



Design/Build Challenge Instructions

Introduction

Settling in a new world presents multiple issues for engineers to solve, including those that relate from infrastructure to life support, to those related to convenience, such as oxygen and water supplies, shelter and housing, and transportation for travel to, from, and around the new world. Each issue could involve the need for multiple engineering designs.

Challenge

A large transportation storage facility – to be built in a new world settlement – is required. The facility must hold all types and sizes of vehicles (some of which may not even exist yet) and have a large door that can be operated easily to open, close, and accommodate the vehicles.

Task

Design a prototype of the transportation storage facility, with specific focus concentrated on the door (features and mechanisms that hold, support, and open and close the door). The prototype must be able to stand on its own, be stable (it may be taped to a table surface) and be able to demonstrate the functionality of the door.

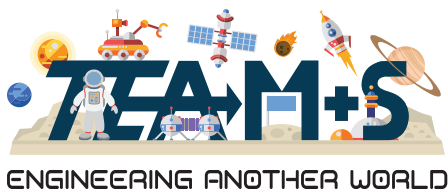
Prototype Criteria

Size

- The structure should appear to be airtight (other than the door) and should be stable. There are no size limitations or requirements for the structure.
- The structure must have an opening; the door must cover the opening (the larger the opening, the higher the evaluation score).
- When closed, the door must cover the opening completely (with no visible gaps).

Configuration

- Nothing should be present along the bottom of the opening. A vehicle must be able to slide into the structure, through the door, along the tabletop.
- Opening the door must rely on the use of at least one pulley.
- To simulate a heavy door, a bag of (25) pennies must be secured to the door using tape; the bag of pennies must be secured to the door.
- The structure must be built to demonstrate the opening of the door. The structure must stand on its own (no team member may hold the frame or support the structure). The structure may be taped to a tabletop to secure it during operation.



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Operation

- The demonstration must include:
 - Opening the door
 - Measuring the opening (from top of the door to the tabletop)
 - Closing the door
- The door must be operated by one team member only.
- A separate team member may measure the opening.
- When the door is being operated, it may not be touched by anyone on the team. No part of the operator's body may be closer than 6" to any part of the door during any part of the operation.
- The team member measuring the door opening may be within 6" of the door - but may not help operate or hold the door in any way.

Judging Criteria

- Door opening: The height of the door will be measured vertically from the base (tabletop) to the top of the opened door.
- Door opening: The width of the door will be measured from side to side of the door opening. If the opening is not consistent, the measurement will be based on the smallest distance from one side of the door opening to the other side of the door opening.
- Building structure: The structure must not have any gaps and be stable enough to stand alone.
- A pulley must be used to operate the door.

Timing

15 minutes (prior to start time): Release the challenge.

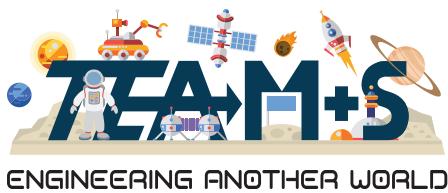
- Teams may sketch and brainstorm, however, they may not begin the build portion of the challenge.

90 minutes: Design, build, test, iterate, record.

- At the designated start time, team members will design, build, test, and record their entry. This includes team construction of the prototype, using only approved materials from the materials list; video recording of the operation of the door; video recording of a member measuring (in inches) the height and width of the door opening. Videos must not be longer than 30 seconds.

15 minutes: Submit.

- Teams must complete the Datasheet and Honor Statement and upload the forms and recorded video, per the instructions and submission link provided.



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Your solution must be constructed out of the specified materials – no extra materials are allowed. The scissors, ruler, and writing utensil may not be used in the design; they may only be used as tools.

