

RESOURCE NOTES ON JET CONTRAILS AND ASSOCIATED ITEMS
Influence on Astronomical Observing Conditions

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- * Contrails of concern to [FAA Ombudsman](#)
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- * [Fewer contrails seen from Space Shuttle after September 11:](#)
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- * [Bjorn Lomborg, author of the "The Sceptical Environmentalist", portrayed with contrails \(from "Politiken"\).](#)

Last revised: April 4, 2003 --- Send your suggestions to: 

ASTRONAUT & TOP NOTCH OPINIONS [... top of document](#)

Space Shuttle astronaut Dr. Fred W. Leslie:

"I remember seeing contrails stretched across the planet": <http://www.ssl.msfc.nasa.gov/...>

International Space Station astronaut Umberto Guidoni

... told EU Commission Chairman Romano Prodi that "the space station gave a perfect view of the effect of human damage to the [atmospheric] environment": <http://www.cnn.com/...>

Astronaut Dr. Andy Thomas:

"One of the most readily visible signs of human presence, is the occurrence of contrails from aircraft in the upper atmosphere. These are crystals of ice formed from water, a byproduct of the combustion process in the aircraft engines, and which is collected into the wake vortices of the aircraft. They are very long lasting, and can be seen over virtually all parts of the world as white streaks across the sky. They can be striking around cities that are major air traffic hubs, and can oftentimes be seen radiating out from these cities, like spokes in a wheel" (From an account of visual observations from his 141 day stay onboard Space Shuttle / MIR, STS-91, in 1998): <http://shuttle.nasa.gov/history/...>

Astronaut Guy Gardner:

"... Guy Gardner, associate FAA administrator for regulation and certification, agreed. The former astronaut said that from space, 'you look down and don't see boundaries. What you do see is contrails of airplanes, especially on the North Atlantic.'" (Aviation Week and Space Technology September 12, 1998): <http://www.awgnet.com/...>

Shuttle-MIR astronaut Jerry Linenger:

- wrote to his son, who was en route Russia: "I'll be looking for the contrail of your jet as you head across the ocean (usually, easily seen from space...)": <http://spaceflight.nasa.gov/history/...>

Astronaut Dr. George D. Nelson:

"It is striking that everywhere you look out the windows of the Space Shuttle you can see some evidence of human activity. Ships with wakes, airplanes with contrails, fires, electric lights, agriculture and engineering": <http://www.scimathmn.org/...pdf>

President Clinton

takes a balanced view on contrails: "... The real test of this new airport is not simply whether the skies are streaked with the contrails of jet planes. The real test of this new airport is the growth it generates, the jobs it creates, and the hope it inspires. It is found in the eyes of the children living on farms, and in these mountains, children who look skyward and imagine the places they will go": <http://www.dot.gov/affairs/...>

Former Senator Wendell Ford:

"In the early part of this century, a community was hard pressed to survive without a railroad station. Today, our airports have replaced the railroad station and the train's tracks across the countryside have been replaced by the plane's contrails across the open skies. Just as railroads played a critical role in the economy of yesterday, so too do airplanes and airports play an important role in today's economy" (statement Before the U.S. House of Representatives): <http://www.nata-online.org/...>

United States Environmental Protection Agency:

"Currently, there are no regulations addressing contrails and their atmospheric effects" (September 2000): <http://www.epa.gov/...pdf> from [click](#)

Dr. Cheryl E. Merritt, Yale University:

"The jet airplane has revolutionized travel since about 1960. It has brought people and cultures closer together. It has created environmental problems. Harmful chemicals sift down from the smoky trails of low-flying jets. The scream of jet engines is constantly heard by people who live near big-city airports. Jet aircraft, particularly the supersonic transport (SST) could engender stratospheric air pollution with consequent changes in climate. Jet exhaust contains water, CO₂, oxides of nitrogen, and particulate matter. It is speculative just how harmful these pollutants can be": <http://www.yale.edu/...>

Paul R. Ehrlich (1968):

"The causal chain of the deterioration [of the environment] is easily followed to its source. Too many cars, too many factories, too much detergent, too much pesticide, multiplying contrails, inadequate sewage treatment plants, too little water, too much carbon dioxide-all can be traced easily to too many people" (quoted by Adil Najam in Population Research and Policy Review, Vol. 15 No. 1, p.1-17): <http://www.mit.edu/...>

Dr. Richard Witt, The International Association 'Cosmos & Philosophy':

'... environmentally, the modern aeroplane is a bloody nuisance. [...] Briefly, emissions from aircraft make a more than trivial contribution to the chemical degeneration of the atmosphere, and perhaps assist actively in the process of climate modification. // We can start with an unfamiliar technical term, but one to keep in mind: contrails': <http://www.uek.cas.cz/11thIACP/witt1.htm>

THE EYE-SORE, IN PHOTOS AND WORDS ... top of document

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[Contrail Photos from Ground and Space](#)

[Contrails in Words](#)

CONTRAIL PHOTOS FROM GROUND AND SPACE ...

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1. At least 80 contrails over the ocean near Newfoundland (3 Mb picture in PNG-format, not all browsers may display it): <http://visibleearth.nasa.gov/...>
2. Contrails over Karlsruhe, Germany: <http://www.wolkenatlas.de/...> - and - [click](#) - and - [click](#) - and over Texas - [click](#) - and - [click](#)
3. Contrails over the French National Parc at Vanoise: <http://mesola.obsppm.fr:80/...>
4. Contrails near Luke Air Force Base, USA: <http://www.homestead.com/...>
5. Contrails in artistic photos are rare, here is one (with kind permission from Steve Berlin): <http://www.photoscene.com/...> from [click](#)
6. Contrails in Dutch Weather Pictures: <http://www.geocities.com/...>
7. Contrails seen from an airplane: <http://australiasevereweather.com/...>
8. Sky over Half Dome, Yosemite, contaminated by contrails: <http://hawley.interspeed.net/...> - and - [click](#)
9. Contrails in scenic photography: <http://www.spruance.com/...>
10. Photograph of contrail casting shadow on lower cloud deck which is also a contrail: <http://www.bact.wisc.edu/...>
11. Superb contrail photo: <http://www.atmos.washington.edu/...>
12. Satellite image (NOAA) of Europe, processed by DLR, Oberpfaffenhofen: <http://imkpcdemo.fzk.de/...> ... with automatically recognized contrails: <http://www.dfd.dlr.de/...>
13. TIROS satellite photo of contrails near Anticosti Island: <http://24.229.44.109/...>
14. Contrails over California, seen in Terra spacecraft imaging: <http://www.seaspace.com/...>

- and many more photos in section [The Evidence](#)

CONTRAILS IN WORDS ... up

1. You cannot escape from the contrails: "Wenn man nach einem langen und erlebnisreichen Tag vor seinem Zelt sitzt und die untergehende Sonne betrachtet, wie sie die Felsen in ein tiefes Rot taucht, und einem nichts anderes als Stille umgibt, könnte man fast die Zivilisation vergessen, wären da nicht die Kondensstreifen der Flugzeuge in 10.000 Meter Höhe": <http://www.proteus.at/...>
2. The Asheville Tribune, June 7, 1999: "Not a cloud in the sky. When is the last time you can remember repeating that phrase?": <http://www.ecotoday.com/>
3. "Airlines steal the sun for profit: on a typical blue-sky day in South-East England, up to 20 jet contrails crisscross the sky and spread into a haze" (by an action group against Manchester Airport extension): <http://www.mfoe.u-net.com/...>
4. "Contrails are changing Earth's skies. In terms of Earth's history, they are a new kind of cloud. Jet fuel exhaust. What once were clear nights are now clear nights with contrails. Where on the planet can one go and not see a contrail?": <http://www.spacestar.net/...>
5. Photography: "I can't tell you how many times I have set up to photograph a sunrise or sunset and while waiting for the best color, have a jet plane fly right through my picture leaving an ugly contrail behind": <http://www.apogeephoto.com/...>
6. Scenic photographer bothered by contrails: "After dodging rattlesnakes, climbing to the point of my exhaustion, we reached a point up the valley and opposite Halfdome. The elevation we judged at about 1500 feet above the valley floor. It was risky photographically. In the morning, the mountain was solidly clouding over, but very often at this time of the year, the weather changes produced the most opportunity for photography. By late afternoon, however, the sky had cleared. Except for the business of the jet contrails, the opportunity seemed perfect": <http://www.spessart.com/...>
7. Outdoor photography problems: "Jet contrails, those annoying 'linear clouds' that seem to appear just after you've set up your tripod and composed, are a problem with no real solution. Sometimes you're immediately aware of contrails, sometimes you hear the plane and search the sky, and sometimes, well, I've gotten film back and am convinced that my lab put that contrail into the picture because I sure didn't see it": <http://www.outdoorphotographer.com/...>
8. Grand Canyon and contrails: "But today, artists say the air and noise pollution at the Grand Canyon are bad and getting worse. Some artists won't go to the crowded South Rim anymore during the busy summer months, and others won't go to the canyon at all. Gordon Hempton, a sound designer for Microsoft Corp. best known as the "Sound Tracker" for his recordings of the world's quietest places, said, "The quiet places are really vanishing. The Grand Canyon is a waste of time for nature sound recordists." Jack Dykinga, a Tucson photographer who has taken nearly 6,000 shots of the canyon, said he won't even try to take photos during the busy summer months. He said there are days when whole rolls of film are useless because jet vapor trails mar the sky. "You can't see that far. That's the most notable change. It's definitely hazier," he said.": <http://www.nonoise.org/...>
9. Wilderness Lost: "Most of us who live in the Outback know the feeling of being able to look on a big scope of country that seems relatively unchanged by humans. There remain, for many of us, places where we can sit on a ridge and look across a vista that seems untouched by civilization. Frequently, though, that feeling is broken, or at least badly bruised, by the sight of an aircraft contrail, or by the sound of an internal combustion engine": <http://www.americanoutback.com/...>
10. An amateur astronomer laments contrails (12/03/1999): "Once again we had crystal clear skies on Wednesday night only to find Friday night that the air had a ton of moisture at the upper level. Jet contrails went across the entire sky. Oh well... I night of learning!": <http://216.59.71.3/...>
11. Death Valley: "Here one finds a pristine stillness, marred only by traces of jet trails": <http://www.gorp.com/gorp/...>

