

Preston Elementary, 800 Tallmadge Rd. Cuyahoga Falls Ohio, 44221
Mr. Keith Nelman's 4th and 5th Gr. Science

STEM Wars

Define the Problem

- Han Solenoid and Chewbeaker crashed their ship into a swamp on Dacobalt. They need to get out so they can save STEM.

Define the Knowns

- the droid H-N1L is broken.
- They are trying to save STEM
- The Droid H-N1L says the words “**electromagnet**”, “**pulley**”, “**hydro pump**”, and “**evaporate**”, before he shuts off. Those are tips on how to get the ship out of the swamp.
- There are lots of vines, trees, rocks, and other natural objects on Dacobalt.
- Dacobalt is surrounded by boulders with cobalt ore.
- Han and Chewbeaker are smugglers and have things on board that could help them get out of the swamp.

Define the Unknowns

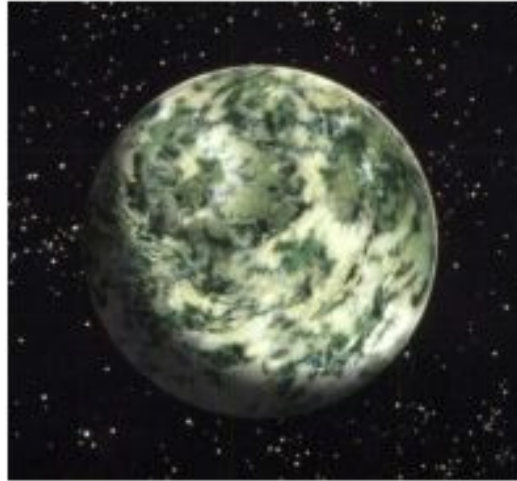
- what is the force of gravity on the planet of Dacobolt?
- What is the size of the ship? (weight?)
- we do not know what is inside of their ship that could help them

Estimated Values for the Unknowns

● **Gravity Force**

We estimated the size of Dacobolt by researching its parody planet Dagobah. We found the information on Wookieepedia the Star Wars wiki. This website claims the planet is about 8,900 km in diameter. Since a **planet's** size and mass **determines** its **gravitational pull** we compared Dacobolt to planets in our solar system to help us determine its gravity. Dacobolt is said to have many rocks on the planet therefore we can compare it to the 4 inner planets in our solar system. We came up with the planet having a gravitational force of about 63% of what we have here on Earth.

This is a picture of Dagobah where Yoda lived. We believed this to be the same size as the project's planet of Dacobolt. This helped us figure out the gravity on the planet based on the size.



