mystery science

Grades K-5
Mini-Lesson + Activity: "Why can't airplanes fly to space?"

VIDEO TRANSCRIPT

MINI-LESSON VIDEO 1

Hi, it's Doug! Back in December 2018, the company Virgin Galactic made history when they successfully flew the first plane all the way to the edge of space. Called the VSS Unity, it wasn't exactly an airplane, though. You can see here, another plane first carried it up really high, then let go of it. And you can see, it's got this rocket engine it fired until it got to space. The VSS Unity is what people are calling one of the first space planes. What about airplanes, though? Someone named Jared has a question about this. Let's give him a call now.

[Video Call]

- Hi, Doug!

- Hi, Jared!

- I have a question for you. Why can't planes fly to space?

- That's a great question.

All of the astronauts who go to space get there using a rocket. And yet, airplanes do go really high, so why don't we use planes to get to space? To figure this out, we need to know more about how a plane flies at all. I promise, once you understand how an airplane flies, I think you'll be able to easily figure out why airplanes can't fly to space. So, we'll come back to the question of space at the end. First, let's talk about how an airplane flies at all. And when you stop and

think about that, it's actually pretty amazing, isn't it? Think of just how heavy an airplane is. Why wouldn't it just fall out of the sky? There's a clue, and it's something you have to try for yourself. Next time you're in a car going fast, like on the highway, and the windows are down, try holding your hand out, but not just sticking your hand straight out—instead, at a tilt, like this. Now, obviously, you wouldn't want to stick your hand out if there are cars very close to you going past. Make sure your parents are supervising. But give this a try. If you've ever tried this before, you'll feel what happens. As soon as you tilt your hand, it starts to get lifted up. What's going on here? Why does tilting your hand make it suddenly start to lift? What do you think?

MINI-LESSON VIDEO 2

Here's the thing to notice: When you put your hand out the window, at first, if you have it straight like this, air just goes around your hand. But as soon as you tilt your hand, now some of that air bounces off your hand this way, pushing your hand up as it does. You may not have any experience flying an airplane, but it's the same basic idea when you fly a kite. Notice how a kite, too, is tilted. If it's a windy day, the air hits the bottom of the kite and bounces off the bottom, lifting the kite up off the ground. That's what makes a kite fly. So, next time you see an airplane, have a look. What do you notice? The wings are tilted. Of course, being tilted alone isn't enough. There has to be wind that's hitting the wing. Check out this video of an airplane just sitting on a runway during a windstorm. There's no one even on board this plane. In fact, they've got it roped down so that it won't take off. You can see why. Each time a gust of wind comes by, it lifts the plane up. It's the tilt of the plane's wings that pushes the wind downwards, lifting the plane off the ground. Now, obviously, when you want to fly in an airplane, it's not that you just have to sit there and wait for a windy day. So what if there's no wind? Well, it's helpful to think again of flying a kite. On a day with no wind, you can still make the kite lift up by running along

the ground. By running, that pushes the kite forward through the air. What you're doing is creating wind that hits the kite. Well, a plane is no different. It doesn't have to be a windy day to fly. That's what a plane's engines do. A plane's engines constantly push the plane forward through the air. They create wind that hits the tilted wings. Because the wing is tiled, as the air hits it, it pushes up on the plane. But what about the fact that planes are so heavy? This Boeing 747, for example, weighs the same as 50 elephants. The amazing thing is, there's really no limit to the amount of weight that can be lifted, as long as the engines create a strong enough wind. Check this out. They've placed an empty van right behind this giant plane to give you a sense of the incredible power of its engines. Look at this; whoa! Now you can understand why airplanes can't fly to space. The higher up you go in Earth's atmosphere, the less air there is. By the time you reach space, there's no air at all. Even if a plane had the most powerful engines in the world, those engines are useless if they're not pushing the plane forward through air. So the name “airplane” really is a great name for what it is. Airplanes can't stay up in the air without pushing air downwards. Just so you know, the tilted wings of most large airplanes is definitely not the only way to push air downwards. There are other types of wing designs that can do this too, but all of them work using the same basic idea. That's all for this week's question. Thanks, Jared, for asking it. Now, after this video's done playing, my friends and I here at Mystery Science have created a step by step activity where you could make your own paper airplane and see how long it can stay in the air. I hope you'll try it. Have fun, and stay curious.

ACTIVITY INTRODUCTION VIDEO

In today's activity, you're going to make your own airplane—a paper airplane we call the V-Wing Glider. Since it's a paper airplane, there's no engine. And since you're inside, there's no wind. So that's the challenge of this glider plane. After you make it and launch it, you'll be able to

make small changes to it to see how long you can keep it in the air. Now, making a good glider plane can be tricky, so we'll show you how to get started, step by step.