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- [Gulf War](#)
- [Middle East Conflict](#)
- [Kosovo Conflict](#)

SPANISH CIVIL WAR ...up

1. Spanish Civil War, September 21, 1938, text only: "The Messerschmitts are mixing it with No 4, judging by the contrails and the lines of tracer left behind in the high, cold air. - and - "The one hundred and fifty aircraft weave and unravel an enormous pattern of white trails in the air": [http://www.aire.org/...](http://www.aire.org/)

WORLD WAR II ...up

Pictures

1. WWII picture: [http://www.geocities.com/...](http://www.geocities.com/)
2. The famous TIME MAGAZINE photograph from January (June?) 1944 showing B-17 and P-47 contrails: [http://members.tripod.com/...](http://members.tripod.com/) - and - same picture in another location: [http://www.457thbombgroup.org/...](http://www.457thbombgroup.org/) - and on the photo's history: [http://www.390th.org/...](http://www.390th.org/)
3. More WWII contrail pictures from these sites: [click](#) - and - same picture in another location: [http://www.fscwv.edu/...](http://www.fscwv.edu/) ... and more contrail pictures from one of these sites site: [click](#)
4. WWII Photo of seven planes with contrails: [http://www.457thbombgroup.org/...](http://www.457thbombgroup.org/)
5. WWII (picture): [http://www.457thbombgroup.org/...](http://www.457thbombgroup.org/)
6. Contrails from falling WWII plane: [http://www.acs.oakland.edu/...](http://www.acs.oakland.edu/)
7. Contrails en masse over St. Pauls Cathedral during Battle of Britain: [http://www.parlier.com/...](http://www.parlier.com/)
8. WW-II photo of contrail over St.Pauls Cathedral [http://www.accessweb.com/...](http://www.accessweb.com/)
9. Contrails in wall art at Smithsonian's Air and Space Museum: [http://www.fscwv.edu/...](http://www.fscwv.edu/)
10. Formation flying in contrail cirrus: [http://www.web-birds.com/...](http://www.web-birds.com/) - and - [click](#) - and - [click](#) - and - [click](#) - and - [click](#) - all described on [click](#)
11. B-17 and B-24 contrails seen on WWII photographs: [http://w3.tvi.cc.nm.us/...](http://w3.tvi.cc.nm.us/)
12. Photograph of contrails in formation flying: [http://www.fix.net/...](http://www.fix.net/)
13. "Crewmen of an American ship watch the contrails as American and Japanese planes fight it out above Task Force 58": [http://www.worldwar2.com/...](http://www.worldwar2.com/)
14. WWII contrail photo: [http://www.worldwar2pilots.com/...](http://www.worldwar2pilots.com/) from [click](#) - and - [click](#) from [click](#) - and - [click](#) from [click](#)
15. WWII contrails (excellent photo): [http://home.att.net/...](http://home.att.net/) - with text on: [click](#)

Text (mostly with no assurance of authenticity)

1. G.A.Paulikas: "Spring 1945 ... Up to 300 US bombers at a time ... forming clouds that looked like thick cirrus ... covering a good fraction of the sky", Letter to the Editor of Science, 1997, July 4, p.TBD
2. "Meyer, now a lieutenant colonel, was awarded an oak leaf cluster to the Silver Star for downing three Bf-109s and one FW-190 on Nov. 11, 1944. Ten days later, he earned his second DSC for leading 11 P-51s in an air battle east of Leipzig, against more than 40 enemy fighters. Meyer maneuvered his formation into position for a surprise attack, himself shooting down three FW-190s. In one case, he used the contrail of an FW-190 for cover, firing at the unseen enemy until he could see strike flashes through the contrail, then breaking off just before ramming the burning enemy plane": [http://www.westnet.com/...](http://www.westnet.com/) - and also on [http://www.afa.org/...](http://www.afa.org/)
3. WWII: "The morning of 23 December 1944, hp) broke clear and cold. "Visibility unlimited," the air-control posts happily reported all the way from the United Kingdom to the foxholes on the Ardennes front. To most of the American soldiery this would be a red-letter day-long remembered-because of the bombers and fighter-bombers once more streaming overhead like shoals of silver minnows in the bright winter sun, their sharply etched contrails making a wake behind them in the cold air.": [http://www.3ad.org/...](http://www.3ad.org/)
4. Russians chasing high-flying German reconnaissance planes, recognizing them only by their roaring and their contrails: [http://hits1.infoart.ru/...](http://hits1.infoart.ru/)
5. [date?] March 1944: "Strategic Operations (Eighth Air Force): Mission 246: 555 B-17s and 193 B-24s are dispatched to industrial areas and aviation industry plants at Berlin, Erkner and Oranienburg but deteriorating weather and dense contrails force the formations to abort or seek targets of opportunity": [http://www.lts.aetc.af.mil:80/...](http://www.lts.aetc.af.mil:80/) - also on [http://paul.rutgers.edu/...](http://paul.rutgers.edu/)
6. "The spectacle of seeing hundreds of aircraft trailing formations was an extraordinary sight," said Freeman, who was a base rat at Boxted near Colchester. "On one cold and freezing day, early in 1945, when I was 15, I saw the contrails of a thousand bombers forming in the sky at one time. I didn't count a thousand, but there were 28 groups, and I knew that each group had 30 to 40 in each formation": [http://www.af.mil/...](http://www.af.mil/)
7. "To Fly and Fight: Memoirs of a Triple Ace" by Col C. E. Anderson with Joseph P. Hamelin "You knew how it was up ahead, and you knew it would be like that for you any minute now, the German single-seat Fw 190s and Me 109s coming straight through the bombers, mixing it up with the Mustangs, the hundreds of four-engined heavies and the hundreds of fighters scoring the crystal blue sky with their persistent white contrails": [http://www.cebudanderson.com/...](http://www.cebudanderson.com/)
8. Finnish-Soviet air fight, [date?] February 1940: "We completed both our missions successfully. We had a well thought out plan which had worked in that we approached our targets over Ladoga, through enemy airspace, took the photographs from the altitude of 7500 metres as fast as we could and gave a farewell bombing. All went according to the plan. We did not spot any enemy fighters. I was concerned about one detail though. I tried to alternate our height to get rid of the contrails we were making, but that was not possible on that day, humidity and cold air made my efforts in vain. I told the other crewmembers to give a more alert lookout because I knew Soviet fighters would be drawing contrails too": [http://www.dalnet.se/...](http://www.dalnet.se/)
9. WWII (February 20, 1944; text only; also on other URLs): European Theater of Operations: "... dense contrails and frost prevent most aircraft from attacking": [http://www.lts.aetc.af.mil/...](http://www.lts.aetc.af.mil/)
10. February 6, 1945, Mission #25: "The contrails were dense, persistent - really hard to even see our own squadron. Our Air Leader really got worried about us being by ourselves": [http://www.geocities.com/...](http://www.geocities.com/)
11. WWII (text only, 26 August 1944) [http://chasntx.home.texas.net/...](http://chasntx.home.texas.net/)
12. 467th Bombardment Group (Heavy): "Twenty-two aircraft, each carrying 6x1000lb general purpose bombs took off starting at 0850. Two returned early. One was unable to find the formation because of clouds and contrails, and the other experienced an oil leak" (May 19, 1944): [http://www.siscom.net/...](http://www.siscom.net/)
13. "The p-47's would be zig-zagging over us at 45000 feet leaving contrails, and shortly after crossing the coastline we picked up German fighter planes, Me-109's and Me 190's": [http://aafo.com/library/...](http://aafo.com/library/) -- "We were making large contrails, and a Focke Wulf got in our contrail about a mile out and flew in it until he was one hundred feet away. He then climbed until he broke out of our contrail": [click](#)
14. "On the 16th of July, 1944, we climbed to 30,200 feet to stay above the contrail-spawned clouds over Munich. The only time that I ever experienced real vertigo was when leading a low squadron of B-17s and looking up at planes that were generating serious contrails. Each prop on every plane in the formation made a huge swirl that continued to rotate as we passed underneath. I had the sensation that the entire formation had gradually turned into a 90 degree bank. When flying close formation one can't concentrate on flight instruments to get oriented. I asked my copilot if he was OK and could he take over and he said, fine. All was well in a few moments after I could look away from those rotating contrails and get my bearings": [http://www.381st.org/...](http://www.381st.org/)
15. [date?] "I saw almost nothing today except friendly planes and vapor trails (contrails). There was a little flak, but it didn't bother our group. Over the top of the clouds I could see four wings of B17s going over the target ahead of us. Everybody was making contrails. It looked like a series of twisted bowling alleys. P47s, P38s and P51s played tag around us all the time": [http://metalab.unc.edu/pub/...](http://metalab.unc.edu/pub/)
16. "Am 12. Mai 1944 findet, wie in dieser Zeit fast täglich, ein Luftangriff auf Frankfurt statt. Die Bomberverbände überfliegen meinen Heimatort im Taunus. Das ist nicht, ungewöhnlich Man sieht zu den Kondensstreifen hinauf und fühlt sich sicher. Dann steigen deutsche Jäger auf und es gibt einen heftigen, lang dauernden Luftkampf": [http://www.koblentz.de/...](http://www.koblentz.de/)
17. "In the early evening of the 16th August 1943, three Messerschmitt 109Gs were on a reconnaissance mission over Portsmouth, southern England. They were at around 36,000 feet and considered themselves so invincible at that height, that once they had turned for their base, they maintained a steady, straight course and speed. Their sunlit contrails were clearly visible against a clear summer sky": [http://www.warbirdart.demon.co.uk/...](http://www.warbirdart.demon.co.uk/) - and - (where the artist got the contrail wrong) [click](#)
18. [date?] "I set the throttle to 100% and also engaged the methanol injection so as to obtain maximum power from the Daimler Benz engine. I trimmed for climb and riding just above stall speed gained altitude rapidly. I could see contrails in the distance and I headed toward them. At 23,000 feet I leveled off and began my pursuit. Off to my left at 11 o'clock was a badly damaged B-17 trailing alot of smoke. I closed in but before I could apply the coup de grace the crew bailed out of their flying coffin": [http://js27.org/...](http://js27.org/)

