

# CHRISTINE BICKERSTAFF

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## Introduction

In line with the Aeronautical Society policy on fairness, the next speaker's from Airbus. Christine Bickerstaff is on the Airbus Research and Technology Team covering operations, infrastructure and the environment working on a major task looking ahead to see how Airbus can design aircraft and contribute to the development of related aerospace activities to reduce the impact on the environment. She's a physicist, with 29 years' experience of engineering in the aircraft industry, and she's particularly interested in how to accelerate economically and safely the uptake of technology to improve environmental performance.

## Christine Bickerstaff

Thanks, hello everyone. Well, yes, it is 29 years and 4 months in the industry and I was actually involved in the whole... one of the subjects of sustainability - *noise* - for even longer, I'm sorry to tell you.

The first work I ever did inside a predecessor of Airbus, in fact in BAC, was associated with *community noise trying to reassess what could be possibly done in the way of shielded aircraft*. So, I have a very long experience of trying to estimate what will be the effects of changes and trying to work out with other people whether it is worth it.

Another thing that shows my age is that I was associated with the assessment of whether we'd ever have a *supersonic son of Concorde*. I don't know whether you think I should be happy or sad that my calculations of noise have prevented us, at least at that time, with the kind of engines we could manage to devise with Rolls Royce and SNECMA.

## AIRBUS VIEW/ ARE WE ON OUR WAY TO SUSTAINABLE DEVELOPMENT?

We've been agonising inside Airbus on "*what does sustainable aviation mean?*", because we've been trying quite hard to not only think about what we've been doing and what we are doing right now as we lead up to the A380, but, even in these difficult times, we're trying to think ahead for the future.

## WHAT IS NEXT? - AIRBUS CONSIDERS A RANGE OF POSSIBILITIES

So what is next? *Hydrogen-powered* planes were mentioned. That is a subject where we have decided that we *need to know a lot more about the atmosphere* before we spend much more on the other sides, like the engineering of the aircraft itself and even how to cope with the arrangements on the ground.

Some of the things we are thinking of are going to definitely *remain paper planes*, just because we've had to be so directed in respect of what we're doing on the A380. Don't imagine that we don't have a future project office that really tries to look at different things.. It does do so. On the other hand, some of what they want cannot possibly come to pass.

## DISCUSSING WHAT AIRBUS HAS SAID TO THE RCEP

We've been responding to the *Royal Commission on Environmental Pollution* and, in fact, to other people who've asked us, like the *Greater London Authority*, I've

bothered to show *what we've actually said*, because we don't necessarily agree with everything they've concluded. We've put in what we thought and we're telling you again what we thought.

So, obviously, we've summarised and said that we thought, that we'd improved our *environmental performance by research and design*, said how important it is. , It's nice to actually hear some of that coming back again (from the reports).

One of the practical sides of things is that it (air transport) is a pretty efficient means of transport, at least for some distances. Everybody must agree (being on an island, it does mean that there's this water in the way - a fairly important part), *long distances* are much easier by travelling by air.

There is a practical point, you may not like it, but people do *travel the long distances, because it is now possible to do so*. I'm old enough to remember travels that took 24 hours and they're not very funny. You wouldn't want to do it with your children, unless they were coming once every 10 years to see their grandparents in Europe or America, etc. You wouldn't want to do it again, it's not very funny that kind of long distance travel, if you have to stop very often.

(Referring to fuels) The words '*political instabilities*' was said to the Royal Commission on Environmental Pollution last year, before we had the war in Iraq.

We've made considerable efforts in research of noise and emissions and we are making considerable efforts inside the EU and ICAO and I'll come back to that.

#### SUSTAINABILITY: THE TRIPLE BOTTOM LINE

The Royal Commission asked several questions and most of them did have a bearing on *sustainable development*, which is why I've bothered to remind you what those questions were. You'll remember in a flash, because you all contributed.

We've got the problem that we're trying to satisfy lots of demands. This has been mentioned several times, so I'll flash past it. *We are trying to satisfy economical and social demands, as well as environmental demands*, and exactly what they are does depend on which country you're in. Even in one country you end up trying to balance your different industries and you have to decide how much you'll put up with in each industry.

