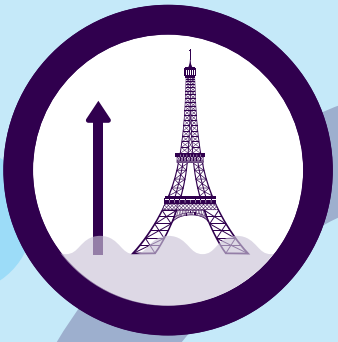
I'm a Scientist Get me out of here



Climate Warming - Ban flying?

The Royal Institution Science Lives Here

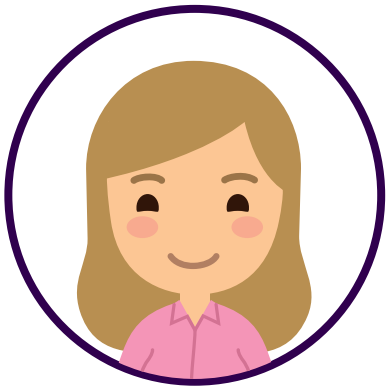
IBM

Lloyd's Register Foundation

UK Research and Innovation

This kit has been produced by the award-winning I'm a Scientist team on behalf of the Royal Institution, supported by funding from Lloyd's Register Foundation, UKRI and IBM.

Naomi Brookes Historian of Science



I study the history of science, and how technology develops. It tends to stop and start. It's impossible to predict. Powerful batteries are very heavy, which means that current electric planes can only fly about 100 miles. It's better to take the train for that distance. We don't know when, if ever, lighter batteries might be invented, or other types of zero-emissions planes. I think a ten year ban won't work and we should ban short haul flights instead - flights of less than 800 miles. That's about the distance from London to Barcelona.

Fact: People have been saying that clean, powerful nuclear reactors that work by fusion instead of fission would be available in 30 years, for about 70 years. But they still aren't here.

Issue: We don't know when usable zero-carbon planes will be invented. It could be never.

Question: Is it sensible to make policy on guesses about future inventions?

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Terry Griffiths
Retired plumber

I don't agree with a ban. I worked hard all my life, and saved up. As a plumber I often worked all over Christmas, for emergencies. I worked lots of overtime. Now I'm retired, me and my wife are doing all the travelling we always dreamed of. We've been to Florida, we've been to China and seen the Great Wall. We've been on safari in Kenya and seen elephants and lions. It's been magical. And also international tourism employs millions around the world. There's other things that emit a lot more carbon than flying. Don't take away our dreams!

Fact: Aviation causes 3.5% of global warming. Heating and electricity cause 30% of Greenhouse Gas emissions.

Issue: I worked hard all my life, planning to travel when I retired. It's not fair to take that away.

Question: Why pick on the things that will affect me? Why not work on improving building designs so we use less CO_2 for heating?

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Szani Márai
Musician

I love music, and play the guitar, the fiddle, and keyboards. I make my living composing music for TV shows, and a bit of teaching. My passion is music from different cultures - from Northumberland clog dances to Mongolian throat singing, I'm fascinated by all of it. Travelling is my one extravagance. I don't have a car, and cycle everywhere. I eat vegetarian. I recycle and reuse as much as possible. But I do take one long haul flight a year to immerse myself in a new kind of music, and expand my musical horizons.

Fact: The average domestic car emits as much CO_2 in one year as one long haul flight.

Issue: I don't agree with a ban, I think it should be personal choice. I would happily give up many other things, if it meant I could keep my travel.

Question: Why are we looking at one particular issue - flying - instead of looking at our wasteful consumer culture.

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Ejiro Okocha
Architect

I live in Lagos in Nigeria, one of the fastest growing cities in the world.
It's my passion to design beautiful buildings for people to live in. But more and more my city and other parts of Nigeria suffer flooding. There's more extreme weather. It's hotter in the summer, and malaria is worse. Climate change is impacting us in the global south the most, but it's not us who are emitting all that carbon!

Fact: On average, North Americans flew 50 times more miles than Africans in 2018. Europeans flew 25 times more miles.