19. "Convinced that the Polish forces were doomed and, consequently, no longer a danger to Moscow's plans for communist domination of Central Europe, the Soviets finally acceded to pressure from Washington and agreed to permit a single flight of American planes to land on Russian airfields. On a bright sunny day, on September 18 [year?], the contrails of a large group of planes appeared over the beleaguered city and the white parachutes started dropping like petals from trees. It was too late, the area in our possession had been so reduced in size, and the drop was made from such a high altitude, that most of the supplies fell into German hands. This was the only attempt to provide large scale air-drops -- too little -- too late...": [http://www.espressobiega.com/...](http://www.espressobiega.com/)
20. "On [date?] Nuremberg, you could see everyone - the plumes of smoke, the contrails from your engines. Poof! They started shooting us down like geese": [http://www.valourandhorror.com/...](http://www.valourandhorror.com/)
21. "Eben werden wieder durch den Drahtfunk Einflüge starker Verbände gemeldet. Die beiden letzten Tagesangriffe auf Berlin waren von hier aus z. T. ganz gut zu beobachten. Man sah über den wolkenlosen Himmel größere Formationen mit ihren Kondensstreifen fliegen bei z. T. recht erheblichem Flakbeschuß": [http://www.joyma.com/...](http://www.joyma.com/)
22. (date??) "The takeoff was uneventful in spite of the snow on the field. Assembly into the formation was routine, if assembly can be considered a routine matter. The mission was uneventful until we reached the IP. Here and in the target area there were 2-3/10ths middle clouds, tops 16,000 feet, and 8-10/10ths thin cirrus clouds with dense persistent contrails. The conditions made formation flying and bombing difficult": [http://www.303rdbg.com/...](http://www.303rdbg.com/) ... and "The contrails were terrific and two B-17s blew up in the confusion. It certainly made a big explosion. They must have been loaded with demolition bombs. We were carrying incendiaries": [click ...](#) and (February 3, 1944, over Wilhelmshaven): "The weather on this mission was the worst (as far as flying was concerned) I have ever seen. Very dense and persistent vapor trails ("contrails" or condensation trails) were encountered at all altitudes above 18,000 feet. These vapor trails plus the dense clouds made flying formation very difficult. In fact, formation flying was practically impossible. On top of this, our group followed another group and got in its "prop wash" and "con-trails": [click](#)
23. An Australian account: "I'm glad you haven't asked me for technical details of the PR spits but they were stripped of guns, ammunition and radio, the weight being replaced by additional fuel tanks and cameras. They were normally flown at full throttle at around 30-32,000 feet, depending upon the tropopause as it was essential not to leave a persistent contrail": [http://www.pnc.com.au/...](http://www.pnc.com.au/)
24. 06/28/1944: Nearly 300 HBs [heavy bombers?] abort because of heavy cloud and dense contrails at operational level. [http://www.airforcehistory.hq.af.mil/...](http://www.airforcehistory.hq.af.mil/)
25. "Near the end of our tour several of us thought we sighted German fighters, but it was impossible to be sure. For all that we actually saw were long white contrails, almost perfectly straight, as though the planes that made them were incapable of turning. But the impressive aspect of these sightings was their "impossible" altitude. We flew often at about 30,000 feet, near our ceiling. And yet the contrails we sighted were so far above us that we could not make out the craft that caused them. Sometime later we heard of the new German jets and realized these were what we must have seen, flying at perhaps 60,000 feet or more": [http://users.rcn.com/...](http://users.rcn.com/)
26. WWII history, text only [date?]: "Williams' last mission was to Hanover, Germany. He flew much of the mission at 35,000 feet but descended to 22,000 feet to eliminate the contrail that gave away his position. [http://www.1.drive.net/...](http://www.1.drive.net/)
27. WWII history, text only: "I could as well tell about my easiest victory on the 28th of May 1944. I was basing at Malmi. Suursaari sent us a report: buzzing to the west. I was sent to identify. The coastline was covered by a thin veil of cloud, having climbed above it I saw a contrail. I began to climb to it, and when I reached the same altitude the contrail stopped. I kept a sharp lookout and saw a Pe-2": [http://www.elknet.pl/...](http://www.elknet.pl/) and, from the same site: (May 27, 1944) "You knew how it was up ahead, and you knew it would be like that for you any minute now, the German single-seat Fw 190s and Me 109s coming straight through the bombers, mixing it up with the Mustangs, the hundreds of four-engined heavies and the hundreds of fighters scoring the crystal blue sky with their persistent white contrails": [click](#)
28. WWII history (Thursday 7-13-44): "Back to Saarbrücken and this time it was a snap. Carried 3 - 2000. Supposed to fly right wing in low left, but our lead got lost in contrails and headed for base": [http://members.home.net/...](http://members.home.net/)
29. WWII contrails (text only) mentioned for October 8, 1942: ""We turned our aircraft out to sea in an attempt to get out of range of the German fighters and out of the heavy flak, but it wasn't our day, as some long range ME-110's must have picked up our con-trail and hit our other two engines less than two hours later, north of Holland and near Terschelling Island, a part of the Frisian Island chain": [http://www.ip-services.com/...](http://www.ip-services.com/)
30. WWII contrails (text only) mentioned for February 8, February 14, and March 18, 1944: [http://www.net1plus.com/...](http://www.net1plus.com/)
31. WWII history (text only): Contrails leading to the downing of Messerschmitt Me 262: "On 7 April 1945, Major Robin Olds was leading the 479th Fighter Group on a mission over Germany in his North American P-51 Mustang "Scat VI." Escorting a formation of bombers, Olds noticed contrails popping up over clouds at his nine o'clock position. Turning toward the contrails, he got "Tally-ho" on a group of 12 Messerschmitt Me 262 jets diving in on the bombers. After an engagement with one of the jets, Olds looked back at the bombers and saw an Me 109 attacking the formation. He followed the enemy through the middle of the bombers, opened fire and scored direct hits. The pilot bailed out and his airplane went straight in!": [http://www.au.af.mil/...](http://www.au.af.mil/)
32. WWII history (text only, with original flight-log): "May 5, 1944 [...] Place - Cherbourg, France [...] Remarks - Bad weather again - no mission credit - flew at 24000 ft. but clouds & contrails up to 28,000 - couldn't top them - B-24 you know. No losses." [http://www.ctol.net/...](http://www.ctol.net/)
33. WWII, text only: Mar 15, 1944 Brunswick: "Just enough breaks in the clouds to pick up a pinpoint now and then. Intense flak at target but not too accurate. Got 3 hits forward of R. waist window. - FW190 sneaked in D. Millers contrails and shot him down in flames. Eight chutes & 1 burning chute observed": [http://www.b24.net/...](http://www.b24.net/)
34. WWII: Memories of contrails quoted by a Japanese family: [http://members.aol.com/...](http://members.aol.com/)
35. WWII: J.Reynolds inquiry of contrail observations during WWII http://www.ecotoday.com/read_eco.html
36. WWII text: on the use of contrails, on November 21, 1944: [http://www.westnet.com/...](http://www.westnet.com/)
37. WW-II (1943, no date given): "Weather conditions were as forecast with heavy contrails over England and crossing into France. I looked out my astro hatch at quite an amazing sight for me - the largest array of B-17s that I could ever imagine. What a glorious feeling": [http://www.lakenheath.af.mil/...](http://www.lakenheath.af.mil/)
38. WW-II contrails on August 26, 1944 [http://chasntx.home.texas.net/...](http://chasntx.home.texas.net/)
39. WWII: May 17, 1942: Several RAF squadrons conducted a feint toward Holland trying to draw the Luftwaffe northwards. 303 RAF, the Eagle Squadrons, 352nd FG. 44th SOS and 416 RCAF left contrails as they passed high over Occupied Europe. This allowed the 305th HBG to conduct their secret mission ...": [http://www.fourthfightergroup.com/...](http://www.fourthfightergroup.com/)
40. WWII, second hand account, text only: "Dad described the power and beauty of an armada of hundreds of gleaming aluminum B-17s streaming four contrails (which unfortunately made them more visible to the flak batteries and fighters)": [http://res3.geocities.com/...](http://res3.geocities.com/)
41. WWII: Text only: Contrails observed on October 9, 1944 over Koblenz: [http://www.446bg.com/...](http://www.446bg.com/)
42. WWII (text only; 7 April 1945 near Hamburg): "At about 1240 hours we observed numerous contrails high above the bombers approaching from various directions. They started making high overhead passes on the bombers at about 1250 hours": [http://www.web-birds.com/...](http://www.web-birds.com/)
43. WWII accounts, verbal: 303rd BG experience near Hamburg, on June 25, 1943: "As I recall we were in bad soup shortly after take-off, which was compounded by serious contrails as we got higher. Then we began to lose visual contact with others": [http://www.chez.com/...](http://www.chez.com/)
44. November 21, 1944: On numerous contrails from B-17 and P-51 Mustangs over the North Sea (is this history or fiction?): [http://www.tankbooks.com/...](http://www.tankbooks.com/)
45. WWII (text only): "Feb. 21, 1945 Wednesday. NURNBERG-Industrial Area. First mission after being grounded for ten days. Good feeling to fly again. Also our first mission with Burrington as our Pilot. Roberts flew Co-pilot. Lot of flak going in near the present front lines. P-51 escort looked like a bomber stream. Lot of contrails. Burrington-Pilot. 8 hrs. 20 min.": [http://www.geocities.com/...](http://www.geocities.com/)
46. "On March 18,1945, the McCaldin aircraft was hit by a ME 262 fighter over Berlin. The ME 262 had come in under the heavy contrails, both generated by aircraft under certain weather conditions": [http://www.khosla.com/...](http://www.khosla.com/)
47. B17 contrails in low resolution thumbnail photo (redundant?): [http://sites.netscape.net/...](http://sites.netscape.net/)
48. WWII (text only): "The day was March 18, 1945, the target was Berlin, where approximately 1300 heavy bombers of the 8th AiR Force were to drop bombs. On that day our scheduled bombing altitude was to be 21,000 for my Bomb Squadron, the 391st BS of the 34th BG. As we neared Berlin at that altitude we began to stream contrails from the wing tips, the tips of the tail assemblage, and the tips of the propellers on each of the 4 engines. We were, in effect, clouding the sky over Germany . In an effort to eliminate this phenom we were told to go to "Angels5" which meant that we were to add 5 hundred feet to our scheduled bombing altitude. So we went to 21,000 +500 or 21,500 feet and the problem did not resolve. If anything it got worse! We kept adding 500 foot increments to our scheduled altitude until our aircraft reached 27,500 feet, still trailing contrails." -Hal Province 34th Bomb Group": [http://www.newsmax.com/...](http://www.newsmax.com/)
49. WWII (text only): Contrails on January 30, 1944: [http://hometown.aol.com/...](http://hometown.aol.com/)
50. REDUNDANT TEXT [http://members.nbci.com/...](http://members.nbci.com/)
51. WWII (September 7, 1940, Battle of Britain): "But as the man-made thunder grew closer and louder, and the black curtains spread and thickened in the east, they looked up and saw the sky filling with tiny silhouettes sharp and clear against the blanket of contrails spun by the scores of circling fighters": [http://www.dynotech.com/...](http://www.dynotech.com/)
52. WWII (Christmas 1944, text only): "This holiday it was our crew's turn. The heavens were still moist. At fighting altitude our planes left long, thick, and lasting contrails. We created the clouds we had to fly back through": [http://www.metro.net/...](http://www.metro.net/)
53. WWII photo (redundant?): [http://store4.yimg.com/...](http://store4.yimg.com/)
54. WWII photos of contrails (redundant?): [http://freepages.military.rootweb.com/...](http://freepages.military.rootweb.com/)
55. WWII contrail account of unknown date, 1944: " As we climbed up to our altitude of 25,000 feet, the clear sky was turning into solid contrails. The only ship I could see was the ship on which I was flying formation ": [http://www.southernoregonwarbirds.org/...](http://www.southernoregonwarbirds.org/)
56. SAME STORY? WWII (October 10, 1943?): "We had a max effort heading out to Germany, and the sky was clear as a bell. Really a CAVU day (ceiling and visibility unlimited). Climbing out on course, as we approached 20,000 feet the lead ship began to develop contrails. As we climbed up to our altitude of 25,000 feet, the clear sky was turning into solid contrails. The only ship I could see was the ship on which I was flying formation. As I checked my position on this ship and then checked my instruments I developed VERTIGO (an unbalance of the inner ear). I thought for sure I was flying left wing straight down, yet my instruments all said I was flying straight and level. So I would glance at my instruments and glance at my leader till we flew out of that super-contrail layer": [http://www.southernoregonwarbirds.org/...](http://www.southernoregonwarbirds.org/)