#### AIRCRAFT DESIGN - LONG LIFE CYCLE

We said (to the RCEP) that we were a pretty *long life-cycle industry*. So, for people who don't quite appreciate how that's made up. The development of an aircraft is cheerfully said to be 5-10 years or so, but people in the industry know that often it's in the thoughts even years before that. Production – something can be in production 15-25 years, that's fairly typical. I hate to say it – in the old days when we weren't so good, things were in production for too short a time and we couldn't do it (well) and scrapped the aircraft after building hardly any of them. We don't want to be in that situation any more. The life of any aircraft might last 25-45 years. Some people might know that I'm actually trying to persuade those inside Airbus to try and seriously assess the value of the lifetime of the aircraft, because that's one thing that's crept up on us. The regulations need to be established on the basis of that, as Herbert said, and I agree with it too.

By the way, I won't say all that's on the slide in every case, because I'm trying to pick up just points off them. But, in response to this thing of "*will the projected growth outweigh the conceivable technological gains?*", we had to say that we did agree with

what was in the IPCC (report) and then we said that the industry was trying really hard and has these ambitious targets. We did say, "Treat us fairly and treat things in a global context".

#### RESPONSE TO RCEP ON GROWTH & GRAPH ON GROWTH IN AIR TRAVEL

This graph on air travel - it *will continue to grow strongly*. We haven't bothered to update it, because we don't know exactly how to do it. We'll expect a dip in it, we'll expect a slight shift, but we don't know what it is. We really don't see any reason to believe that it's going to be that much altered.

#### GRAPH ON "MANY AIRLINES DELIBERATELY MAINTAIN A YOUNG FLEET"

There's one side that nobody's mentioned at all, I was getting worried that every aspect would be covered by the time it came to me and you don't want to get just the Airbus view on it. One bit that hasn't been much mentioned is that *many airlines try to maintain a young fleet*; for instance, in Western Europe (that dark blue dashed line), so that by 2000 the average age of the aircraft in Europe was only just a bit over 8 years. This means that in practical terms, technological improvements have *an effect in things like noise and local emissions more quickly than in global terms*, because you don't usually throw the aircraft away, you turn them into freighters, so they may still be flying into the UK, if the UK isn't worrying about it. Or, you do sell them off to other countries, where they're less fussy. On the other hand, they may be flown slightly less, but that is an aspect of getting the technology in, that has more effect on the noise more quickly.

#### AVIATION PART OF GLOBAL PICTURE / SUSTAINABILITY: TBL/ AIRCRAFT DESIGN

Aviation's part of the global picture - back to this fact that we're trying this balance all the time - on economy and social and environment. Aviation's one of the things that we really think matters and has great international significance and we can't imagine wanting to get rid of too much of it. I'd never actually met Jonathan Porritt, until very recently, so I'd imagined that what he would be saying would be, perhaps, the opposite of what I wanted, but he's actually taken a very positive attitude and tries to see what can be done.

We obviously have lots of impacts. The ones that really matter are the *operations (operational use of the aircraft)*, but there are all the other areas. Herbert went through them in detail for Boeing, so I don't have to go into them much, but, as far as energy goes, the operations are the key feature, and, if we're looking at climate change, absolutely categorically, yes, it's with the operations that you need to concern yourself.

I've been very interested in other areas as well, because there are *other sustainability issues* and some may come to haunt us, if we don't worry about them. Mike Steeden this morning mentioned the other work that's been done on which we made a presentation on last year in "*Rising to the Environmental Challenge*". That was really *trying to interest the wider set of people in sustainability issues*, because most people can't do a thing about the climate change. It's only Boeing, Airbus, Rolls Royce and a few other big players plus, of course, the people who are pressuring us, who can do something about it.

But there are the other sustainability issues, which may become very expensive to the industry, and are of great interest to *small and medium-sized companies*, who don't want to go out of business, because we haven't thought of them (the issues). The whole idea on design is that, yes, it's very innovative, it's very important, it makes lots of new technologies, it's huge for partnerships, particularly in Airbus. We

need to understand more and more those stringent environmental demands, not requirements that someone's written for us, but the real demands. Of course, there are practicalities – though we don't know exactly how much each really matters, we have to ensure they're balanced!

## AIRCRAFT DESIGN – ENVIRONMENTAL REQUIREMENTS

### LOCAL REQUIREMENTS

The local requirements, I'm still having *noise* at the top, because that is, for instance, in respect of the A380, which I'll be talking a little bit about, that's a very serious and important issue for us. *Air quality* around airports, this is so important in the UK, because it's come to a head at this stage. The EC directives came into place, the UK laws have come into place and drawn it very much to the attention of the Government and, of course, people owning airports are having to calculate those effects.