- **Size of the Ship**

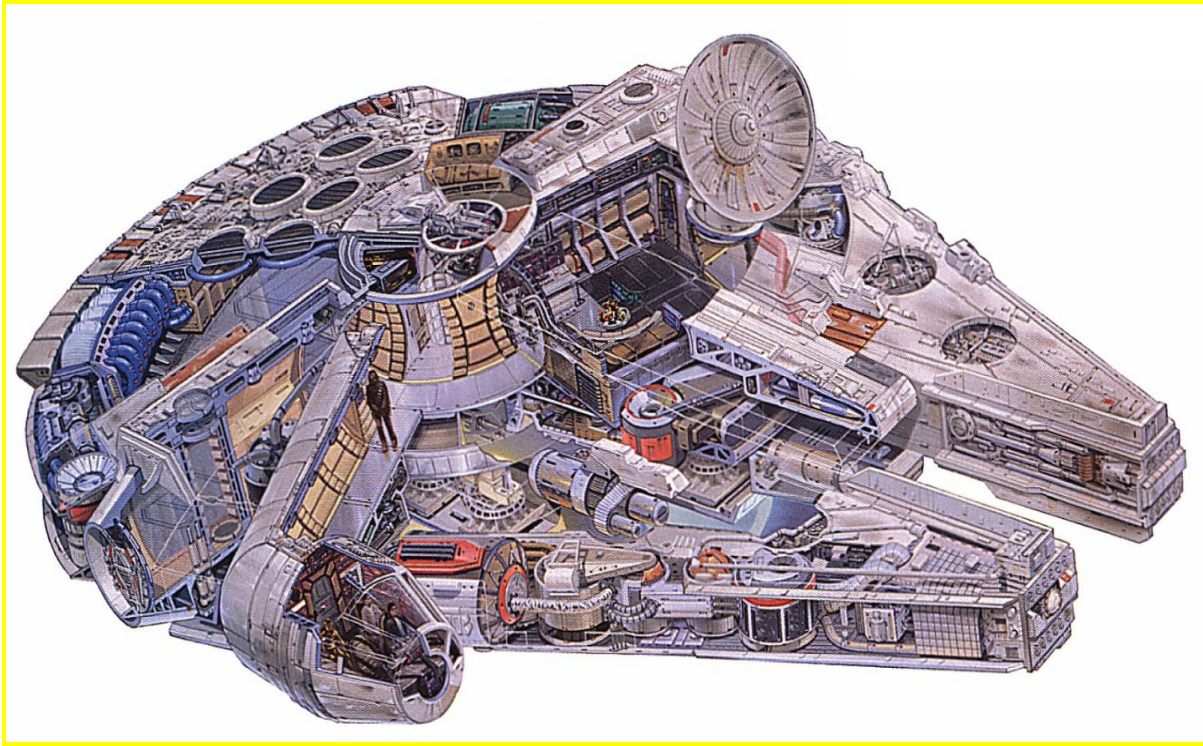
- **About 400,000 pounds**

- It was very difficult to figure out the mass of the ship. We had the dimensions but could not figure out the weight. We came to a conclusion that it was bigger than a fighter jet and a little smaller than a 747. We also have read that the real Falcon was lightened to reduce weight to help it fly faster.



- **Inside the ship Items that could help them**

Because this is a cargo ship and Han Solenoid and Chewbeaker are smugglers there has to be a way for them to load heavy things. What our class came up with is that there might be a winch or two on board to pull escape pods and other heavy objects up the ramp. There might even be pulleys in the cargo to help us.



Our Idea for the Solution

Han Solenoid and Chewbeacker have gotten the Millennium Falcon stuck in a swamp on Dacobalt. We think we can get it out with the things H-N1L said “**electromagnet**”, “**pulley**”, “**hydro pump**”, and “**evaporate**”. We believe that Han Solenoid and Chewbeacker must have some helpful stuff on board like winches and **pulleys** because they are smugglers. Their spacecraft is a cargoship so we believe they must have some type of winch or winches on board to load heavy equipment like Escape Pods. The winch alone can not lift something as heavy as the Millennium Falcon so we plan on using pulleys found on the ship. We would need a total of 16 pulleys. We would use 4 pulleys hooked up at each corner to use a 9:1 Pulley System at the corners. We probably would have to use some vines as rope for the pulleys. The vines would then be hooked up to the line of the winch. We plan to use pulleys and a winch which has an **electromagnet** in it to pull the Millennium Falcon up. While the Millennium Falcon is up it will be able to lower its landing gear. When the ship is suspended in air, we will use a hydro pump to get rid of some water in the swamp. We will also fire the engines of the Millennium Falcon to heat up the swampy area that it was stuck in to help evaporate the water. When we are finished, the Falcon can be lowered back down with the landing gear using the pulleys. The ship would be disconnected from the pulleys and vines which makes the Millennium Falcon free to take off and save Stem!

Here is our solution explained through a math problem:

Using a 9:1 Pulley System at each corner and 2 winches

400,000 pounds = the wt. of the ship / 4 (for each corner) = 100,000 pounds

100,000 pounds / 9 (9:1 pulley system) = about 11,200

11,200 x 4 (number of corners)= 44,800

44,800 x .63 (gravity of Dacobolt) = 28,224 pounds

We would use 2 winches to pull 2 corners a piece. The winches would need to be able to pull about 14,100 pounds each.

Science Topics Involved in Our Solution

- Earth and Space Science- Finding the out what the gravity on the planet might be.
- Mechanical Advantage using pulleys
- Physical Science- Thermal Energy

Our Experiment

Note: For the sake of time and money we decided to use a 2:1 pulley system in our experiment in place of the 9:1 ratio pulley system.

Materials:

2x4's

8 pulleys

rope

eye screws

Millennium Falcon toy

electric motor (for the winch)

Zip ties and zip tie adhesive mounts

Conclusion:

We were able to lift the model using the pulleys but the model winches did not work. The electric motors that we used were not powerful enough to lift our toy but an electric drill was. We decided that 2 winches with 15,000 pounds of pull to pull the line connected to the vines that lifted the ship.



My class really enjoyed this lesson. It was a great way to engage my students and get them excited about my unit on Space which we will begin next week. I used this project to introduce topics such as gravity and size of planets. I do not teach about pulleys but it was nice to touch on them this week. We really enjoyed getting to bring the world of Star Wars to the classroom.

Thank you for the opportunity!

Keith Nelman
4th and 5th Grade Science
Preston Elementary 800 Tallmadge Rd.
Cuyahoga Falls, Ohio 44221

cf_nelman@cfalls.org
<http://mrnelman.weebly.com/>