57. Various WWII B17 contrail photos (redundant?): [http://www.nmia.com/...](http://www.nmia.com/)
58. Plauen Mission, March 19th, 1945: "We continued to climb slowly, but we were flying in light cirrus and now we were pulling contrails, visibility seemed to vary from one to two miles horizontally, flying conditions were marginal": [http://wejones.ftdata.com/...](http://wejones.ftdata.com/)
59. WWII (March 4, 1945, text only): The bombing of Zurich: "The weather as it appeared to the weather scouts was not insurmountable but . . . the contrails created by the First and Third Divisions plus the initial units of the Second Division created a cloud layer which units could not climb over nor descend below, for they created their own weather. It is unbelievable that so many units could fly so long in such conditions, turn around and withdraw without heavy losses from collision" ... and ... "Meanwhile, wing assembly had been raised to 18,000, then 20,000, and finally to 23,000 feet, an altitude at which the Liberators began to handle sluggishly and formation flying became all the more difficult. The thick, twisting contrails still prevented any visual sightings" ... and ... "Both Lieutenant Sincok and Major Keilman struggled to keep in contact with that lead as the continuing contrails and increasing cloud coverage reduced visibility": [http://www.airpower.maxwell.af.mil/...](http://www.airpower.maxwell.af.mil/)
60. Contrails mentioned in a WWII report: "At these heights they had to carefully avoid getting so high that condensation trails were formed, as ground control had reported 20-plus bandits in the area" (August 9, 1941; I.Wedge, pers.info.): [http://www.redtwo.demon.co.uk/...](http://www.redtwo.demon.co.uk/)
61. WWII (text only; no date, but the text surely allows identification of the fight): "I carefully search the sky for enemy escorts but I can make out only three or four condensation trails above the bombers": [http://ww2f.dogfighter.com/...](http://ww2f.dogfighter.com/)
62. WWII (text only, probably September 26, 1943): "Our formation of bombers, marked by condensation trails progressed across the sky unmolested": [http://members.aol.com/...](http://members.aol.com/)
63. WWII: daterail contrail: <http://www.redtwo.demon.co.uk>
64. WWII: contrails (text only) observed April 5 1945: "Unterschlaersbach (10 miles W of Nurnburg) 5 April, jet airfield shocked by our 2 ship formation. Very bad weather, 25,000 ft clouds, dense persistent contrails, assembly impossible. Back over Belgium at 800 ft 7 1/2 hrs, 900 miles": [http://www.jccc.net/...](http://www.jccc.net/)
65. WWII (text only, November 1944): "Eight B-29s of the 45th Bomb Squadron launched a strike in November 1944 from our advanced base at Hsinching, China, against a Nippon Air Depot at Mukden, Manchuria. [...] The sky was clear and all aircraft were leaving thick contrails behind them. West of the target, and above our altitude, I could see a short contrail behind a plane so far away that I could not identify it. [...] I could make out a tiny dot whose contrail was turning toward our formation": [http://www.40thbombgroup.org/...](http://www.40thbombgroup.org/)
66. WWII (text only, 28 May 1944, over the British Coast): "Contrails were encountered at 22,000 feet and upon request, the Wing leader let down a thousand feet": [click](#) and (March 18, 1944) "The time then was about 1500 hours when an estimated 60-75 ME-109 and FW-190 fighters swept in on the Group out of the contrails, five and six line-abreast, and attacked through the formation. Enemy fighters attacked twice more in the same fashion before ": [click](#)
67. Several contrail reports in the WWII account, redundant? [click](#)
68. WWII (text only, March 18, 1945): "We were in the #3 position slightly behind and below the element lead. As we neared our target of Berlin, the sky was clear but we were leaving heavy contrails. There had been no warning of bandits when our tail gunner opened fire. Four ME-262s came in hidden by the contrails and hit four of us" (crash landing follows): [http://www.100thbg.com/...](http://www.100thbg.com/) and "SUNDAY, JANUARY 30, 1944: TARGET: BRUNSWICK, GERMANY--6 HOURS--(-40 DEGREES)--MEDIUM FLAK--HEAVY OVERCAST--GOOD ESCORT-- CONTRAILS VERY HEAVY, HAZARDOUS FLYING CONDITIONS--BOMBED AT 28000 FEET": [click](#)
69. WWII (text only, September 7, 1940): As the fighters strove to break through the massive escort, bombers faltered and broke away with blazing engines, twisting streaks of pale tracer patterned the air, condensation trails from the fighters high above wheeled and curved, parachutes drifted down towards the green world below, and columns of smoke rolled darkly up to meet them from the first funeral pyres. [http://www.dyno-tech.com/...](http://www.dyno-tech.com/)
70. WWII (text only, December 23, 1940): "To most of the American soldiery this would be a red-letter day-long remembered--because of the bombers and fighter-bombers once more streaming overhead like shoals of silver minnows in the bright winter sun, their sharply etched contrails making a wake behind them in the cold air": [http://www.shsu.edu/...](http://www.shsu.edu/)
71. WWII (text only): Ken Blowers for The Evening Star (redundant?): "On a frosty morning in January 1945 I once counted more than 1,000 bombers forming into battle formations high above Ipswich, each leaving its brilliant stream of four white condensation trails across the blue of the winter sky": [http://www.suffolk-nov.co.uk/...](http://www.suffolk-nov.co.uk/)
72. WWII (text only, September 23, 1940) "An area from Dartford to Margate became a mass of twisting, whirling white vapour trails as the fighters from both sides weaved and spiraled against the backdrop of now bright blue sky": [click](#)
73. [http://www.wallowa.com/...](http://www.wallowa.com/)
74. WWII (text only, March 1, 1944): "Weather clear and sunny. We were quite interested in watching the P-38 and the British Spitfires play around in the skies those above 25000 feet was leaving the most picturesque vapor trails": [http://www.150th.com/...](http://www.150th.com/)
75. WWII (photo, March 22, 1945): "A little bit of beauty during a war; vapor trails made by a formation on the way to an airfield at Kitzingen, Germany": [http://www.446bg.com/...](http://www.446bg.com/)
76. WWII (text only, 1 November 1944) "The primary target for the first mission in November was the South Ordnance Depot at Vienna, Austria. The thick layers of clouds which had been encountered over Italy and over the Adriatic practically dissipated over Yugoslavia. Atmospheric conditions were such over the alps, however, that extreme haze and vapor trails reduced visibility to one mile. Under these conditions the third alternate, the Marshalling Yard at Graz, Austria, was selected for the attack": [http://www.461st.com/...](http://www.461st.com/)
77. WWII (photo, no date): "B-17Fs at altitude": [http://ww2f.dogfighter.com/...](http://ww2f.dogfighter.com/)
78. WWII (photo, no date) (redundant): "B-17Fs contrails": [http://ww2f.dogfighter.com/...](http://ww2f.dogfighter.com/)
79. WWII (text only, spring 1944): "When we started our turn to south toward Berlin, we found that though the bombing altitude had been briefed for 30,000 ft. our bombardier couldn't see downward because of the contrails left by the proceeding groups": [http://www.gulfcoastwing.org/...](http://www.gulfcoastwing.org/)
80. WWII (text only) "Jan 24th 1943: Briefed for Frankfurt, Germany. Took off in dark at 7 a.m. -- Heavy contrails at 15,000 ft. had difficult time grouping formations. Were 150 miles over enemy territory when we were recalled to base. -- Came out across Holland so did not drop bombs. -- Salvoed in Channel" - and - "Feb 22nd 1944 Briefed for Schwienfurt, Germany.-- Bomb load, ten 500 lb Demos.-- Took off in snow flurries, climbed to 22,000 ft. Heavy contrails made grouping difficult. Visibility almost zero at times. We headed out across Channel badly formed.--Recalled.-- Landed at base with full bomb load ": [http://209.25.250.72/...](http://209.25.250.72/)
81. "Vapor trails mark the path of 759th Squadron, 459th Bomb Group B-24 Liberators on the way to Germany from their base, Giulia Airfield, a former Axis base near Cerignola, Italy. Excerpted by permission from WWII War Eagles, p. 210. (James Wilson via 459th Bomb Group Association) [but is the blue color added to a b/w photo?]" : [http://www.ethell.com/...](http://www.ethell.com/)
82. WWII (photo): "Vapor trails of 322nd Bomb Group B-26s on bombing mission deep inside Germany, Winter 1944-45, taken from my pilots seat.": [http://www.fastlane.net/...](http://www.fastlane.net/)
83. WWII (text only, December 24, 1943): "Thousands of planes in the sky, so many vapor trails that a clear, cold sky actually became cloudy": <http://www.tuttle2000.com/history/sweatingitout.asp>
84. WWII (text only, 23. or 24. December 1944): "The weather had cleared and it looked like all the Allied Air Force came out. The sky was filled with planes and vapor trails all over. Some P-38s and Mustangs strafed the German lines down below us": [http://www.99div.com/...](http://www.99div.com/)
85. WWII (text only, January 28 1945): "Weather - clear and cold. No Church services were conducted in the Bn. this morning. In the early afternoon flights of heavy bombers were seen and heard overhead - their vapour trails showing snow-white against the clear blue sky. From their direction we would hazard that COLOGNE will be the recipient of their loads": [http://victorian.fortunecity.com/...](http://victorian.fortunecity.com/)
86. WWII British Civil Defence (with modern photo): "Watching the skies for jet contrails was the mission of every member of the observer corps": [http://home.att.net/...](http://home.att.net/)
87. WWII (Text only, april 8, 1945): "Hundreds of B-17 Bombers flew overhead toward the German lines. Their engines made an almost constant drone and the sky was almost white with the many vapor trails": [http://www.google.com/...](http://www.google.com/)
88. WWII (text only, April 17, 1945): "We were flying in as close formation as possible to leave a good bomb pattern in the strike area. Flak had just begun to explode as the anti-aircraft gunners searched for our range. We were easy for them to spot, as our contrails were heavy that day, pointing like fingers in the sky toward our squadron as it flew straight and level on its bomb run. [http://www.91stbombgroup.com/...](http://www.91stbombgroup.com/)
89. WWII (text only, June 4, and June 10, 1944): "Forming trouble was again experienced on this mission when assembly was attempted above 24,000 feet with contrails. "The formation was all screwed up and then, when we reached the target, we made three distinct runs without dropping. The PFF ship messed up the mission unforgivably..." and "Weather kept the entire Eighth on the ground on 9 June, but the following day the 491st went to Conches Air Field in France after another futile attempt to effect an orderly assembly at 25,000 feet with contrails. ": [http://www.jps.net/...](http://www.jps.net/)
90. WWII (text only, July 21, 1944): "Loss number three was 41-28987, here described by the pilot, 2nd Lt. Earl W. Newton. "We flew into contrails and overcast near Stuttgart": [http://www.jps.net/...](http://www.jps.net/)