Additionally, we've been talking to people like the British Airports Authority about the effects of *ground operations* and also talking to airlines about *maintenance repair and overhaul* - maintenance, recycling and disposal are all really important issues to us and I'll describe them a bit more (later).

### GLOBAL REQUIREMENTS

The global requirements, yes, at the very top is *global warming*. I mentioned the *ozone balance*, because, if we did ever go to supersonic aircraft at all, that would be of some consideration. I put in brackets *fuel use* for the reason that's already been argued today, which is that we don't actually think we'll run out of kerosene quickly and it will be easier to shift other industries and leave us the kerosene, if absolutely required.

There is this nasty thing at the bottom which is – “*is there always a technical solution?*”.

### NOISE

Noise has been a huge part of our design process, so from concept to definition going round and round the loop of the aerodynamics of performance, structure and maintainability and trying to trade off. That continues on in development, still testing at huge expense in cooperation with engine manufacturers, to produce our aircraft.

### ENVIRONMENTAL TRADEOFFS

Tradeoffs have been mentioned and it really is important that people realise it isn't only between the environment and the economy and that we're just weak and we have got these technologies up our sleeves and don't want to pay for them.

There really are serious tradeoffs between the *noise and NOx* and *NOx and CO<sub>2</sub>* and *noise and CO<sub>2</sub>*, to such an extent that on our A380 we really are carrying a bit of extra penalty, very particularly because we want to be able to fly out of airports like Heathrow.

### A380 NOISE-RELATED IMPROVEMENTS

We've done a huge amount on noise-related changes from the engine size, where we've *increased the fan diameter to reduce the jet noise* which means that you've got to put an effort into the turbomachinery to compensate and into the *nacelle* improvements, lengthening that which you don't get for nothing - you get your *noise improved by increasing your drag a little bit*. We are also aiming at having *no splices in the inlet*, so that the actual liner is not divided into any bits, so you can fit in as much liner as possible.

That's engine side of it, so coming to the aircraft, the other side of it. The aircraft - it really does matter what you're doing on the design. We've optimised *the wing tip device, the high lift system*, and, if we need it, we've got other *airframe noise reduction items identified*.

#### NEW NOISE REDUCTION TECHNOLOGIES (NOISE LEVELS), AIRPORTS WITH NOISE ABATEMENT PROCEDURES & A380 NEW AUTOMATIC NOISE ABATEMENT PROCEDURES

It's not only the certification figures that people are interested in, they're also interested in the *whole noise climate around the airport*, so we have put an awful lot of effort for the A380 into the *flight management system* to optimise the takeoff performance and the noise abatement procedures.

Going back to what we have done, I've cut out all the invidious comparisons with Boeing and Airbus by the way, I'm just comparing Airbus aircraft. In going to a much heavier aircraft for the *A340-600 compared to the -300*, we still got quieter aircraft departure noise, that's the sideline and under the flight path takeoff noise (averaged). We were ambitious enough to think, and then remembered that we damn well had to do it, that we were really going to have to make the *A380*, despite being the much heavier aircraft, *just as good*. That is an *enormous achievement, when you look at the takeoff weights*. Some people don't appreciate our efforts.

While looking for the A380 target airports we found that most of them - there were 24 target airports - nearly every single one, wherever you looked in the world, happened to have *noise abatement procedures*. You can see the only ones that didn't have them were a few in Asia.

We did put this effort in. We put a huge effort, because of the fact that we know that there's really non-optimal handling of noise departures. So, we've tried to make it, so that the pilot can't get it wrong. The whole idea is that there'll be a *flight management system that will reliably and reproducibly handle those noise abatement departure procedures with noise-optimised trajectories*. We're trying to make it, so that just before the flight the pilot does choose appropriately, we make it as easy as possible, so that you end up having allowed for the actual day conditions.

I hate to say it, but I am so old that I remember that this technology isn't that new, because Concorde was so noisy that we've had to be doing this for quite a while.

#### FUEL CONSUMPTION IMPROVEMENTS & A380 NOMINAL EMISSIONS

Some of you aren't interested at all in the noise bit, because you say it's the other sustainability that you're worrying about and, again, not generalising, but looking at the fuel improvement on our own aircraft, it has been fairly remarkable.

