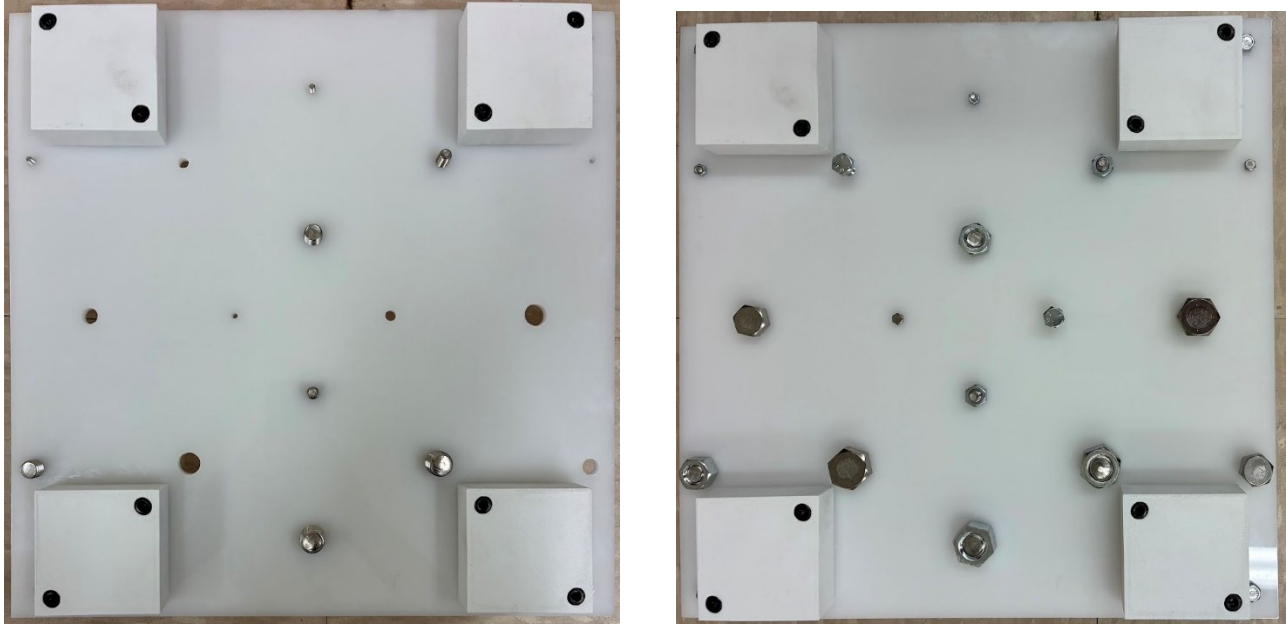


NIST Task Board #5

This document conveys fabrication instructions of a NIST task board designed for [benchmarking and performance measurement of robotic systems](#) (testing procedures described in separate document TBD) in various assembly operations dealing with threading fasteners. 16 threading tasks are presented. 8 Bolts and 8 nuts threaded onto the board at 4 different sizes (4mm, 8mm, 12mm, 16mm). Each size has one unobstructed location and another that is close to an obstacle making threading tasks more difficult. 16 total tasks of threading bolts and nuts are

Place Pictures of board disassembled and assembled (respectively) here.



(a) Disassembled

(b) Assembled

Figure 1. Identification of key components as labeled in the subsequent parts list and their locations on the task board.

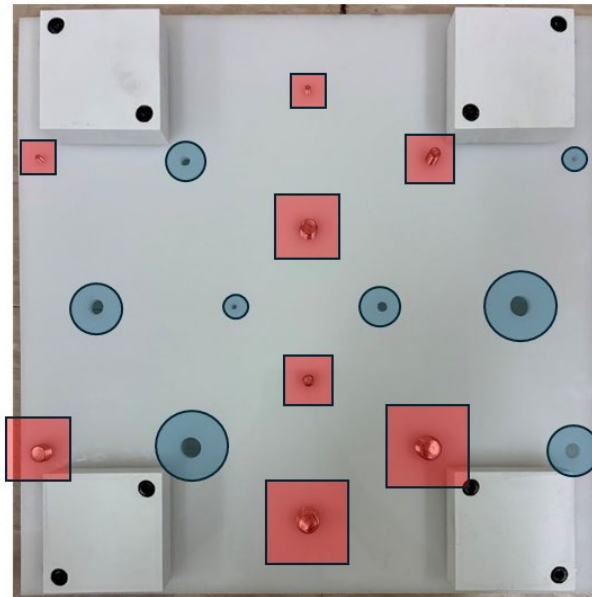
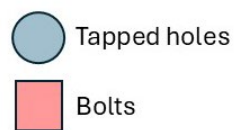