Issue: It's not fair that high-income places, like the USA and Europe, emit the carbon, but less developed countries, like mine, suffer the consequences.

Question: Why won't people in Europe take drastic action to reduce their carbon emissions?

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Errol Watson - GP

I'm a doctor in Bristol. My mum came here from Jamaica, in the 60s, to work as a nurse, in the NHS. She loved her years here, mostly, but when she retired, she moved back to Jamaica. She said her old bones needed the sunshine. I'm staying here. I was born here, my kids, wife and friends are here. And my job, which I love. But once a year we go on holiday to Jamaica, and I get a hug from my mum. I'm against a flying ban, but I'd be happy to pay more for my flights, to discourage people who fly a lot.

Fact: Almost 5 million people born in the UK now live in other countries. 57% of people in the UK have friends or family living abroad.

Issue: Banning flying has a disproportionately big effect on people who - through no fault of their own - have family members who live far away.

Question: Can you imagine not seeing your mum for ten years?

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Diego Cortez
Former flight attendant

I think climate change is out of control, and we need to be looking at drastic measures, or we are not going to survive. I looked around and realised there was no future in the aviation industry, and I retrained as a paramedic. Given that the world is practically on fire, I don't think a ten year flying ban is even that drastic! It's a pause. A time for technology to step in, and solve the problem for us. A bit like how lockdown bought us time to develop a COVID-19 vaccine.

Fact: 9 out of the 10 hottest years on record have been this century. To have a hope of keeping to 1.5°C warming, we need to get to zero net emissions by 2050.

Issue: This may seem like an extreme idea. But I think our situation is extreme and we need to take drastic action.

Question: Do you want to be telling your grandchildren that they live in a world with vast areas uninhabitable, because we aren't willing to make tough decisions?

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Bablu Sayontoni Anti-airport Campaigner

I started off interested in this because I live near Heathrow, and I didn't want even more noise and pollution. I'm a postman, not some long-haired hippie! But my daughter took me along to some meetings, and the more I found out, the more I think flying is a bad idea. It's so bad for the environment. Me and my neighbours don't fly, we can't afford it. Most people in the world do not fly. It's a small number of people making all this pollution.

Fact: Only 11% of people, worldwide, took a flight in 2018. 1% of people cause 50% of global aviation emissions.

Issue: Flying causes a massive output of CO_2, for the benefit of a relatively small number of people.

Question: What is so essential about being able to holiday on the other side of the world, that it's worth this damage to the environment?

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Olivia Braithwaite
Sheep farmer

The farming industry has done a lot in recent years to reduce our emissions. However, producing food just releases a lot of CO_2, and it takes a lot of work to reduce that even a little. But everyone needs to eat! Whereas no-one truly needs to fly anywhere. I think people fly much more than they need to, because there are so many cheap flights. There are other forms of transport. And you can holiday in the UK. Banning flying would be an easy way to reduce carbon emissions in one big go.

Fact: Aviation fuel (unlike other fuels) is not taxed. I pay more tax, paying for the petrol to run my Land Rover, than British Airways do for all their planes.

Issue: Unlike other things that release CO_2, flying is unnecessary. Everyone could live without holidays to Thailand, or Tenerife.

Question: If we leave it up to individual people's consciences, do you think climate change can be stopped?

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Kit N°16

Teacher Notes

Question:

"Should flying be banned for ten years?"

Lesson plan

The different 'rounds' of the debate help students think through the issues and reconsider their opinions. The structure also shows them how to build a discussion and back up their opinions with facts.

Starter: 5 minutes.

Have they ever been on a plane? Where did they go? What do they think are good and bad things about flying? How would you travel to Australia if you couldn't take a plane?

Main Activity: 35 minutes.