The other side is the actual *emissions*. That is a summary of the nominal situation on emissions, "nominal" means that Rolls and Pratt & Whitney and GE have guaranteed to us, but we have not allowed anything else on top of it. By the way, that makes it look as though Rolls isn't as good as the other engine, but we think that Rolls is very pessimistic and will come out all right in the end.

People have been talking about what's the benefit of CAEP(ICA0's Committee on Aviation Environmental Protection). The advantage is that it does really push you into trying very hard, and sometimes it's very hard. Rolls is being suitably pessimistic at the moment, for instance, in respect of smoke.

### RESPONSE TO RCEP RE SCIENTIFIC UNCERTAINTIES

Scientific uncertainties – there are lots of them. We tried to answer that question to the Royal Commission on the principal impacts in flight and this is a summary of our longer input. We said that those ones on the top are the ones (CO<sub>2</sub>, NO<sub>x</sub>, H<sub>2</sub>O, contrails & cirrus) that we think matter, and, that we really did appreciate that there wasn't enough information on contrails and cirrus and we did need to understand them, because of our long timescale.

### MOZAIC PROGRAMME

We didn't wait until last year, we have since 1990 been supporting work on the *MOZAIC programme measuring ozone and other gases (NO<sub>x</sub> included)*. So that's been a long-term commitment.

### NOISE REDUCTION TARGETS/ AWIATOR EC PROGRAMME/ RESPONSE TO RCEP ON TECHNICAL DEVELOPMENTS

We also emphasise that we thought most immediate effects could be *through air traffic management improvements* and as a practicality of our thinking that it's a good idea, most of our modern aircraft are equipped with loads of equipment, which is there - if only we could make the air traffic management use it. What is more, we can retrofit (older aircraft).

### ACARE

This advisory council (I'm sorry to tell you that Lagardère has died recently, one of the signatories) but it's a huge commitment and it's very frightening to the industry, because it's such a huge commitment. I hope that we will be encouraged by the top people knowing and realising that the demands are so hard.

### RESPONSE TO RCEP RE ALTERNATIVE FUELS OR AIRCRAFT TYPES

In respect of possible alternative fuels or aircraft types, we have been doing work on what was called the *CRYOPLANE*, but we pointed out to the Royal Commission that we are pretty keen to know whether the water that will be put out at altitude would be more trouble than it was worth. We are actually working now on the atmospheric. One of the sides we're very interested in is the *water emissions*, because that is in addition to all other points that people have already raised about it (general viability).

The other practicality is that you *need renewable energy for the hydrogen*, otherwise you're doing no good to the global side.

While we were at it, we thought we'd tell them (RCEP) that we're definitely not doing any *nuclear power (aircraft)*, just in case you're wondering.

*We do always investigate alternative designs*. I think that John Green doesn't really believe we do these things, but we have got future project teams that are looking at a very large range of alternatives.

I must point out the *time and expense to assess such designs thoroughly*, because it's no good just doing it as a baby paper exercise. You have to try and work out how you could get it in to a viable production aircraft, and that's a huge thing. It's not like it used to be in the days when you just somehow built a few things. If you're lucky, you're actually in America and you do it for the military and then eventually, 25 years later, Boeing can do it for the civil side. We're not there in just knocking up brilliant ideas and then turning them into viable production aircraft; it's very, very difficult.

In case you're wondering, we still have got some *low key work on supersonic aircraft*. There's dedicated research on that, so there's dedicated research on *atmospheric impacts*. We're looking at tradeoff with local impacts.

## DIALOGUE WITH STAKEHOLDERS

One important part – and what I've been trying to do in the UK in the last year particularly – is trying to have a really serious dialogue with the stakeholders. This is Airbus's approach, we've been discussing with all the stakeholders, but it's been very important, because the UK (Government) has been looking at several areas very strongly.

## AIRBUS WAY – ENVIRONMENTAL REPORT

This comes from our report, some copies of which are outside in case you want to read it; so obviously (dialogue) with our customers, with the authorities, and that's the point I'm referring to (pointing to authorities) the UK is pushing several areas, but I'll refer to that more in a moment. The shareholders themselves are other stakeholders. Employees are very much more aware and need to be even more aware, because people at the top can wish anything they want, but middle management can definitely subvert it and at the low level ignorance can definitely subvert anything that you're trying to do. The passengers and society at large (are also stakeholders).

