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5-8:Man-Made Clouds

Glossary

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There are many different types of clouds in the sky, but did you know that some of them are man-made? "Contrails" are the long, thin clouds that are left by airplanes as they fly past.

Contrails is short for "**condensation** trails." They are line-shaped clouds that are formed by airplane exhaust at high altitudes. Even though contrails have a high-tech origin, they have a very down-to-Earth cousin that almost everyone has seen. Have you ever gone outside on a cold day and been able to see your breath when you exhale? That little cloud is formed by

the water vapor in your breath, which is normally invisible. In cold weather, however, the vapor condenses into a visible cloud.

Contrails are formed in much the same way. Aircraft engine exhaust contains water vapor. Since temperatures are colder at higher altitudes, that water vapor condenses into a visible form-ice crystals. This leaves the streaks across the sky behind airplanes. The water vapor from the aircraft engine may also be joined by moisture already in the air. This makes the contrail larger. Contrails may occur as one of two different types, depending on the temperature and humidity of the atmosphere. If the humidity is low, then a short-lived contrail will form. Short-lived contrails are seen for a short distance behind the airplane and scatter quickly.

In higher **humidity** environments, a longer lasting contrail will happen. Ice particles formed by the condensation of the water vapor from the engine exhaust will be joined by water in the atmosphere. This will create a contrail that extends a



long distance behind the airplane. It can remain visible long after the airplane has gone. These contrails can last for hours and can even grow. They can spread for several miles. They can become as tall as the length of two to four football fields. These contrails can even continue to spread until they turn into cirrus clouds that you can't even tell apart from naturally occurring clouds.

Since contrails are made up of water vapor, they do not create any direct health risks for humans. However, some NASA researchers are looking into whether contrails may have a negative impact in another way. Contrails are man-made clouds. They add to the Earth's cloud coverage. As a result, they might affect atmospheric temperature and climate. Long-lasting, line-shaped contrails cover about 0.1 percent of the Earth's surface. This does not include the cirrus clouds that can evolve from contrails. Since contrails are most common in areas with heavy airplane traffic, however, the cloud cover they create is also much heavier in those areas.



Air traffic and contrail formation may continue to increase. NASA researchers believe that they could have a major impact on the environment by the year 2050. They are still looking into what effects contrails actually have. It may be decided that they have a harmful effect on the environment. Then, ways would have to be found to reduce that impact. One solution would be to plan flights away from problem areas. Researchers at NASA are also working with partners to create more efficient jet engines. These engines would greatly reduce the discharge created by air travel, which might help reduce contrail formation.

***Courtesy of NASA's Aeronautics Mission Directorate  
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## On The Contrail

**Subject:** Mathematics, Science, Technology

To graphically determine characteristics of contrails.

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## Cloudy Contrails

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To investigate the conditions that must be present for clouds to form.

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