Finance and Corporate Services
Information Management

10 October 2011
FOIA reference: F0001234

Dear XXXX

I am writing in respect of your recent application of 5 October 2011, for the release of information held by the Civil Aviation Authority (CAA).

Your request:

> *"I would like to know what the planes are doing in the sky when they drop 'gas' of some kind into the atmosphere which then stays for a long period of time. This causes 'trails' across the sky.*
>
> *I have many photographs of this over long periods of time now.*
>
> *This is completely different to usual aircraft planes whose trails disappear into the atmosphere quite quickly.*
>
> *These trails can be seen for many hours after they have been 'dropped.'*
>
> *Under the Freedom of Information Act - I would like to know exactly what this is please and what the purpose of these trails are.*
>
> *As members of the public living directly underneath, we have a right to know what these planes are doing right above our houses, where our children are growing up".*

Our response:

In assessing your request in line with the provisions of the Freedom of Information Act 2000, we are able to provide the information below.

The CAA has no knowledge of, or involvement in, any operation to "drop 'gas' of some kind into the atmosphere". Based on the content of your request, I would suggest that you are actually referring to the formation of persistent condensation trails (contrails) by aircraft transiting along the Upper Air Traffic Service (ATS) Routes that are established over southern England.

Condensation trails, or contrails, are formed when water vapour, which is emitted from aircraft engines as part of the combustion process, comes into contact with cold air. Depending on the ambient atmospheric conditions, such as temperature, pressure and humidity, the water vapour may form cirrus clouds. These conditions vary greatly, even at the same altitude and a result of this would be that the contrails appear in an intermittent

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manner. Depending on such factors as temperature and wind speed, the cirrus clouds may develop further or subside.

The water ejected through the exhaust tends to raise the relative humidity of the air in the wake of the engines. On the other hand, the heat generated by the engines tends to lower the relative humidity by raising the temperature of the wake. In certain conditions the net result is to increase the humidity to saturation so that a cloud is formed which trails behind the aircraft. This type of trail can ordinarily occur only if the air temperature is below a critical value, which varies almost linearly from about -24 deg Celsius at sea level to about - 45 degrees Celsius at 50,000 feet. The critical temperatures, which are only slightly affected by the type of aircraft, apply to aircraft flying at cruising speed in an atmosphere just saturated with respect to ice; the corresponding temperatures for saturation with respect to water are lower by about 2 or 3 degrees. Contrails can occur exceptionally at temperatures above the critical values when the free air is supersaturated with respect to ice (i.e. the air contains more water which, if all frozen, the air could not 'hold), or when fuel consumption is greater than it is under normal cruising conditions e.g. with the throttle fully open.

Once a trail is formed, it broadens by diffusion. If the surrounding air is at or near saturation, the trail evaporates slowly or not at all and is then long and persistent. If the relative humidity is low, the trail only appears as a short plume behind the aircraft. It is not uncommon for the air to be supersaturated with respect to ice. Since the exhaust gases contain sublimation nuclei from combustion, any trail formed in these conditions is persistent and may thicken until the ice particles fall out as snow. However, the attainment of saturation of the atmosphere is not sufficient for the trail to become visible; condensed water or ice particles must be in sufficient concentration to be seen, and this further depends on illumination, background contrast, distance and other viewing conditions.

This phenomenon has been widely observed and reported over many years and there is much ongoing research into the impact of aviation on climate change including the effects of contrails and cirrus clouds. Further information on contrails is reported in the Intergovernmental Panel on Climate Change report on Aviation and the Global Atmosphere, Cambridge University Press, 1999 (http://www.grida.no/climate/ipcc/aviation/). A simpler explanation is provided in the Royal Commission on Environmental Pollution report on the Environmental Effects of Civil Aircraft in Flight published in 2002 (http://eeac.hscglab.nl/files/UK-RCEP_CivilAviation_Nov02.pdf - see page 13 in particular).

As well as water vapour (the primary exhaust emission), jet engines emit carbon dioxide, small amounts of unburnt hydrocarbons, oxides of nitrogen and carbon monoxide. Such emissions are regulated and the International Civil Aviation Organisation (ICAO) detail standards limiting the emissions from turbojet and turbofan aircraft in Annex 16 Volume II to the Convention on International Civil Aviation. The European Aviation Safety Agency (EASA) is responsible for certification of engines in the EU and will do so providing the engines meet the standards set out in the above Annex. European Commission Regulation (EC) No 1702/2003 sets out the applicable environmental protection requirements and certification specifications in Part 21A.18(b). It should be noted that EASA only certify engines for aircraft registered in the EU. Aircraft registered outside of the EU are certified by their own regulatory authorities. A databank containing information on exhaust emissions on aircraft engines that have entered service can be accessed through the following link: http://www.caa.co.uk/default.aspx?catid=702&pagetype=90

As alluded to above, there are numerous upper ATS routes established over the UK; these routes are published in the UK Aeronautical Information Publication (AIP) and can be accessed through the Aeronautical Information Service (AIS) website (www.ais.org.uk). To view the chart on the website, you will need to select UK AIP, then Enroute Information – ENR Index and scroll down to locate the "Upper Airspace Control Area and Upper ATS Routes (South Sheet)" chart in section ENR 6.3.0. For your reference, I have enclosed an

enlarged copy of this chart onto which I have marked the approximate location of your property with a red circle. It is important to note that the ATS routes are established as corridors and the lateral limit of each is 10 nautical miles. The level of separation provided to aircraft transiting within these routes is 3 nautical miles laterally **or** 1,000 feet vertically; consequently, aircraft will not necessarily follow the path as displayed on the chart.