=== not fully sorted according to conflict

1. WWII (text only): Contrail observed in Asian air-space, on April 7, year uncertain: [http://glorene.com/...](http://glorene.com/)
2. First movie called VAPOR TRAILS, 07/18/1947: showing US B-17 flying in circles leaving round rings of vapor trails. 3) US B-17 in flight leaving long line of vapor. 4) US Same as sc 2. 5) US Same as sc 3. Reel 3: 1) US Series of shots of vapor trails. Good From NARA THE JET STORY, 10/04/1941. BOMBING BREMEN & WILHELMSHAVEN, 07/26/1943.

SHUTTLE MISSION TO REGENSBURG, 08/17/1943.
 THE THUNDERBOLTS: RAMROD TO EMDEN, 10/02/1943.
 WILHELMSHAVEN, 11/03/1943.
 GERMAN PRISONERS EVACUATED TO NAPLES; GERMAN PLANES DIVE BOMB ANZIO, ITALY: EVACUATION OF WOUNDED MARINES, 12/22/1943.
 MISSION TO AIRFIELD NORTH OF ROME, 01/14/1944.
 MISSION TO WILHELMSHAVEN, 02/03/1944.
 MISSION TO BERLIN, GERMANY, 03/22/1944.
 MISSIONS TO BERNBERG & OBERPFAFFENHEFEN, 04/13/1944.
 COMBAT MISSION BERCK SUR MER, FRANCE 06/02/1944.
 MISSION TO HAMBURG, GERMANY, 06/18/1944.
 MISSION TO BERNBERG, GERMANY, 06/29/1944.
 JAP PLANES ATTACK CARRIER AND TASK FORCE, 06/30/1944.

