The Open University

Transcript

Where does outer space begin?

Bang Goes The Theory (S1,E1).

Presented by Jem Stansfield and assisted by Dallas Campbell and Liz Bonnin.

DALLAS CAMPBELL: Coming up next for you, we have got a space anniversary, but possibly not the one you're thinking of. Now it's a story of incredible courage. And it's a story that we want to remember here on the show.

JEM STANSFIELD: This footage from 1960, almost half a century ago, is of Joe Kittinger, floating up in a balloon to just over 100,000 feet, and then calmly jumping out. On his freefall descent, he reached speeds of over 600 miles an hour, and he still holds the world record for the highest skydive. And to celebrate his achievement, we thought we'd have a go.

DALLAS CAMPBELL: Kittinger almost died in the attempt. So for this we needed a man of action. We need somebody who could laugh in the face of danger.

JEM STANSFIELD: You are absolutely right. We're going to need Mini Dallas from last week.For me, there's two incredible things about Kittinger's mission. One, he parachuted back from space. And two, he went there in a balloon.

And it got me thinking-- how high do you reckon a helium balloon goes when you let go of it?

JEM STANSFIELD: Well, in theory, if it's less dense than the air around it, it will keep on rising to the edge of space but there is a problem.

Down here at ground level, you've got the full weight of the Earth's atmosphere. And that squeezes this balloon, keeping it in the shape that it is. But, as the balloon rises, the weight of the atmosphere gets less, atmospheric pressure gets less, allowing the balloon to expand and expand until--[POP]--it bursts.

And that's our first challenge-- getting the right amount of helium in the balloon to get it to the edge of space but not so much that it explodes on the way. The next thing that's going to cause problems to any space engineer is weight. It doesn't matter if your spacecraft has "NASA" written on the side of it, or "bang." Keeping the mass low is the key to waving Earth goodbye.

Spacecraft need to save weight. And, for that, they usually go for the most exotic alloys and composites available. I'm no different. I've gone for a step growth polymer, or polyurethane insulation foam, as it's known at the local builder's yard. Now the thing with this stuff, it's an amazing insulator. But it's not very strong.

But luckily for me, it doesn't need to be strong because all it has to do is get a lightweight doll and a couple of cameras from here to the edge of space.

That doesn't mean it's a walk in the park. We'll take off at around 20 degrees C on a nice summer's day. But then things are going to change pretty fast. There's almost no air up there. And the temperature drop is deadly.

By using a plastic Dallas, we neatly avoid the cost of a funeral. But we can't get around all the problems caused by temperature. You see, at 50,000 feet, the air temperature's down to minus 50 degrees, which is why I'm here in an industrial freezer. The problem lies with the electronics. Batteries don't like cold temperatures. And these cameras here, they're designed for maybe minus 5 on your skiing holiday or 30 degrees on your trip to Benidorm. So we have to test if the batteries in these things are good at minus 50.

The coldest point will be near the top of the troposphere, at around 60,000 feet. Above that, Dallas will be in the stratosphere and the temperature will eventually begin to rise again.

OK. That's about five minutes. Battery's still working. Dallas, have a little look at yourself.

All we need now is a very large balloon. A mate of mine, Steve Randall, who's designed the electronics, and with the aid of some string and tape, we have ourselves a space mission.

LIZ BONNIN: The first Campbell in outer space, I'm loving the sound of that.

JEM STANSFIELD: It is just the edge of space.

LIZ BONNIN: That's good enough for me.

JEM STANSFIELD: And he hasn't got there yet.

In 1960, NASA spent millions getting this man-- Joe Kittinger-- to parachute from the edge of space. Now we are mounting our own near space mission-- Operation 500, so-called because that's what it's costing us. All we're using is a bit of foam, some high street video cameras, and a very big balloon full of helium.

This is what we call the payload. So the balloon is going to be lifting this into space. These arms, they just serve one purpose, and that's to hold the cameras. The cameras have to be out here just so they've got enough distance to focus on Dallas down below. And when we send him up into space, these are what's going to record the journey. This is ready to launch now. We've got a go. Steve, you ready?

STEVE RANDALL: Yeah, we're ready.

JEM STANSFIELD: 3, 2, 1. And Dallas and his helium balloon are heading off to the edge of the atmosphere. All we have to do is keep up with him on the ground.

Well, little Dallas is on his own now. And just like a proper space mission, all the data is broadcast down onto a computer here on Earth. That then can monitor his altitude, his latitude, and his longitude.

At just a few hundred feet, little Dallas encounters his first barrier-- dense cumulus cloud. It might fog the lenses, but it won't slow his ascent.

Just right now, he's pretty damned high. According to this, we're at about 30,000 feet. That's the kind of place that airplanes fly.

At this height, there is a risk we could encounter a jet stream-- a narrow band of easterly flowing winds that could hit 200 miles an hour and blast us out over the North Sea.

Where he is now in the upper atmosphere is actually the coldest that little Dallas is ever going to feel-- minus 55 degrees.

But lucky, there is good news. As he goes higher, he's actually going to get warmer because he's going to start collecting more of the Sun's radiation.

Wow. The balloon's now gone over 50,000 feet. That's out into the stratosphere there.

Right now, he's at 94,000 feet. So he's pretty much into space as we speak.

We've done it! 100,000 feet and the curvature of the Earth is clearly visible. The on-board computer is set to release little Dallas and his parachute at exactly the same height as Kittinger-- 102,800 feet.

Unhitched from the balloon, and with almost no air resistance to slow him, Dallas hurtles back to Earth, accelerating until, like Kittinger, he reaches his terminal velocity at around 600 miles an hour.

At that point, after an incredible journey, the batteries run out.

We're searching now for where we anticipate Dallas to be landing. And a worst case scenario for me is that he lands in a populated area. Things from space should not be dropping on human beings.

The last contact we had with the Dallas doll suggested he might be heading for the town of Chatteris in Cambridgeshire.
For all the planning design and weather surveillance that has gone into this, it's come down to the fact that we're looking for a six inch doll dressed as an astronaut

And after two hours of searching--Come here! Come here! Come here! Dallas! He's made it! Dallas, you're now an astronaut. He's made it!And here he is.

LIZ BONNIN: Aw, seriously, that was so amazing to watch. I mean, it's probably my favourite film so far.

DALLAS CAMPBELL: I have to say I feel really emotional about it. I'm living my astronaut dreams vicariously through a doll. How long did it actually take to get up and all the way back again?

JEM STANSFIELD: It takes a couple of hours to get up to space and probably only about half an hour to come back down to Earth.

DALLAS CAMPBELL: Now I don't mean to be picky. But you know they say in space no one can hear you scream, but watching that film, when he falls down, you can hear his whistling noise. The sound, so what's going on there?

LIZ BONNIN: I know. It sounded a bit like poor little Dallas weeping. But, actually, at 100,000 feet, there are still a few molecules knocking around the atmosphere, right?
JEM STANSFIELD: Yeah, that's right. And it's 600 miles an hour, like little you were.

DALLAS CAMPBELL: Yeah.

JEM STANSFIELD: You knock into enough molecules to create sound waves and that's the noise you hear.