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INFRASTRUCTURE



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HOUSE OF REPRESENTATIVES  
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Ms. Rosalind Ruth Peterson  
PO Box 499  
Redwood Valley, California 95470

DISTRICT OFFICES:  
1040 MAIN STREET, SUITE 101  
NAPA, CA 94559  
(707) 226-9898

317 THIRD STREET, SUITE 1  
EUREKA, CA 95501  
(707) 269-9595

POST OFFICE BOX 2208  
FORT BRAGG, CA 95437  
(707) 962-0933

712 MAIN STREET, SUITE 1  
WOODLAND, CA 95695  
(530) 662-5272

CAPITOL OFFICE  
119 CANNON HOUSE OFFICE BUILDING  
WASHINGTON, DC 20515  
(202) 225-3311

WEB <http://www.house.gov/mthompson/>

Dear Ms. Peterson:

You were one of several people who had contacted me regarding the number of contrails lingering in the skies over Mendocino and Lake Counties. Many of you were concerned that these phenomena may be caused by government testing of biological or chemical agents or by weather modification experiments conducted by the government.

I asked for your patience while I contacted government, academic, health care and industry experts in an effort to determine why contrails seemed to be more prevalent on the North Coast now than they were several years ago and what impact, if any, these contrails could have on our environment. I thank you for your patience and I would like to now share my findings with you.

**Contrails:**

Condensation trails, or contrails, are produced by aircraft engine exhaust. Contrails are mostly water, but also may contain carbon dioxide, nitrogen oxides, hydrocarbons, carbon monoxide, sulfur gases, soot and metal particles that are emitted by the aircraft.

There must be suitable weather conditions immediately behind a jet engine for a contrail to form: high humidity and cool air. The high humidity will cause water in the engine exhaust to condense on either the exhaust gases or other particles already existing in the atmosphere. If the air temperature is cold enough, these water droplets will freeze and form the ice particles that become a contrail.

If humidity is on the low side, the contrail will be short lived. If the humidity is high, the contrail will persist as the newly formed ice particles absorb water from the surrounding atmosphere. These persistent contrails can be quite large and can last for hours. Air turbulence can cause them to spread and disperse so that they resemble cirrus clouds or take on unusually shapes. Numerous airplanes passing through an area on established flight paths can all produce contrails that criss-cross one another in the typical and sometimes alarming checkerboard pattern. This all, in turn, can turn the sky hazy, a feature many of you have commented on.

These contrails, consisting as they do of ice particles, can also reflect light in the sky, causing some of the unusually colorations in some of the photos that have been sent to me.

Contrails can only develop between 25,000 and 30,000 feet and will completely evaporate before reaching ground level.

Contrails do contribute to both warming and cooling changes in the earth's temperature. Jet fuel produces greenhouse gases in engine exhaust that, taken together with other greenhouse gases, contributes to warming the lower atmosphere and the earth's surface. On the other hand, contrails have a higher density of ice crystals than natural cirrus clouds and persistent contrails can, therefore, decrease the amount of solar radiation reaching the earth's surface, thus making it cooler.

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Two university scientists in Wisconsin and Pennsylvania conducted temperature studies during the three-day period following the 9/11 terrorist attacks when all aircraft over the United States were grounded. They found the average temperature between night and day, the diurnal temperature, during this period to be three degrees higher than normal, confirming the effect of persistent contrails on surface temperature. You would have to conclude that jet aircraft traffic, particularly when persistent contrails result, is a weather modifier, whether intentional or not.

### *Volume*

It is then instructive to examine the amount of air traffic passing over the North Coast. There is a VHF Omni Directional Range Tactical Air Navigation Center (VORTAC) located in the sky above eastern Mendocino County. This is not a tangible entity but a navigational point on a map that pilots use as they exit and enter Bay Area airports. It is also used by pilots on transcontinental and intercontinental flights.

Pilots aim for the Mendocino VORTAC so that on any given day, there are hundreds of planes passing overhead. Many of these planes departing San Francisco and Oakland airports reach cruising altitude where contrails can form as the pass into Mendocino and Lake Counties.

I have enclosed a map provided by the FAA showing the number of flights passing through Lake and Mendocino Counties on July 17, 2003, a date picked at random. On this day, there were more than 400 flights, many criss-crossing, although at different altitudes. If weather conditions are right on this or any other typical day, people are going to see a lot of contrails.

There is another VORTAC due east along Interstate 5 that has even heavier traffic than the Mendocino VORTAC. Depending on the direction of the winds, contrails from these aircraft can also drift westward into the North Coast counties.

I have also enclosed two more maps showing arrivals and departures at Bay Area airports on July 17. If incoming traffic using the Point Reyes VORTAC is significant, air traffic controllers will pull them planes of this approach and route them northward along the Mendocino coast. These maps demonstrate this occurring on July 17.

From this information we can conclude that the North Coast is a highly traveled hub for aircraft.

While this traffic is high, it is not atypical according to the FAA, commercial and military pilots I have spoken to who travel in this area and small aircraft pilots who fly into and out of airports on the North Coast. None of these sources could anecdotally confirm either a greater number of planes or corresponding contrails in the sky.

Nonetheless, it is a huge volume and when weather conditions are right, people will notice both the planes and the contrails.

### *Military Exercises*

Navy and Air Force planes do travel through and off the North Coast in training exercises, routine patrols and in support of our armed services overseas. I have spoken with both Navy and Air Force personnel at Travis Air Force Base and at the Pentagon in Washington. I am satisfied that they are not conducting experiments of any kind nor are they engaged in any weather modification programs, other than by contributing to the volume of air traffic in the region, which in turn has been shown to affect temperature.