- Anti-aircraft Battery are silhouetted against German sky streaked with vapor trails from allied and enemy planes engaged in Christmas Day dog-fight. Near Puffendorf, Germany., 12/25/1944. - with unknown photo on: [http://www.nara.gov/...](http://www.nara.gov/) [http://www.nara.gov/...](http://www.nara.gov/)
- WWII (April 6, 1945, text only): "Two aircraft were missing as a result of a mid-air collision shortly before reaching the target at Leipzig: #43-38958, Green Hill Belle, 427BS, and #44-8647 (No Name), 360BS-M. The dense contrails appeared to contribute directly to the collision": [http://303rdbga.com/...](http://303rdbga.com/)
 - WWII St.Pauls Cathedral contrails, photo: [http://gallery.yimg.com/...](http://gallery.yimg.com/)
 - WWII (text only, there is another report also for this date): Merseburg - one of the roughest targets in the ETO! Most difficult mission was mission #275, 21 Nov. 1944; target Leuna works in Merseburg, Germany. Thick fog from 18,000 to above 28,000 feet made visual bombing impossible. PFF (Radar) bombing from 18,000 feet was ineffective and also exposed the group to murderous accurate flak. Thick contrails obscured vision and made tight formation impossible. As it was, Lt. Green's plane collided with Lt. Virag's ship sending him down where ME-109s finished the job. Many ships dropped bombs when they saw others salvo, resulting in a scattered drop and in no way accurate.": [http://www.303rdbga.com/...](http://www.303rdbga.com/)
 - WWII (text only): "5th April 1945 (Mission 158) AC 43-38286 (Flying Dutchmen), Don McCutchan, 7th Squadron Unterschlaersbach (10 miles W of Nurnburg) 5 April, jet airfield shocked by our 2 ship formation. Very bad weather, 25,000 ft clouds, dense persistent contrails, assembly impossible. Back over Belgium at 800 ft 7 1/2 hrs , 900 miles": [http://www.jccc.net/...](http://www.jccc.net/)
 - Check for redundancy: WWII (Nov 21, 1944, text only): "Meyer maneuvered his formation into position for a surprise attack, himself shooting down three FW-190s. In one case, he used the contrail of an FW-190 for cover, firing at the unseen enemy until he could see strike flashes through the contrail, then breaking off just before ramming the burning enemy plane": [http://acepilots.com/...](http://acepilots.com/)
 - WWII memories, February 3, 1945, over Berlin, with contrails; text only: [http://www.dhm.de/...](http://www.dhm.de/)
 - WWII (text only): " As you've assumed, the bomber crews as well as our fighter escort saw contrails about every day even though an effort was made to avoid them. As was often said, they represented large fingers pointing to the bombers. Obviously of assistance to the enemy fighters who could spot us at a considerable distance. The nature of the contrails was such that they required certain atmospheric conditions to form. Thus, they were principally affected by altitude. At the pre-mission briefings, they typically advised us of the altitude that the formation of contrails could be expected with an effort made to avoid that particular altitude. More often than not though, we did in fact make contrails indicating that their information was faulty or that flying at that altitude couldn't be avoided. We in B-24s typically bombed from about 22,000 feet while the B-17s, which could fly higher, bombed from around 27,000, particularly at tough targets where higher was better in an effort to avoid the flak as much as possible. My recollection is that the contrails persisted for some time. While I don't recall timing them, I would guess that they could be seen for fifteen minutes or more. At times, Germany appeared to be almost covered by contrails as far as you could see. Essentially creating a cloud layer which could possibly persist for hours I suppose. The bombers' in more or less straight lines, the fighters', usually above us, more random as they criss crossed or circled. A common sight was the escorts dropping their tanks and heading off after the bad guys. The contrails also tended to create a cloud layer which restricted the visibility of the following aircraft. So, contrails represented a problem to us and were to be avoided if at all possible": [http://www.ecotoday.com/...](http://www.ecotoday.com/)
 - Doublet? Contrails and flak, WWII: [http://www.secretvietnamwar.com/...](http://www.secretvietnamwar.com/)

KOREAN WAR ...up

- 1950: "As we moved nearer to the target, I spotted contrails across the river. For the past thirty minutes there had not been one word on the radio, and then, I heard loud and clear; "Bandits at ten o'clock, coming in." Immediately the throttles went to 100% and the dog fight was on": <http://www.onr.com/user/dtg/Chapter1.htm>
- 1953: "For one thing, Red interceptors were locating the B29s by trailing their contrails on moonlit nights. Such nights were now avoided": [http://www.airpower.maxwell.af.mil/...](http://www.airpower.maxwell.af.mil/)
- "Darkness no longer afforded B-29s protection to attack targets in North Korea; enemy night interceptors shot down four B-29s in January. The enemy used ground radar to guide interceptors to the medium bombers; moonlight, contrails, searchlights, and flares for visual identification; and controller aircraft for coordination of fighter passes": [http://www.au.af.mil/...](http://www.au.af.mil/)
- "The Fifth Air Force joined the Navy and Marines to provide fighter escorts to intercept enemy aircraft before they could attack the B-29s. Bomber Command also restricted missions along the Yalu to cloudy, dark nights because on clear nights contrails gave away the bombers' positions": [http://www.maxwell.af.mil/...](http://www.maxwell.af.mil/)
- "I recall the specifics of the route of flight and the actual flying of the mission itself, but do not recall the escorts. Typically, there was the rendezvous over Chinampo Peninsula, normally SOP for long range reconnaissance, the calling off of MiG trains leaving the station as reported by "Stovepipe Control" and the F-86s weaving overhead as escorts. Far ahead in the skies over China, the tiny silver dots and contrail streamers would start to form as the Migs climbed up through contrail altitude. Contrails over North Korea/China start to form at about 28,000 feet and quit forming at about 34,000 feet in the late fall and winter time. A defensive measure/bit of information well worth knowing. It makes an airplane harder to see if they ain't pulling contrails. You either fly above or below the contrail level": [http://www.cottonpickers.org/...](http://www.cottonpickers.org/)
- "1953 Jan. 10/11: 307th BW B-29s bombed Sonchon and Anju marshaling yards. Enemy searchlights illuminated a B-29 apparently betrayed by its contrails, and fighters shot it down": [http://www.afa.org/...](http://www.afa.org/)
- "Another reason for the friction was that often the F-86s were supposed to provide a MiG cap to protect the Fighter Bombers from attack during their bombing runs. The F-86s were sitting at 30,000 feet watching for contrails from the north. Unfortunately, the seasoned Russian pilots simply came in low without any tell-tale contrail and attacked the heavily laden F-84s": [http://kalanio.tripod.com/...](http://kalanio.tripod.com/)
- "We were to have a major setback at this point. When we got to high altitude and started leaving contrails, the contrails totally obscured the view-finder in the rear compartment. I couldn't see a thing. We had never left contrails on any of our practice flights so were not aware of the problem": [http://www.rb-29.net/...](http://www.rb-29.net/)

FRENCH INDOCHINA WAR ...up

- Air War over French Indochina (text only, 1954): "Although the airstrike never came to fruition, USN aircraft did fly reconnaissance missions in support of the possible strike, and forces on the ground at DBP [Dien Bien Phu] reported sighting jet contrails high in the sky ": [http://www.hedgehoghollow.com/...](http://www.hedgehoghollow.com/)

COLD WAR ...up

- "Telltale Contrails: Normally the flights were a quick loop, overflying targets near Vladivostok and Sakhalin in the Soviet Far East. Between April 1954 and February 1955, USAF pilots conducted nine missions, usually comprising four aircraft flying at altitudes from 45,000 to 48,000 feet. They knew they would be tracked by Soviet radar but of greatest concern were the aircraft contrails that pinpointed their location": [http://www.afa.org/...](http://www.afa.org/)
- Cold War (1954): "It was a clear day (not a cloud in the sky) as we coasted in to the Soviet Union. Suddenly we started to generate contrails like six white arrows pointing to our airplane. (Not in the forecast!) As we passed over our first recon target I could see the fighters circling up to meet us and knew it would only be a matter of time before they reached our altitude" (text only): [http://nerd.dartmouth.edu/...](http://nerd.dartmouth.edu/)
- Probably before 1962: An apparent contrail over the old BMEWS installation at Thule Air Base: [http://www.bwcinet.com/...](http://www.bwcinet.com/)

VIETNAM WAR ...up

Compared to World War II, there are very few veteran accounts available on the net, and almost no photos. The only 'contrail' picture I found is from 'agent orange' spraying, and the only texts, the following document in State Department archives and one was veteran account. Further to this, the "National Archives and Records Administration" (<http://www.nara.gov>) holds many films from the Vietnam war, showing contrails.