Figure 2. Hole pattern for disassembled board showing where bolts and holes are located

Disclaimer

Certain commercial equipment, instruments, or materials are identified in this paper to foster understanding. Such identification does not imply recommendation or endorsement by the National Institute of Standards and

Technology, nor does it imply that the materials or equipment identified are necessarily the best available for the purpose.

Purchasing:

- 1) Majority of parts specified based on availability through MISUMI, an international distributor of components. Other vendors may supply the same parts.
- 2) The design files of the laser-cut board can be downloaded in various formats from LINK. The design file can be uploaded to a laser cutting service, e.g., upload taskboard5_tapped.STEP to Ponoko. To minimize variation in board properties, please select for cutting the design in white Acrylic board of 9mm thickness, 384mm length, and 384mm width.

Parts List

(Example)

ID	Item	New Part Number	Unit Cost	unit	Cost
1	Laser Cut Board	-		1	
2	M4 - Hex Socket Screws	CSH-SUS-M4-14	\$3.77	2	\$7.54
3	M4 - Standard Hex Bolt	RSCB4-8	\$0.22	2	\$0.44
4	M4 Hex Nuts	LBNR4	\$0.64	2	\$1.28
5	M4 Threaded Inserts	HLTS4-8	\$1.48	4	\$5.92
6	M8 Hex Socket Screws	CSH-SUS-M8-22	\$5.10	2	\$10.20
7	M8 Standard Hex Bolt	HXN-SUS-M8-8	\$2.44	2	\$4.88
8	M8 Hex Nuts	LBNR8	\$0.82	2	\$1.64
9	M8 Threaded Inserts	HLTS8-8	\$1.71	4	\$6.84
10	M12 Hex Socket Screw	CSH-316L-M12-20	\$3.57	2	\$7.14
11	M12 Standard Hex Bolt	HXN-SUS-M12-10	\$10.98	2	\$21.96
12	M12 Hex Nut	LBNR12	\$1.92	2	\$3.84
13	M12 Threaded Insert	HLTS12-12	\$2.69	4	\$10.76
14	M16 Hex Socket Screw	CSH-316L-M16-25	\$31.62	2	\$63.24
15	M16 Standard Hex Bolt	HXN-SUS-M16-10	\$17.62	2	\$35.24
16	M16 Hex Nut	LBNR16	\$2.34	2	\$4.68
17	M16 Threaded Insert	HLTS16-16	\$4.50	4	\$18.00
18	M6 Block Bolt	CSHZ-ST-M6-40	\$0.86	8	\$6.88
19	M6 Leg Bolt	CSHZ-ST-M6-50	\$0.94	4	\$3.76
20	M6 Leg Nut	LBNR6	\$0.73	4	\$2.92
21	Adjuster feet	LEMS6	25.57	4	102.28
22	Obstruction block	3D printed	N/A	4	0
			Total		\$217.16

** Choice of supplier as long as specifications are met.

Tools List

- 1) Allen/hex wrench metric set
- 2) 4mm, 8mm, 12mm, 16mm tap



Figure 3. Tools that are used for assembly

Assembly Instructions

Step 1 task: Set up

- 1) Download and print all the 3D files for the Obstruction block.
- 2) Unpack and separate all parts.
- 3) Tap every hole on the board except for the M6 clearance holes used for mounting the obstruction blocks, based on its respective size taps. M4, M8, M12, M16.



Figure 4: Obstruction block mounted (side view)

Step 2 task: Mounting the bolts and blocks

- 1) Mount each of the obstruction blocks using the M6 bolt and M6 nut.
- 2) Thread the longer bolts with socket heads through the bottom of the board so that their threads are protruding through the top face of the board. Locations shown in Figure 2.

The following parts should be set aside for the assembly task of the ATB.



x 2

Optional feet:

- 1) 4 M6 x 25 bolts and 4 feet are provided for optional use. Each of the corners of the board receives an M6 bolt and it captured on the backside using an M6 nut. The Feet can then be threaded onto the leg bolts.