REQUIRED MATERIALS

QUANTITY	SIZE	DESCRIPTION (Click link for Option to Purchase)	EXAMPLE
25	8½" x 11"	Standard white paper	
20 Feet	Any Ply	Cotton Twine or String	
40	Standard, No.2	Non-Mechanical Pencils, unsharpened	
25	Any	Rubber Band	
100	Metal, 1¼" x ¼"	Smooth Paper Clips	
20	8.5" L (max.); .20-.25 dia.	Straws, paper or plastic	
6	Standard, metal or plastic	Sewing Bobbins	
1 roll	¾" x 250" (max.)	Transparent Tape	
20	4.5 x 0.38 x 0.07 in.	Wooden Craft Sticks	
25	Standard	Pennies	
1	Sandwich size	Re-closable storage bag	

Required Tools (not to be used as part of the final build)

1	Standard	Ruler	
1	Standard	Scissors <i>Scissors must only be used for cutting paper or string.</i>	
1	Misc.	Writing Utensil	

Items Needed for Challenge Set-Up:

- **Flat surface** on which to build and test your structure.
 - For example, the floor or any flat tables in classrooms, cafeterias, media rooms, or sturdy temporary tables.



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Evaluation Criteria

The prototype will be evaluated based on specific criteria, as follows:

1. Maximum of ten (10) points per criterion:

Record the height and width measurements of the door opening. There is a total of 10 points possible each for both height and width based on the measurements entered here. (The highest / widest door opening receives 10 points; the higher/wider, the better.)

Height of door opening (in inches): _____

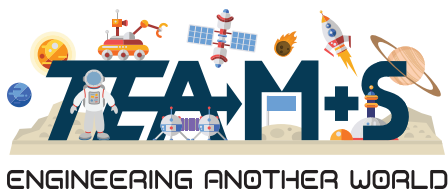
Width of door opening (in inches): _____

2. Maximum of five (5) points per criterion.

	5 points	3 points	1 point	0
Door covers opening	Door completely covers the opening with no gaps (the door may be larger than the opening)	Door covers most of the opening, although some gaps exist	Multiple gaps noted; door is undersized	No door
Structure appears airtight	Structure has no obvious openings	Structure has significant openings that would need to be fixed to be airtight	Structure is largely open	No structure
Structure stability	Structure stands on its own during entire door operation	Structure stands freely but needs help to remain in place during operation	Structure needs to be held in place	No structure
Pulley	Pulley is used successfully in operation of the door	Pulley is present, but assistance is needed to help in operation of the door	Pulley is not used	No pulley

3. Door operation penalties will result in a deduction of points. Note that other penalties are possible, such as for violating rules, constraints, or challenge requirements:

- Operator was within 6" of door during operation
- More than one team member assisted in operation of door
- Team member, other than the operator, was within 6" of door during operation
- Bag of pennies was not attached to door during operation



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Video Submission

Only one video may be submitted (team should select the best recording). A team member must state the school name and participant ID at the beginning of the video recording. The submitted video must be continuous (not edited). Videos must be 30 seconds or less and include:

- Height and width measurement of door opening
- Operation of door opening and closing
- Pulley used to operate the door
- Building structure supporting the door

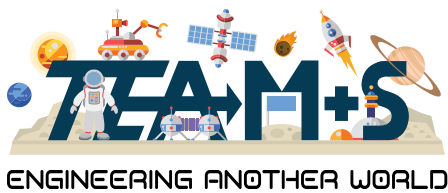
Failure to show required elements, including the measurements of the door opening, will result in a zero (0) score for height and width.

Videos will be uploaded to a hosting platform via a URL link using the provided submission link and instructions. The video link must be “unlisted” so that it is viewable for judging.

Videos that are not able to be viewed for judging will result in disqualification. Videos submitted via email will not be accepted.

Datasheet Submission

Complete the Design/Build Challenge Datasheet and Honor Statement. Verify the information is accurate and written clearly. Submit the forms and the video URL using the instructions and submission link provided. (Video and forms' upload instructions are available in the online coach account.)



Design/Build Challenge Datasheet

Your information

Complete the information below and submit the completed form to your proctor. Verify the information is written clearly and accurately. One datasheet per team must be submitted to TSA along with the video URL and Competitor Honor Statement using the instructions and submission link provided in your online coach account.

Coach Name: _____

Coach's email address: _____

Participant ID number: _____

School: _____ State: _____

Your data

Record the height and width measurements of the door opening. There is a total of 10 points possible each for both height and width based on the measurements entered here. (The highest / widest door opening receives 10 points; the higher/wider, the better.)

Record your measurements (in inches) below:

Height of door opening (in inches): _____

Width of door opening (in inches): _____