1) **Split students** into as many **groups** as characters you want to cover.
2) **Give** them their **character cards** - one per group, and give them a few minutes to read them over.
3) Get one student in each group to **read out** their **first section** to the rest of the class.
   What are the class's initial thoughts? Is there one position they identify with or reject?
4) Take it in turn to **read out** their **fact**. Does it change the way they think?
5) **Read** the **issue**. Any different feelings?
6) Each team **asks** their **question to** the **character of their choice.**

Support: To help students you can put the following prompt sentences up on the board:
"I think flying should/shouldn't be banned because....."
"I think ..... is the most important point to think about."

Plenary: 10 minutes

Vote for which position they agree with most (if there is one). Why? Which arguments were the most persuasive?

Note – Pupils can stay in roles all the way through debate, or only for the first round if you prefer. If it's all the way through, give them a chance to express their own opinion at the end and in the plenary.

For groups who are not confident at class discussion, it might help to have them start by discussing the question and/or their character's position in pairs, and then compare notes in fours. They've then had chance to rehearse some of what they want to say before having to do it in front of the whole class.

Designed for KS4. These debate kits have been used with ages 11-18.

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Background notes for teachers

Welcome to our 16th debate kit. This one looks at whether we should temporarily ban flying, as part of our efforts to tackle climate change. As you may have seen, in the 2020 Royal Institution Christmas Lectures that this kit accompanies, climate change is serious, and the need for action is urgent. We need to consider fairly drastic measures to have a hope of keeping warming to 1.5°C or even under 2°C.

Most information to inform the discussion should emerge in the debate, from the cards your students will read. But we explain some points in a bit more detail here. There's also some useful links and embedded videos in the online page to accompany this kit.

Why focus on flying?

Flying is unnecessary - Overall, as we discuss in the kit, other sectors like agriculture do produce more CO_2, however, producing food isn't optional. People need to eat in a way they do not need to fly. In surveys, even the people taking the flights regard half of their flights as unnecessary. There are other means of transport. If we have to make drastic changes, this seems an easy place to start cutting emissions.

It mainly affects a relatively small number of people - 4/5ths of the world's population have never been on a plane. Even within the UK, 50% do not take any flights in a given year. (We don't know if most of those people do not fly every year, or if they alternate, with most people taking one flight every other year - as the survey data has not been gathered).

It's also unevenly distributed - 85% of people in the UK have taken 0, 1 or 2 flights in the last year. Whereas the 15% of people who have taken 3+ flights in the last year, are responsible for 70% of all flights. A less drastic solution than banning flying would be a frequent flyer levy, to allow people to see their far flung loved ones occasionally, but cut down the number of flights overall. Obviously, globally, most of the people flying are well-off people in developed countries. And in the global south, in countries feeling the earliest effects of climate change, most people do not fly.

Radiative forcing - in short, the emissions from planes are worse as they (mostly) happen high up in the atmosphere. Radiative forcing is the difference between solar irradiance (sunlight) absorbed by the Earth and energy radiated back to space. What matters to the climate is the amount of radiative forcing, not the amount of greenhouse gas, per se. Planes are releasing not just CO_2, but also water vapour, nitrogen oxides (NO_x), and other gases. Some of these, if they happened at ground level, wouldn't have much effect. But high in the atmosphere, they absorb sunlight before dissipating, and contribute a small but measurable amount of warming.

Timescales - Different activities emit different greenhouse gases, which affect global warming in different ways, and on different timescales. In order to compare these 'apples to oranges', researchers calculate 'carbon equivalent emissions', basing their calculations on the effect on the atmosphere 100 years from now. Some of the emissions from aviation (vapour trails, NO_x) break down more quickly than CO_2, but they contribute to warming before they do.

This means that if you look at the five or ten year effect, aviation is WAY more emitting than if you are looking at the 100 years effect.

BUT, arguably, the shorter timescales are what we need to be thinking and acting on right now, to avoid a more than 1.5°C rise by 2050. Restricting aviation would have a bigger effect on global

warming, over the short term, than banning something else that emits 3.5% of global 'carbon equivalent emissions'.

And partly, that short-medium term matters, because a number of things are triggered by an initial amount of warming (forest fires more likely, ice caps melting), that mean more CO_2 is released. Then that accelerates the warming.

