2023-2024 FIRST® Tech Challenge

Do It Yourself (DIY) Guide
Sponsor Thank You

Thank you to our generous sponsor for your continued support of the FIRST® Tech Challenge!

Raytheon Technologies
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Introduction

What is FIRST® Tech Challenge?
FIRST® Tech Challenge is a student-centered program that focuses on giving students a unique and stimulating experience. Each year, teams engage in a new game where they design, build, test, and program autonomous and driver operated robots that must perform a series of tasks. Participants and alumni of FIRST programs gain access to education and career discovery opportunities, connections to exclusive scholarships and employers, and a place in the FIRST community for life. To learn more about FIRST® Tech Challenge and other FIRST® Programs, visit www.firstinspires.org.

Gracious Professionalism®

FIRST® uses this term to describe our programs’ intent.

Gracious Professionalism® is a way of doing things that encourages high-quality work, emphasizes the value of others, and respects individuals and the community.

Watch Dr. Woodie Flowers explain Gracious Professionalism in this short video.
### General Tools Needed

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Part Photo</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Gloves</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Utility Knife</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>25' Tape Measure</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>PVC Cutter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2” Tape</td>
<td>As Needed</td>
<td></td>
</tr>
<tr>
<td>Pencil or Marker</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Yardstick</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Printer*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Paper*</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*A printer is optional for those who would like to print out the AprilTags for the backdrop or for the perimeter walls.

**Gracious Professionalism®** - "Doing your best work while treating others with respect and kindness - It's what makes FIRST, first."
# DIY Backdrop

## Materials Needed – Backdrop

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Home Depot SKU</th>
<th>Part Photo</th>
<th>Est. Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>24in. x 36 in. Foam Core Board (5-pack)</td>
<td>1</td>
<td>Model# 41655106 (5-pack)</td>
<td><img src="image" alt="Foam Core Board" /></td>
<td>$52.89</td>
</tr>
<tr>
<td>All Purpose Glue</td>
<td>1</td>
<td>SKU#1002832577</td>
<td><img src="image" alt="All Purpose Glue" /></td>
<td>$9.28</td>
</tr>
</tbody>
</table>
Backdrop – Step by Step Instructions
You will need to cut one sheet of the foam core board using the diagram below. A larger image is located in Appendix B.

1. Mark out the cut pattern on TWO of the foam boards.
2. Cut out the pattern on **TWO** boards.
3. Glue the two cut boards onto a third solid board.

4. Cut the rear leg from the fourth board.
5. Tape the rear leg onto the glued boards.

6. Stand up the boards and set the rear leg at 21”. Use tape to keep the leg at the correct distance. The front face should be approximately 30 degrees.
7. Attach AprilTags as shown.

8. Finished Backdrop
## DIY Truss and Stage Door

### Materials Needed – Truss and Stage Door

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
<th>Home Depot SKU</th>
<th>Part Photo</th>
<th>Est. Unit Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Charlotte Pipe 1-inch x 10-ft Schedule 40 White PVC Pipe</td>
<td>3</td>
<td>#193755</td>
<td><img src="image1.png" alt="Part Photo" /></td>
<td>$8.48</td>
</tr>
<tr>
<td>1-inch dia Tee PVC Fitting</td>
<td>12</td>
<td>#187925</td>
<td><img src="image2.png" alt="Part Photo" /></td>
<td>$1.97</td>
</tr>
<tr>
<td>1-inch-in dia 90-Degree Elbow PVC Fitting</td>
<td>8</td>
<td>#187984</td>
<td><img src="image3.png" alt="Part Photo" /></td>
<td>$1.48</td>
</tr>
<tr>
<td>1-inch dia PVC Cross Fitting</td>
<td>2</td>
<td>#795984</td>
<td><img src="image4.png" alt="Part Photo" /></td>
<td>$5.22</td>
</tr>
</tbody>
</table>

Note: PVC fittings vary slightly from manufacturer to manufacturer and store to store. The dimensions may need to be adjusted to accommodate the fittings.
Truss and Stage Door – Step by Step Instructions
These assembly instructions are to build a partial, red alliance side truss, and the stage door.

1. Cut the tubing to length:

<table>
<thead>
<tr>
<th>Part</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>22” long</td>
<td>4</td>
</tr>
<tr>
<td>21 ¼” long</td>
<td>4</td>
</tr>
<tr>
<td>13 ½” long</td>
<td>8</td>
</tr>
<tr>
<td>18 ¼” long</td>
<td>4</td>
</tr>
<tr>
<td>9 ½ “ long</td>
<td>8</td>
</tr>
<tr>
<td>6 ¾” long</td>
<td>4</td>
</tr>
<tr>
<td>4” long</td>
<td>2</td>
</tr>
<tr>
<td>2” long</td>
<td>2</td>
</tr>
</tbody>
</table>

Gracious Professionalism® - "Doing your best work while treating others with respect and kindness - It’s what makes FIRST, first.”
2. Assemble Frame 1:

3. Assemble Frame 2:
4. Assemble Frame 3:

5. Assemble Frame 4:
6. Assemble Frames 1,2,3 to build the red Truss:

7. Assemble the Stage Door:
8. Sand 2” tubing to allow for a slip fit into the fitting so that the Stage Door will swing freely.
9. Assemble the Truss, Frame 4, and the Stage Door:
**Barrier**

For teams not using field perimeter walls, simple cardboard barriers can be made to place the AprilTags normally placed on the perimeter wall.

1. Draw the following outline on a piece of cardboard.

2. Cut the shape out being careful not to cut on the fold lines.
3. Fold the cardboard

4. Tape the triangular supports so that the vertical wall is straight up.
5. The finished barrier should look like this.
Appendix A – Resources

**Game Forum Q&A**
https://ftc-qa.firstinspires.org/

Anyone may view questions and answers within the FIRST® Tech Challenge game Q&A forum without a password. To submit a new question, you must have a unique Q&A system user name and password for your team.

**Volunteer Forum**
Volunteers can request access to role specific volunteer forums by emailing FTCTrainingSupport@firstinspires.org. You will receive access to the forum thread specific to your role.

**FIRST Tech Challenge Game Manuals**

**FIRST Headquarters Pre-Event Support**
Phone: 603-666-3906
Mon – Fri
8:30am – 5:00pm
Email: Firsttechchallenge@firstinspires.org

**FIRST Websites**
FIRST homepage – www.firstinspires.org
FIRST Tech Challenge Page – For everything FIRST Tech Challenge.
FIRST Tech Challenge Volunteer Resources – To access public volunteer manuals.
FIRST Tech Challenge Event Schedule – Find FIRST Tech Challenge events in your area.

**FIRST Tech Challenge Social Media**
FIRST Tech Challenge Twitter Feed - If you are on Twitter, follow the FIRST Tech Challenge Twitter feed for news updates.
FIRST Tech Challenge Facebook page - If you are on Facebook, follow the FIRST Tech Challenge page for news updates.
FIRST Tech Challenge YouTube Channel – Contains training videos, game animations, news clips, and more.
FIRST Tech Challenge Blog – Weekly articles for the FIRST Tech Challenge community, including outstanding volunteer recognition!
FIRST Tech Challenge Team Email Blasts – contain the most recent FIRST Tech Challenge news for teams.

**Feedback**
We strive to create support materials that are the best they can be. If you have feedback about this manual, please email firsttechchallenge@firstinspires.org. Thank you!
Appendix B – Backdrop Cutout