



## The physical world: helicopters

### *How helicopters fly*

**ANGELA LAMONT, PRESENTER:** Pilots need incredible skills to get their very best out of these machines, but even a complete novice like me can take the controls. However, a little knowledge of the science of flight is a lot of help, as anyone who dares to take the controls will soon discover.

**TRACY:** I don't really know how it's going to be, to be honest with you. I think it'll be exciting but I think it'll be really scary.

**MARIE:** Scary, but exhilarating

**CAPTION:** MAIDEN FLIGHTS

**ANGELA:** When you're floating around in a ton of metal, it's reassuring to know a bit of the science that keeps you up there.

**ANGELA LAMONT:** The theory of flight covers some really important stuff like: how do you get up in the air, what keeps you there, and what happens if the engine breaks down? Useful stuff for passengers to know, but essential for pilots as two complete beginners are about to find out.

**ANGELA V/O:** Marie and Tracy both work in the Royal Berkshire Ambulance control room in Wokingham. When an emergency call comes in, it's up to them to decide which ambulance to send, and that doesn't always mean one with wheels.

**CAPTION: MARIE MARSHALL:** I've actually been up in the air ambulance and thoroughly enjoyed myself in that, obviously I know it's not the same as flying the thing but it was just amazing what they can actually do.

**CAPTION: TRACY HYSLOP:** When we first found out we were going to get the air ambulance, we all had to go up to give us an idea of what it was about, and I was just amazed by the experience, really how far you could see. In fact I was so taken with it that when I went back to work I actually handed in my notice to my boss and said that I was going to be a pilot, and that was it.

**V/O:** Well Tracy hasn't actually given up her day job but she and Marie do want to find out what it's like to be pilots.

**MARIE:** I'm looking forward to it, the actual sitting in the driving seat, so to speak, and taking over the controls, and actually how it works.

**TRACY:** Well I am a little bit concerned because Marie is a very fast driver and I'm concerned that perhaps that's going to transfer to her being a very fast helicopter pilot.

*(CONVERSATION IN HELICOPTER)*

**ANGELA:** Anyone who wants to be a pilot has to study the science of flight and the first question always is how does a plane or helicopter stay in the air?

**TRACY:** I don't know how they stay up there, I know that they do, and I'm relieved that they do, but I don't know a lot about it.

**ANGELA:** To get into the air you have to overcome the pull of gravity. To do that the rotors send a huge amount of air rushing downwards – believe me, I can feel it – and this creates an equal and opposite force pushing up on the rotors until the helicopter goes up. And for pretty obvious reasons, this effect is called lift.

**CAPTION: PETE CUMMINGS, ROYAL BERKSHIRE AMBULANCE PILOT:** As far as we're concerned lift is what we produce to get two-and-a-half tons of helicopter up off the ground and accelerated into forward flight. The blades are responsible for producing in a helicopter both the lift and the thrust, giving speed.

**TUTOR:** The basic thing about a helicopter is that it's much more simple than you probably thought, OK. We just fly by using a wing and we push our wings around in a circle, in a rotary motion, so they're called rotors and the big secret with a wing is that you've got to keep it moving through the air. If you've ever stuck your hand out of a cold window, you'll know exactly what a wing is doing. If you put it out of the window and it's really flat, then it slides through the air quite easily, and if you increase the angle of your hand, it's harder to push it through the air, but also you feel some lift as well.

**ANGELA:** Rotors are like the wings on an aeroplane. If you look at the end of a rotor it's got this streamlined shape called an aerofoil. It's the curvature on this aerofoil that gives a smooth flow of air over the rotor. Whether it's a rotor or a wing, it's the aerofoil that generates the lift. The shape and angle of the aerofoil in flight makes the air flow faster over the top surface than underneath. The faster the air flow is, the lower the pressure, and the difference in pressure between the top surface and the bottom means that the aerofoil lifts up.

**MAN:** Because of the conservation of energy that faster flow has to get the energy from somewhere and it gets it from pressure, so the pressure goes down to enable the faster flow over the top, and the differential in pressure gives you the lift.