Last year we did put out our *first corporate environmental report* and tried to cover three main areas; one is that we're setting up a much stronger organisation inside Airbus to deal with environmental matters.

*Philippe de Saint-Aulaire* is the *Head of Environmental Affairs* – we call them GDN, we use siglums (letters indicating area of responsibility inside Airbus).

*Rainer von Wrede* is *responsible on the technical side*, so that's more the actual aircraft technologies - things like global and noise and local emissions and so on.

We've got *Bruno Costes* on the manufacturing side, *responsible for what all the national companies are doing*. This is quite interesting, because it's been very difficult to persuade everyone that they would work together seriously, but all of a sudden it's clicked and it's very interesting to see French, German and British and Spanish working seriously together, because people had hidden behind the idea that the regulations and the rules were so different in different countries that they didn't need to really address this. But, in fact, it's a very important part. It's also very important how we work with our sub-contractors.

The other person you may have met is *Phillippe Fonta* on the communication side.

So we've tried to cover in our environmental report all the areas we think are of great interest, and, I've been rather pleased that the person, who was making sure that it all happened, gave us quite some commitments in it. So it's not eyewash.

## RESPONSE TO RCEP ON CURRENT PRESSURES

Continuing on, I said that I was going to make sure that you had a view of what we'd actually said to the Royal Commission because they obviously didn't agree with everything we said, so they didn't have to write it (in their report), did they? The biggest thing that we've considered about the pressures is that the *improvements to-date are really the result of competitive and market forces*, and, although I talk nicely to Herbert and Herbert talks nicely to me, there's no doubt about it, that it's a very big driver, and, if Boeing comes up with really clever ideas on the environment before we do, we'll be dead, and we know that. So there is the *competitive pressure* and you could say that it's just hotter. If you think that the way it's been going hasn't been good enough, possibly that's been because the competition wasn't hot enough and it's only in recent years it is.

*The whole design process is really to reduce fuel consumption, however the trends on fuel and greenhouse's gases will continue and we can see that we could accelerate it by what I've been indicating – we are looking at different designs. Though we do need to remember that some of the demands are actually quite counterproductive. We don't think that further fiscal pressures would actually accelerate research and better outcome.*

#### RESPONSE TO RCEP ON INTERNATIONAL ACTION TO CONSTRAIN GROWTH, etc

*“Should there be international action to constrain growth etc?” That was one of the questions asked and how do you demand it. If you constrain us too much, we won't do anything and you'll have your crappy old aircraft and none of them will be replaced and you won't be inserting any good new technology. We think that artificially constraining the growth could be counterproductive. I just beg people who have got economic models to try and do some of that modelling.*

I've heard people arguing, and we've heard it a bit today, in respect of what we think of ICAO and CAEP. We have to try and agree; we have to come to some agreement. We can see that the UK is trying to push ahead on some of these things but it's got to cooperate. Just on a practical level, we are a major company and we're not just based in the UK. We have to have agreement in how we're going there and we have to have agreement with the US. I welcome Carl (FAA) today and I hope he knows that in Europe people really do see it important to encourage the US to cooperate in dealing with and coming to a consensus on what we really think we have to act on. We can slave away as much as we like in the UK, but unless we can persuade people across the countries to act it will be of no use.

#### RESPONSE TO RCEP ON FISCAL PRESSURES

On the *fiscal side* we've supported the work that's been done, putting considerable effort into it in the CAEP studies. People have commented in respect of the Chicago Convention; some people say “scrap it”. Well, we don't agree, we think it's there for a good reason. We realise that fuel charges may well come up, we've been cooperating, although we wouldn't like it particularly. We realise that emissions trading might be something that could be done and that's what we've been saying and we've been cooperative in helping people assess that. But we do recommend that people think very carefully about too much criticism about international organisations instead of trying to contribute to building a consensus, because that's where we *need to have the consensus. We need the US, and the US has got to start agreeing with us, and we've got to start working and agreeing with them.* I realise that we're in a difficult situation (following 11 September) just at the moment, but that is a very important effort.

Airbus does support continuing the CAEP effort.

#### CONCLUSION

We're aware (of environment/ sustainability issues), we're trying to make everyone in our organisation aware, so that we can improve at all levels. We've put huge efforts into research and into future projects and we want to get a better understanding. We really do want to try and get to sustainability.

Thank you.

(Note: the underlined titles refer to the slides being presented April 2003. Transcript corrected by CMB Feb 2004.)