

Video Transcript for the *Achieving Orbit* Activity:

Hi! My name is Michelle and I'm a member of the IBEX Education and Public Outreach team. We've designed a series of videos to show you how to facilitate the IBEX educational activities for an informal audience, such as museum visitors or after-school program participants. This video is for the activity titled *Achieving Orbit*.

(Captions already existing: "IBEX was launched in the fall of 2008 from Kwajalein, a remote island far out in the South Pacific.")

The IBEX team used a multi-stage rocket to propel the IBEX spacecraft to a high orbit. During *Achieving Orbit*, participants will construct a two-stage balloon rocket that will simulate a rocket that has to reach the proper orbit needed by the IBEX satellite.

(Lengthy rocket animation)

So let's go over all the materials that you'll need for each balloon track for *Achieving Orbit*:

First, you'll need two four-inch long straws. Now, these are not the bendy kind of straws. You want sturdy straws. If the bendy kind is the only kind that you have, just cut the bendy part off. These straws need to be stable and sturdy because this is what our balloons will be attached to.

Next are the balloons. Now these are not animal twist balloons; these are just regular party balloons. Animal twist balloons are made to stick the nozzle closed so that the air doesn't come out of the balloon. We *want* the air to come out of our balloon. So, I'm just going to blow this balloon up just a bit so you can see what I'm talking about. *(Michelle inflates balloon)* Now this balloon is relatively straight - it just has a few bumps in it. But this is what I'm talking about. So, nice and straight on the balloon. If it has a few bumps, that's fine. So, let me let the air out of the balloon. Now this balloon does blow up kind of long. You won't necessarily need to blow it up all the way but just so you can at least have a little bit of straightness on your balloon.

Next, masking tape. The masking tape is what we will use to hold the balloons on to the straws. You'll also need a few feet more to be able to mark out some parts of the floor for the activity, so make sure you have a few rolls handy. It doesn't need to be terribly sticky masking tape either. Actually, it just needs to barely hold the balloon on to the straw. If you have it too sticky, well, then you'll keep changing your balloon every time you do the activity.

Next, we have vinyl craft lacing. Now this vinyl craft lacing is just a long thin piece of vinyl and it is slippery so that that will allow the straw to move along the track very easily. Now, it's thin because it needs to fit onto the straw, and it's also red. Now the color doesn't exactly matter, but you do need a bright color because you are going to have 20 feet of this stuff stretched across a room and you don't want people accidentally running into the vinyl.

Next, you'll need a sharp pair of scissors. You need to cut your straws and you need to cut your vinyl, so a good sharp pair of scissors will do just fine.

Next, you'll need a rubber band. This is what will hold our balloons together, so you want a rubber band that is at least about 3 inches long and at least an eighth of an inch wide – and a little wider even a little better.

You'll also need a binder clip. Now, the nozzle of the balloon in the back will need to have that closed so in order to do that you want a binder clip and you want to make sure that there isn't too much space in between the clips. You want to make sure that it's holding the nozzle of the balloon closed tightly. Large or extra large-sized binder clips might be a little too big for this activity. This is a medium clip and a small clip may work as well, but test it out before you do this activity with some visitors or some after-school participants to make sure that this is all working properly.

Finally, you'll need a balloon pump. You don't want to have to blow up the balloons yourself every single time you do the activity, so a hand operated balloon pump is exactly what you'll need.

Now, *Achieving Orbit* takes up quite a bit of space, so select a space that is at least 20 feet long and about 6 feet wide for each balloon track that you want to set up so that people have the opportunity to move around a bit and not run into each other.

You'll want to attach the vinyl lacing at either end so that it is secure, but you need to have a way to re-attach the vinyl at the beginning end if you need to take the balloons on and off the track.

Now, finally, tear off a 3-foot long piece of masking tape and stick it to the floor about 15 feet from the beginning of the balloon track. You'll want to run it parallel to the track - underneath it. This is your satellite target orbit.

So, let's go over how to set-up *Achieving Orbit*.

So, the first thing I'm going to do is string the two straws onto the vinyl lacing. So, I'm going to take the tape off, just temporarily, just so I can get at the end of it. Take one straw, string it on. And the other straw. And then I'll take the vinyl lacing and tape it back up to the wall. You'll want the vinyl lacing to be relatively parallel to the floor, but if there's a little bit of a dip, that's fine.

Next, I'm going to blow up the balloon that will go on the front of the rocket. So, I'm going to grab my balloon pump. (*Michelle inflates balloon*) Correction: blowing up the one that goes in the back. And I'm going to start with about that much blown up. And I need to twist the nozzle just a bit, just to hold the air in, and clip it with a binder clip. There we go. And the binder clip will hold the air in just long enough for me to be able to do this.

So, next, I will blow up the other balloon.

(Video purposely speeds up as Michelle inflates the second balloon and attaches them together using the rubber band.)

Alright, so I've blown up my balloons. I've closed up the nozzle of the rear balloon. I've attached the nozzle of the front balloon under, tucked it under the rubber band that's on the balloon in the back. So now I'm going to tape the balloons onto the straws. And so I'm going to put one piece here and just lightly tape it on. It doesn't need to be terribly stuck. And then the other one. It looks a little odd, but that's ok.

Alright, now, we're ready to go. So, we've got everything together: the vinyl lacing is on, the straws are ready. When I undo the clip, the first balloon is going to deflate and that will deflate the rubber band tension and then the second balloon will go. That will be our second stage. Ready to take a look? 3... 2... 1... Go!

(rocket launches)

So, we've just had a successful *Achieving Orbit* balloon rocket launch. So, the first balloon deflated. Once it deflated just enough, it loosened the tension on that rubber band and the second balloon went a little farther. And from what I can tell, we just ended up right at the edge of our perfect target orbit – so the balloon ended up just over the edge of our tape mark on the floor. So, we had a successful IBEX rocket launch to put our IBEX satellite into its perfect orbit around Earth.

So, the first thing you'll want to do is invite visitors to participate and then show them the proper balloon setup. So, make sure you have one ready to go before they get there. Next, give them a chance to try working with the balloons themselves.

If your participants are already in small family groups, then one family per balloon track is fine. If you have a large group that needs to be split up, you'll want to have at least 2 people per balloon track, up to 4 to 5 people, at most. Don't have more than this per track or the area will get too crowded.

The design challenge part of the activity will be for the second stage balloon to reach anywhere in the region indicated by the masking tape on the floor. Teams should be encouraged to try this activity multiple times. If the balloon ends up somewhere in that space, the participants will have done the design challenge successfully.

If teams do not have time to do the activity more than once, you can engage them in conversation as to how they might change the balloon setup so that the lead balloon reaches the target area.

When anyone completes the activity, you can use the assessment section of the lesson plan to figure out if your audience understood what the lesson is all about.

We hope you've enjoyed learning more about *Achieving Orbit*. For the lesson plan and for more information about this activity, please visit the IBEX website at www.ibex.swri.edu.

Thanks for watching!