If you are not satisfied with how we have dealt with your request in the first instance you should approach the CAA in writing at:-

Mark Stevens
External Response Manager
Civil Aviation Authority
Aviation House
Gatwick Airport South
West Sussex
RH6 0YR

mark.stevens@caa.co.uk

The CAA has a formal internal review process for dealing with appeals or complaints in connection with Freedom of Information requests. The key steps in this process are set in the attachment.

Should you remain dissatisfied with the outcome you have a right under Section 50 of the Freedom of Information Act to appeal against the decision by contacting the Information Commissioner at:-

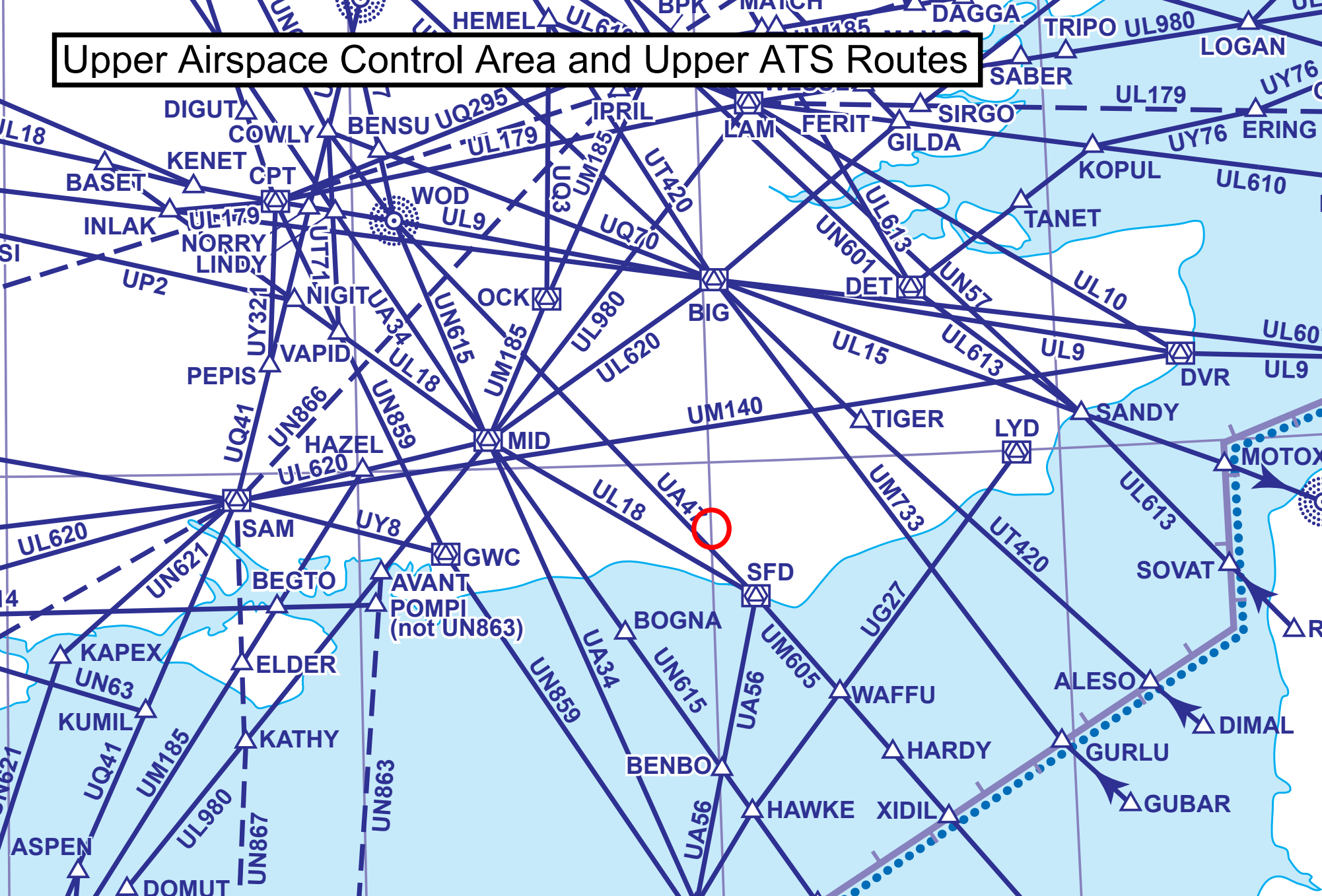
Information Commissioner's Office
FOI/EIR Complaints Resolution
Wycliffe House
Water Lane
Wilmslow
Cheshire
SK9 5AF
www.ico.gov.uk/complaints.aspx

Should you wish to make further Freedom of Information requests, please use the e-form at http://www.caa.co.uk/foi.

Yours sincerely

Rick Chatfield
FoIA & EIR Case Manager

CAA INTERNAL REVIEW & COMPLAINTS PROCEDURE

- The original case to which the appeal or complaint relates is identified and the case file is made available;
- The appeal or complaint is allocated to an Appeal Manager, the appeal is acknowledged and the details of the Appeal Manager are provided to the applicant;
- The Appeal Manager reviews the case to understand the nature of the appeal or complaint, reviews the actions and decisions taken in connection with the original case and takes account of any new information that may have been received. This will typically require contact with those persons involved in the original case and consultation with the CAA Legal Department;
- The Appeal Manager concludes the review and, after consultation with those involved with the case, and with the CAA Legal Department, agrees on the course of action to be taken;
- The Appeal Manager prepares the necessary response and collates any information to be provided to the applicant;
- The response and any necessary information is sent to the applicant, together with information about further rights of appeal to the Information Commissioners Office, including full contact details.

Upper Airspace Control Area and Upper ATS Routes