UK and USA collaborate in airborne climate science projects

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Birmingham scientists are taking part in the first scientific collaboration of its kind, where British and American scientists are trading skills and expertise and are using an unmanned robotic aircraft to gather high altitude atmospheric data.

Today (Friday 25 January) NASA is holding an event at its Dryden Flight Research Center in Southern California to showcase a number of Earth science missions to study climate change and air pollution.

One of the NASA campaigns, the Airborne Tropical Tropopause Experiment (ATTREX), has a sister campaign just starting in the UK – the Natural Environment Research Council (NERC) CAST project: Coordinated Airborne Studies in the Tropics.

The aircraft, a NASA Global Hawk, originally developed for military missions, will explore the tropical tropopause layer, the region where the Earth's air enters the stratosphere. This region is where pollutants and greenhouse gases are transported into and out of the atmosphere and can potentially influence our climate. The scientists will be studying these chemical and climate interactions, and will aim to discover how much of the gas moves up into storms, something we have very little knowledge of at present.

The science teams will programme the Global Hawk to fly into the most climate-sensitive and difficult to reach regions close to the equator, at an altitude of around 20km (approx. 65,600 feet) above the Earth – around twice the height of a commercial passenger jet.
UK lead scientist Dr Neil Harris from the University of Cambridge, said, *'We are the first UK group to work with NASA using the Global Hawk as a science platform. The project will be very efficient in terms of sharing equipment, expertise and data, and we expect the results to answer some fundamental questions about how the movement of atmospheric pollutants can influence the Earth's climate.'*

The Birmingham team will provide a model to simulate the behaviour of very high, very cold, almost invisible clouds which are important in moderating the amount of water entering the ozone layer, which, in turn, is important because water in the stratosphere can destroy the protective ozone shield. The new "drone" robot aircraft provides new ways of probing the air as it moves towards the ozone layer, challenging the model simulations with unique observations. Jointly with Lancaster University the researchers are also developing software to convert the drone's data stream into information for scientific decision-making in real-time, using novel pattern recognition techniques that do not need to "see" the whole data set before starting to extract patterns.

Professor of Atmospheric Science at the University of Birmingham, Rob MacKenzie, said: *'The Earth's water cycle is familiar to every schoolchild, but it still contains many puzzles. The CAST project will provide a unique insight into how water enters the ozone layer and so will help us predict how that protective layer will behave in a warmer-and-wetter future.'*

Two new instruments and software are currently being developed by researchers at several of the partner institutes, and will be fitted into the Global Hawk. One of these is GHOST (GreenHouse Observations of the Stratosphere and Troposphere), a short-wave infra-red spectrometer designed to measure greenhouse gas concentrations and the way they are transported through the atmosphere to and from the Earth's surface. It is being designed and developed at the Science and Technology Facilities Council (STFC) UK Astronomy Technology Centre in Edinburgh, and is a joint effort with the Universities of Leicester and Edinburgh.

Dr Hartmut Boesch from the University of Leicester, who is leading the GHOST project, said, *'The CAST project offers us a unique opportunity to develop an instrument using UK technology, that will address key questions about the transport of greenhouse gases and provide a critical link to satellite observations.'*

Over the next 12 months the research teams will be getting ready for the first CAST-ATTREX high altitude flights with the Global Hawk over the Pacific Ocean and South East Asia, which are planned for January or February 2014. The high altitude flights will be complemented by lower-level flying from the NERC /Met Office BAe-146 Atmospheric Research Aircraft, which is managed by FAAM (Facility for Airborne Atmospheric Measurements).

The FAAM aircraft will begin its research mission from Guam in the Pacific Ocean and land on the island of Chuuk for refuelling before flying to the equator and back. The Global Hawk has the advantage of being able to remain airborne for up to 30 hours, and can travel 20,000 km – a distance equivalent to half the Earth's circumference.

Notes for editors:
1. CAST (Coordinated Airborne Studies in the Tropics) - project partners are the Universities of Cambridge (leading), Birmingham, Edinburgh, Hertfordshire, Lancaster, Leeds, Leicester, Manchester and York, and the UK Astronomy Technology Centre in Edinburgh. They are collaborating on this project with NASA's Eric Jensen (lead PI) and Dave Jordan (project manager), who are leading the ATTREX project in the US.
2. GHOST (GreenHouse Observations of the Stratosphere and Troposphere) - project partners are the Universities of Leicester and Edinburgh, and the STFC's UK Astronomy Technology Centre in Edinburgh.
3. Information about the NASA event: **http://www.nasa.gov/home/hqnews/2012/dec/HQ_M12-235_Dryden_Earth_Science_Media_Day.html (http://www.nasa.gov/home/hqnews/2012/dec/HQ_M12-235_Dryden_Earth_Science_Media_Day.html)**
4. Images and further information about the Global Hawk
Fact sheet **http://www.nasa.gov/centers/dryden/news/FactSheets/FS-098-DFRC.html (http://www.nasa.gov/centers/dryden/news/FactSheets/FS-098-DFRC.html)**
Global Hawk image gallery: **http://www.nasa.gov/centers/dryden/multimedia/imagegallery/Global_Hawk/index.html (http://www.nasa.gov/centers/dryden/multimedia/imagegallery/Global_Hawk/index.html)**

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