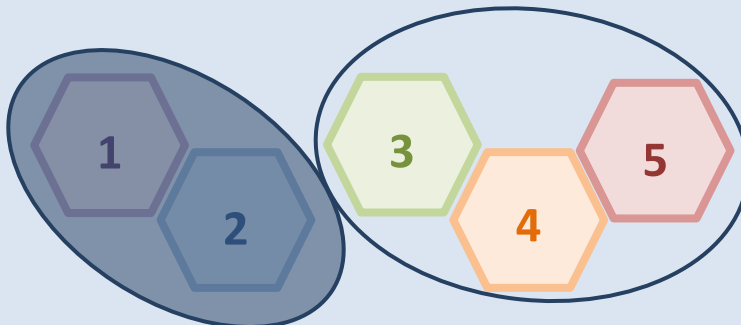


PART 4b: Guide to applying scientific inquiry to rigorously test and evaluate the base TBL apparatus.



- Build from NGSS MS Science Standards on Energy
- Learn about Sensors
- Learn about Servos
- Some exposure to Python
- **Not reliant on Digital Design and Precision Manufacturing**

PART 4c: Guide to using skills to improve the safety and performance of the TBL.



- Application of Physical Computing, Digital Design & Precision Manufacturing skills.
- Stress on divergent/lateral thinking, reiteration, and continuous testing.