Airlines are finally admitting contrails are an environmental problem

December 9 2022, by Kyle Arnold

Credit: CC0 Public Domain

Contrails—those lines of wispy white clouds that follow some jets—may not be so harmless.

Airlines and scientists are coming to a consensus that the water vapor

trails created by airplanes at high altitudes may play a big role in global warming. That's because those contrails, short for condensation trails, create clouds that trap heat in the atmosphere at the critical altitude where airliners fly.

In fact, contrail clouds may be a more significant factor in global warming than carbon dioxide or other fuel emissions, according to a European Union study measuring more than a decade of airline flights. It's part of an emerging field of study in climate science called "effective radiative forcing," which measures the total warming effect instead of the older standard of totaling CO_2 emissions.

Now airlines, including Fort Worth-based American and Dallas-based Southwest, are trying to figure out which of these contrails are most harmful to the environment and what, if anything, can be done about it while flying commercial jets full of passengers.

"Air travel has almost a double-sized impact on global warming than what we thought it was before," said Andrew Chen, an aviation specialist with clean energy nonprofit the Rocky Mountain Institute. "The most interesting dynamic is that the airlines are not shying away from contrails."

Carriers including American and Southwest are teaming up with a group of other aviation companies and the Rocky Mountain Institute to try to get a handle on the contrail problem. Other big airlines such as United, Alaska and Virgin Atlantic are joining the group along with plane manufacturers Boeing and Airbus. Google Research also is part of the effort. It comes after Atlanta-based Delta Airlines announced a partnership in October with the Massachusetts Institute of Technology to get a handle on the worst contrails for global warming.

The plan with MIT and the Rocky Mountain Institute project is to study

which flights create the worst contrails.

The airline industry has set ambitious environmental targets in recent years even after admitting that much of the technology to hit those goals doesn't exist yet. American Airlines and Southwest Airlines set a 2050 date to cut their emissions footprint entirely. To date, most of the emissions reductions that airlines have been able to achieve have been through using more fuel-efficient engines while waiting for a sustainable aviation fuel industry using recycled oils to emerge and research on hydrogen and electric engines.

Contrails present a new challenge, one outside of the traditional carbon emissions focus.

"The science around contrails has become more clear in just the last few years," said Jill Blickstein, vice president of sustainability at American Airlines. "For example, we've known for some time that some contrails formed in the morning can have a cooling effect and that contrails formed at night were more likely to be warming. But we didn't have a good sense of the net impact of all contrails. That warming impact has become clearer recently."

About 65% of jets flying at cruising altitudes of 30,000 to 38,000 feet create contrails, but most of those contrails dissipate within a few minutes and have little warming effect, according to Delta. About 10% of those are "persistent" contrail formations, hanging around for hours.

Contrails form the easiest at altitudes where planes fly the most efficiently because the air is thin.

But whether or not a plane makes contrails depends on a variety of factors, including temperature, altitude and humidity.

The worst contrails happen at night when the earth is naturally cooling without sunlight but manmade clouds at that critical altitude can block heat from escaping, Chen said.

"A small percentage of flights are happening at night, but those are creating the most contrails," Chen said. "And that's the worst time for it to happen."

Even contrails during the day are bad, though clouds may be acting to block some sunlight from reaching the surface, Chen said.

Pilots and airlines know how to avoid making contrails, but there are other factors that go into planning a flight, said Helen Giles, Southwest Airlines' director of environmental sustainability. Airlines have to factor weather, potential turbulence and speed, she said. Then they don't want to make a flight plan based on avoiding contrails when it would burn significantly more fuel.

Predicting contrail conditions 6 to 8 miles high is as precise as predicting weather at ground level. That is to say, good, but not perfect. It's complicated by the fact that jetliners are traveling at about 600 mph.

"We think it's important to engage in the science in this area," Giles said. "We want to understand a little bit better how we can predict the formation of contrails."

The plan is to use satellite imaging and airplane sensors to figure out when planes are making contrails and how long they hang around. Then they can figure out which conditions create the most contrails and combine that with data on weather, turbulence, speed and other factors.

"From an operational perspective, we think we know what we can do to mitigate the impact, but we want to see the modeling before we build a

plan around it," she said. "It's really difficult to weigh the impact of radiative forcing versus carbon dioxide from fuel burn."

Hopefully, minor changes in flying and route planning could keep planes from making contrails entirely, especially in conditions where the clouds do the greatest harm.

Southwest is forming a team to study the topic that includes pilots, dispatchers and network planners in addition to environmental experts, Giles said. Eventually, they hope to bring in the Federal Aviation Administration and other regulators that play a role in flying.

"The concept we're looking at is that we can avoid contrails by modest changes to the flight altitude," American's Blickstein said. "But there are many variables to consider, from the robustness of the model that is predicting the contrail will form and at what altitude, to the value and simplicity of the information we can provide to the flight teams and current weather and air traffic conditions.

"And that's just the start of a long list," she said. "We are at the beginning of what I expect will be a long learning process."