ACTIVITY STEP 1

Get your supplies. When you're done with this step, click the arrow on the right.

ACTIVITY STEP 2

Take a few moments to color your V-wing Glider. Now, this stuff isn't just for fun; giving it some color will make it easier to find when you go to launch it later on. Go ahead and do this now. I'll set a timer for three minutes in case that's helpful. Okay, it's been three minutes. If you want to go to the next step, you can always finish coloring later.

ACTIVITY STEP 3

Okay, watch this step carefully before you begin. What you're going to do is line up the two long ends of the paper, like this. And try to make sure the corners are lined up together. Then, press down to fold the paper in half and run your fingernail along that fold to make a really good crease. Now, I'll tell you, one tip for making a really good paper airplane is to make sure both sides of the paper match. So try your best to fold your paper exactly in half.

ACTIVITY STEP 4

Okay, watch how we do this step first. Open your Glider back up and turn it so that the letters are facing you, like this. Then, take the top of the paper and fold it down to the line marked A, like this. Now, the better you fold, the better your Glider will fly, so use your fingernail again to

make a good crease, like this. For each fold, take your time and try to make the fold as straight as possible.

ACTIVITY STEP 5

Now repeat the fold a few more times. Bring the top of the page down to line B, like this. After each of these folds, use your fingernail again to make that good crease. After folding to B, bring the top of the page down to line C. And so on, down to line D, and then finally to line E.

ACTIVITY STEP 6

At this point the very first fold you made might be starting to disappear, so we need to make that fold stronger. Line up the two corners of the Glider again so that the airplane folds in half. Then, press down to refold the paper in half. Run your fingernail along that fold to make a really good crease, especially along the thick part of the Glider. Then, reopen it, just like that.

ACTIVITY STEP 7

All right, now it's time to make the wings for your Glider. Here's what you do; watch this first. Fold the bottom half up, and then gently pull it down to match the two halves of the plane, just like you see here. Now, you want to take your time. This can be a little tricky. Once you've got it matched, then you'll fold on the dotted line, using your fingernail again to make a good crease. Okay, and then once you've got that, unfold it slightly, like this, when you're done.

ACTIVITY STEP 8

Okay, in this next step, you're going to turn the Glider around and do the same thing. Fold the bottom half up, then gently pull it down, like this, until the two halves of the plane match up. And

then, once it's matched, fold on that dotted line and use that fingernail again to make a really good crease. If you get it, you can go ahead and do this now. But once you do all this, don't fly your Glider just yet.

ACTIVITY STEP 9

Fold the paper back up like this and write your name on both sides. That way, if a bunch of people throw Gliders, you'll be able to find yours.

ACTIVITY STEP 10

You'll use a paper clip to hold the folds of your Glider together. Get your paper clip and place it on the bottom thick part of the Glider, like this. Then, check what the wings look like. Your wings should be in a V-shape, like this. Now, if your wings are flat or pointed down, your plane won't fly well. This shape is better. But what you really want is a V, like this. This shape will really help your plane fly well.

ACTIVITY STEP 11a

Find a partner. Decide who will be the Pilot and who will be the Control Tower. Don't worry, you'll switch roles later so that you'll both get a chance to launch your Gliders. If you're working alone, that's okay too.

ACTIVITY STEP 11b

Older grades: each pair of you will need one Glider Launch Checklist. Younger grades: your teacher will have a copy of the checklist to help you.

ACTIVITY STEP 12

Compare your Glider with your partner's Glider. Make sure the wings make a V.

ACTIVITY STEP 13

Now that your Gliders are ready, form a Flight Squadron with another pair of students to make a group of four. This means you'll have two Pilots and two Control Towers in each squadron. After grouping up, take about 30 seconds to decide on a team name.

ACTIVITY STEP 14

For this step, just listen to what you'll do later. If you're in a class, your teacher has set up a Launch Station somewhere. You may have two squadrons get ready to launch at the same time. Control Towers: you'll move to the side and watch the Pilots. Make sure you're not in the launch area. Pilots: stay on the line. All right, go to the next step to see what you'll do next.

ACTIVITY STEP 15

Once you're all in position, Pilots: you'll launch your Gliders. Control Towers: you'll watch how your Pilot launches their Glider. Older grades: use your checklist and give the Pilots tips. Afterward, switch roles so that the Control Towers also get a turn. Now, if it's not your squadron's turn to launch, watch the other Pilots. By seeing what works well, you might do better when it's your turn. Which Glider will stay in the air the longest? Have fun and stay curious!