Why BANNING flying?
There are other suggested ways of reducing emissions from aviation. Primarily:-

1. Banning short haul flights
2. Introducing a frequent flyer levy

We always try to make our debate kits finely balanced - so that reasonable people could go either way on it as that makes for a more interesting discussion in the classroom. A recent survey showed a majority of Europeans support a ban on short haul flights already. And the UK Climate Assembly voted strongly in favour of a frequent flyer levy. We decided it would therefore be difficult to make a finely balanced kit on either of those proposals, so we've gone for a more extreme proposal.

Why ten years?
Two key reasons:-

We need to make urgent, drastic changes. According to the IPCC, we need to be carbon neutral by 2050, in order to keep the world to 1.5°C of warming. They predict we need to be at 49% of 2017 CO_2 emissions levels, by 2030, to meet that, and to avoid possibly 1.5°C of warming by 2050.

It gives us time to develop zero carbon aviation. A pause, for now, doesn't need to mean flying is banned forever. But it reduces emissions while we wait for a low-emission replacement technology to be developed.

'Global South' - a note on terminology
We've used the term 'Global South' in this kit, to refer primarily to lower and middle income countries. There is no perfect terminology here. "Third World" is widely regarded as out-dated and insulting. "Developing" countries/world is also regarded by many as patronising as it implicitly positions all the countries in the world in a kind of hierarchy, with certain nations at the top and all the others aspiring to be more like them. Global South is regarded as a more neutral term by some. Although it has been criticised for being ambiguous.

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This kit has been thoroughly researched and fact-checked with relevant experts. With many thanks to Dr Alice Bell and Leo Murray of climate change charity Possible, Anna Hughes, of Flight Free UK, Dr Stuart Capstick and Dr Katharine Steentjes of Centre for Climate Change and Social Transformations (CAST) at Cardiff University.

We also consulted research and publications from the International Air Transport Association (IATA), Airbus Aerospace, Heathrow Airport, and the National Travel Survey, from the Department for Transport.

There are links to further information, and references at flying.imascientist.org.uk

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Kit No. 16

Science Debate Kit: Climate Warming - Ban flying?

"Keep these kits coming please!"

For in-depth resources on this debate go to: flying.imascientist.org.uk

Debate Kit: Ban flying

Should flying be banned for ten years?

A structured practice debate on a controversial topic.The different 'rounds' of the debate help students think through the issues and reconsider their opinions.The structure also shows them how to build a discussion and back up their opinions with facts.

You can use all eight characters, or fewer, as you wish.

The minimum is the four essential characters **(in bold)**, this gives two for and two against.

Characters

Yes	No
• **Bablu Sayontoni - Anti-airport campaigner**	• **Errol Watson - GP**
• **Olivia Braithwaite - Sheep farmer**	• **Naomi Brookes - Historian of Science**
• Ejiro Okocha - Architect	• Terry Griffiths - Retired plumber
• Diego Cortez - Former flight attendant	• Szani Márai - Musician

Facilitation tips

- Ensure pupils know there is no right or wrong answer.
- Be observant of ones who want to speak and are not getting a chance.
- Encourage students to give a reason for their opinions.

Designed for KS4 but can be used with ages 11-18.

For groups who may need extra support you can put the following prompt sentences upon the board:
"I think we should/shouldn't ban flying because..."
"I think …… is the most important point to think about."

Learning notes

Learning objectives:

- To practise discussing and debating issues and expressing an opinion

Other learning outcomes:

- Consider social, ethical and factual issues in an integrated way
- Think about different points of view
- Learn to back up opinions with facts

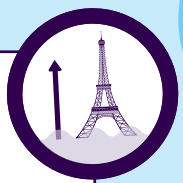
Curriculum points covered:

Thinking scientifically

- Evaluating the implications of technological applications of science
- Developing an argument
- Reflecting on modern developments in science

Substantive

- Consider social, economic and technical issues around climate change and the effects of human activity.



"Particularly like the format plus the accuracy of the scientific information"