1. Agent Orange spraying: <http://www.lbjlib.utexas.edu/...> and [click](#)
2. Vietnam War: "But pilots regard the airplane as a workhorse, not a thrill machine. A U-2 squadron commander in Vietnam, Willie Horton remembers flying sorties from dawn to dusk in the 1960s, back and forth, his camera hunting for enemy activity. "I'd be on station for five hours and I'd see a [SR-]71 contrail above me, coming in from the China Sea toward Thailand," he says. "An hour later I'd see a contrail going the other way. I'd know that pretty soon that S.O.B. would be in a bar having a cold beer and telling stories and I'd still have five more hours up there"; <http://www.Airspacemag.com/...>
3. 1967: Three contrails better than many: FOREIGN RELATIONS OF THE UNITED STATES, 1964-1968, Telegram From the Embassy in Laos to the Department of State/1, Vientiane, December 20, 1967, 0603Z: "... On day-time overflights for strikes in NVN and SVN he was a little more skittish and asked whether we could avoid mass formation overflights with ostentatious contrails. I said I would look into this, but undertook no commitments. He did not press it further, so I consider his statement stands in the form of a desideratum rather than a condition. It seems to me that his desideratum would be met if strike missions are flown in cells of three, which I gather is normal practice": <http://www.state.gov/...>
4. "It was harder to spot and track the Phantom with its new paint (all Air Force F-4Cs were painted USAF colors, until mid '65), but he watched as the F-4 streak down to ocean waves--wispny contrails swirling in its path. "FOX-4 . . . you're taking fire from the shore!" Globes of orange-pink wafted lazily from the tree-line with no chance of intercepting the fighter-bomber, and winking out hundreds of yards behind him": <http://www.war-stories.com/...>
5. A-1 Skyraider wing-tip contrails observed during bombing mission over Vietnam: <http://www.lbjlib.utexas.edu/...> from <http://militaryhistory.about.com/...>

PAKISTAN-INDIA 1965 AIR WAR ... up

1. "Nevertheless Rab Nawaz persevered and, with intense concentration, eventually succeeded in manoeuvring the Sabres into visual contact with the target whose contrails no doubt played an important part in this interception" (deep link lost?): <http://www.pakdef.info...>

GULF WAR ... up

1. NOAA image which may show reconnaissance flights or refuelling operations over Saudi Arabia and Iraq: <http://www.astro.ku.dk/~holger/IDA/S/page02015.html>
2. Gulf War (January 18, 1999): "The co-pilot of a U.S. Air Force EA-6B electronic jamming plane was flying protective cover for several British Jaguars over northern Iraq last month when he was surprised to see the contrails of an Iraqi surface-to-air missile and hear an explosion overhead": <http://www.kurdistan.org/...>
3. Contrail numbers reveal lost planes: "On the first night of the war, a huge package of five KC-135s refueling twenty F-15Es en route to targets in Iraq flew through the RJ orbit. Later, RC-135 crew members would count the number of southbound contrails passing over the Saudi-Iraqi border. Even numbers usually meant that all of the strike package was returning; odd numbers often meant that a jet had been downed in Kuwait or Iraq and that the hunt was on to rescue the missing aviator": <http://www.afa.org/...>

MIDDLE EAST CONFLICT ... up

1. "The space over Tel Aviv is crisscrossed by the contrails of the airliners and the surveillance aircraft who keep a constant watch to deter any attack" (text only): <http://www.geocities.com/...>
2. Contrails in Israel-Lebanon conflict (text only): <http://www.shirhadash.org/...>

KOSOVO CONFLICT ... up

1. Europe-bound aircraft seen on February 11, 1999 NOAA data: <http://www.osei.noaa.gov/...>
2. A SPOT image from the same day seems to show massive contrail coverage over Los Angeles: <http://www.astro.ku.dk/~holger/IDA/S/PHOTOS/LA.jpg>
3. A B52H en route Kosovo, May 1999: <http://www.af.mil/...> and a strikingly similar B52-contrail picture
4. The Washington Post (1999), pictures of B52H departing with smoke emission: <http://www.washingtonpost.com/...>
5. Der Spiegel (May 24, 1999) on Kosovo contrails (text only): "Der Himmel über Matejce sieht aus wie ein blauweißer Schnittmusterbogens Kreuz und quer laufen die Kondensstreifen über das Firmament. Es wird heiß werden, die Luft zittert schon am Morgen": <http://spiegel.de/...>
6. Die Welt, April 3, 1999: Kosovo conflict, 1999, text only: "'Nato, Nato, Nato', jubeln die Männer. Frauen zeigen ihren Kindern die Kondensstreifen der Jets am blauen Himmel": <http://www.welt.de/...>
7. Five or six contrails are seen on cover of the 1999 annual report of "Medecins sans Frontier" 's Danish section, Læger uden Grænser. The photo was taken in a refugee camp is Kukes, Northern Albania, April 1999. <http://www.astro.ku.dk/~holger/IDA/S/page0147b.html>

CONTRAILS AND ASTRONOMY ... top of document

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- [Various astronomical Concerns](#)

CONTRAILS AND AVIATION NEAR OBSERVATORIES ... up

1. IAU: Aviation near astronomical observatories is discussed in this document, which also gives recommendations on how to lessen the impact (no aviation above 10 degrees above the horizon, and not closer than 5 km (60 km?)): Graham Smith, F., 1977, "Report & Recommendation of Commission 50", IAU-UNESCO - DG/2.1/414/44
2. IAU Resolutions relating to aviation above observatories: (the full texts are available from references included in <http://www.jb.man.ac.uk/...>)
 1. IAU Transactions, Vol. XII (Hamburg), Resolution No. R5: "During total eclipses of the Sun, important scientific observations made from the ground by professional astronomers may be hampered, or even ruined, by the vapour trails from aircraft flying in the zone of totality. The International Astronomical Union accordingly requests the competent authorities in the countries concerned to regulate flights at the times and locations of total solar eclipses in such a way that their interference with scientific programmes be avoided."
 2. IAU Transactions, Vol. XVI (Grenoble), Resolution No. R9: "The International Astronomical Union notes with alarm the increasing levels of interference with astronomical observations resulting from artificial illumination of the night sky, radio emission, atmospheric pollution, and the operation of aircraft above observation sites."
3. Contrail over La Silla observatory: <http://www.eso.org/...>
4. Own concern for contrails affecting astronomy (see the two aircraft CCD-filmed in second URL!): <http://www.eso.org/gen-fac/...> - and - [click](#) - and - [click](#)
5. Contrails in all-sky imagery and animations (impressive!) from Cerro Tololo Interamerican Observatory: <http://www.ctio.noao.edu/...>
6. Scripps Oceanographic Institution: Contrails seen in all-sky imager data: <http://dev10.sgp.arm.gov/...> (also earlier and later pics) - and - [click](#) (a superb animated gif can be made of DsgpwsirawredC1.00.990101.024200.jpg through DsgpwsirawredC1.00.990101.034800.jpg) - and - [click](#)

7. Stargazing at Fremont Peak Observatory on December 19, 1997: "0025: The moon is still doubly-obscured, and atmospheric moisture is quickly becoming apparent; there are huge contrails hanging in the sky, and everything is getting bright": <http://www.isr.co.jp/...>
8. Spanish observatories at Canary Islands Tenerife and La Palma enjoy legal protection from overflights: Ulrich v.Kusserow (Bremer Klimatage 1998): "...Die Seeing-Bedingungen für die Beobachtungen der Sonne am Tage und des Sternenhimmels in der Nacht waren in dieser Zeit nicht gut. Was war die Ursache dieser Bewölkung? Offensichtlich waren es die Unmengen an Düsenflugzeugen, die auf der Hauptflugroute in den Süden im Umgebungsbereich so vieler Flughäfen wie München, Stuttgart, Friedrichshafen, Straßburg, Innsbruck, Basel oder Zürich Kondensstreifen über Kondensstreifen über den Himmel verteilen. Zunächst sehr scharf geradlinig und eng begrenzt, nach einiger Zeit mehr oder weniger gleichmäßig sich ausbreitend und schließlich diffus werdend, bildeten diese Kondensstreifen mehrere Tage lang einen fast durchgängigen Wolkenteppeich. Gerade in der klaren Luft bedarf es sogenannter Aerosolen, den unter anderem auch von Flugzeuge ausgestoßenen, in der Gasatmosphäre schwebenden Flüssigkeits- und Feststoffpartikeln, als Kondensationskerne, damit sich überhaupt Wolken ausbilden. Daß diese Kondensstreifen ein wirklich ernstzunehmendes Problem auch für beobachtende Astronomen sein können, das macht eine vor etwa einem Jahr vom Instituto de Astrofísico de Canarias (IAC) auf Teneriffa unter dem Schlagwort "Gesetz des Himmels" durchgesetzte Verfügung deutlich, wonach es von jetzt ab für Zivilflugzeuge grundsätzlich und für Spezialflugzeuge mit sehr wenigen Ausnahmen verboten ist, in einen am Boden 10 km breiten, in der Höhe bis zu 50km zunehmenden Korridor über den europäischen Großsternwarten in Iza(a auf Teneriffa und Roque de los Muchachos auf La Palma einzudringen)": <http://members.aol.com/...>
9. Amateur astronomy: "Focus your telescope using the airplane in front of a contrail" (sic!): <http://www.atmob.org/...>
10. Astronomy: "Moonlit contrails look much different from sunlit contrails": <http://www.ucolick.org/...>
11. Woody Sullivan using contrails in astronomy teaching: <http://www.astro.washington.edu/...> - and - <http://mimas.astro.washington.edu>
12. Dave Crawford, GNAT/IDA, on photometric reductions, argues: "Besides the effects of air mass differences, there are temperature and humidity impacts, inversion level altitude, east-west and north-south effects (and towards-away from a city or mine or whatever), jet trails, light clouds, heavy clouds, and so on, all of which change on varying time schedules.": <http://www.gnat.org/...>

SOLAR IMAGING ...up

1. Mt.Wilson, white light photo of the Sun, with crossing airliner (July 25, 1991): <http://physics.usc.edu/...> - and - [click - and - http://www.uh.edu/...](http://www.uh.edu/...)
2. Jet with contrail crossing Sun: <http://www.ngdc.noaa.gov/...>
3. The end of coronal observations at Mt.Wendelstein observatory: <http://bigbang.usm.uni-muenchen.de:8002/...>
4. Contrails over the "Pic du Midi" observatory, from its home page (the observatory is known to be bothered by contrails in its coronographic work): <http://mesola.obspm.fr/...> - and from Observatoire Midi Pyrénées: <http://www.obs-mip.fr/...> - and from Bureau de Longitudes: <http://www.bdl.fr/...> - and - [click -and- http://www.rockefeller.univ-lyon1.fr/...](http://www.rockefeller.univ-lyon1.fr/...)
5. Contrails over Mt.Washington observatory: <http://www.mountwashington.org/...> from [click](http://www.click)
6. Contrail in time-lapse solar imaging (amateur): <http://jimvb.home.mindspring.com/...> - from [click](http://www.click)
7. Student solar observers encouraged to report contrail observations: <http://ethel.as.arizona.edu/...>
8. Hydrogen alpha image of the Sun (Corbis, copyright): <http://piximg.corbis.com/...>

SOLAR ECLIPSES ...up

1. R.Bunge's photo of two U.S. Navy A-7E attack jets flying in formation in front of a partially eclipsed Sun.: <http://www.radix.net/...>
2. Solar eclipse August 11, 1999: "Contrails disappear from view as the totality draws closer" (text only): <http://www.astroinfo.at/...>
3. On the solar eclipse (Concorde) contrail shadow cast on clouds: <http://www.farshore.force9.co.uk/...>
4. Solar eclipse observation marred by contrails: "Am 12.10.1996 sah 's dann schon besser aus, die Wolken ließen den Blick weitgehend frei, das Ende der Finsternis verberg sich dann allerdings hinter stark zunehmender Zirrenbildung (Kondensstreifen von Flugzeugen). Dies hatte dann noch den Effekt, daß das Finsternisende umrahmt war von Halo und Nebensonnen": <http://home.t-online.de/...> - and - Solar eclipse August 1999 marred by contrails: "Insbesondere ist die aktuelle Bildung von Kondensstreifen durch den starken europäischen Flugverkehr eine nicht zu vernachlässigende Gefahr für die Bildung von lokalen Cirren": <http://www.vds-astro.de/...>
5. Solar eclipse 12.10.1996 obstructed by contrail-cirrus: <http://home.t-online.de/...>
6. Solar eclipse in India, 1995: "Following 3rd contact an aircraft contrail was seen underneath the sun, and a loud sonic boom was heard": <http://www.eclipsetours.com/...>
7. Solar eclipse 1999: photo of contrails from Concordes and one Hercules aircraft: <http://www.hurstweb.freereserve.co.uk/...> - from - [click](http://www.click)
8. Concordes contrails in solar eclipse pictures: <http://home.wanadoo.nl/...>
9. A contrail from a IAF MiG-29 chase plane observed during the 24 Oct. 1995 solar eclipse: <http://www.jucaa.ernet.in/...>
10. "Die Wolken kommen von Westen, in 3 Schichten. Gaaanz oben die feinen Zirren, darunter zerfledderte Kondensstreifen der vielen Flugzeuge über dem Verkehrsknoten Mittlerer Neckarraum, und in 2-5 km Höhe rießige Kumuluswolken, wie Berge aus geschlagener Sahne. Dazwischen kleine Stücke blauer Himmel": <http://home.t-online.de/...>
11. August 11, 1999 solar eclipse seen from France: "... there are some ugly things happening at 25,000 feet. Now every jet contrail is growing": <http://www.mreclipse.com/...>
12. Contrails over Germany, shortly before the August 11, 1999, solar eclipse: <http://www.schremmer.purespace.de/...> quoted from [click](http://www.click)
13. H.Walker: "Shadow bands during the [August 11, 1999] eclipse or a con-trail?": Astronomy and Geophysics, October 1999, vol 40. p.9.
14. Jet contrail the obvious explanation for the "dark shadow bands" seen during the August 11, 1999 solar eclipse (with high-quality all sky photo): " My fish-eye shots clearly showed the dark bands and I enjoyed my 15 minutes of fame when one photo was published in the Telegraph and another across half a page of the Guernsey Evening Press": <http://www.u-net.com/...>
15. On the contrails seen in Finland during solar eclipse: <http://www.bujack.de/...>
16. A Concorde/solar_eclipse photo linked from Radio Denmark; it seems to be a fake: <http://www.dr.dk/...>

LUNAR ECLIPSE ...up

1. A lucky lunar eclipse January 20-21st, 2000: "As the moon rose shortly before the eclipse the sky was filled with high cirrus clouds and thick con trails. An hour before 2nd contact it cleared completely": <http://www.icstars.com/...>

NIGHT TIME ASTRONOMY ...up

1. Contrail passing Milky Way (poor, but only night-time contrail photo known): <http://www.spacestar.net/...>
2. A night-time astronomical photo ruined by an airplane and its contrail: <http://www.astroinfo.ch/...>
3. Jet airplane, with contrails, passing the Moon (from Mt.Wilson observatory): <http://www.astrophys-assist.com/...>
4. "One night without contrails, for photography of comet Hale-Bopp": <http://www.jpl.nasa.gov/...>
5. Hale-Bopp and two airplane contrails: <http://www.en.com/...> - and Hale Bopp with contrail cirrus: [click](http://www.click)
6. "Saturday, April 05, 1997: Despite some very thin high clouds and contrails comet Hale-Bopp was visible this evening, but due to poor seeing wasn't very bright in Savannah": <http://www.premierweb.net/...>
7. Hale-Bopp photos crossed by contrails (seen by trained eye, only): <http://www.nezumi.demon.co.uk/...>
8. Comet Hale-Bopp crossed by stroboscopic airplane lights: <http://members.aol.com/...>
9. Hale-Bopp picture with airplane lights: <http://www.mreclipse.com/...> from [click](http://www.click)
10. Photo of Sagittarius ruined by aircraft lights: <http://personal.physics.lsa.umich.edu/...>
11. Star trails over Lick observatory, with aircraft lights: <http://www.snapnet.com/...>
12. Jet aircraft crossing Moon: <http://www.mpia-hd.mpg.de/...>
13. Contrail on hazy sky, over Moon: <http://aibn47.astro.uni-bonn.de/...>
14. Amateur astronomer suffering from contrails (text only): "Hallo, ich wohne am Rand des Odenwaldes und leide wie wir alle unter dem schlechten Wetter und den Kondensstreifen des Luftverkehrs": <http://members.aol.com/...>
15. Measuring clouds at night is not easy: <http://www.cira.colostate.edu/...>
16. Contrail cloud cover (over Europe) during daytime is about twice as high as during nighttime (DLR): <http://www.dlr.de/...>

POTENTIALLY USEFUL CONTRAIL DETECTORS ..

up

1. NOAA ship Discover, fish eye lens sky pictures: <http://saga.pmel.noaa.gov/...>
2. NOAA Mauna Loa all sky camera: <http://mloserv.mlo.hawaii.gov/...>
3. The USAF Academy Observatory All-Sky Camera: <http://www.usafa.af.mil/...>
4. All-sky camera of the Australian Antarctic Program, at Kingston: <http://www.antdiv.gov.au/...>
5. University of Washington/Apache Point Observatory's all-sky IR camera: <http://www.astro.washington.edu/...> Eric Deutch informs: "The movie for any night ever taken with the camera can be found at [click](#) ... One recent daytime movie (short) can be viewed (MPEG format) at: [click](#) . This MPEG is about 34 frames and 370 kB. It shows a contrail drifting across the sky not far from the Sun, which is also seen.

VARIOUS ASTROMICAL CONCERNS ..up

1. Comparison between the importance of light pollution and aircraft contrails: "I've been hoping that what happened in California (deregulation) wouldn't happen here (Missouri) because I'd be in a world of hurt for spare cash. Maybe it would be all for the better if that is the only way to get light pollution under control. Increased electric bills would be a real project killer, but I do already have several instruments to observe with. However, as my previously very dark rural location has become increasingly suburban, I've noticed that the biggest limitation is tropospheric transparency. From aircraft contrails at high altitudes (the worst source of obscuration), all the way down to diesel exhaust from several different truck stops, everything has gotten hazier. The closest truck stop is seven air miles distant and it only takes a few months to start turning my white dome black after it has been repainted. Additionally, that one truck stop throws out enough to produce its own glow, as seen from here": <http://astro.umsystem.edu/...> - and - "Light pollution has largely destroyed our visual and photographic view of the night sky and aircraft condensation trails are now destroying the daytime sky. One might have thought that light pollution would have been the greater problem, but electronic detection and processing methods have helped to mitigate the worst effects. I wonder what are the chances of a development to nullify the obscuring and sometimes turbulent effects of aircraft condensation trails on astronomical observation? These may yet turn out to be the more serious problem": <http://www.google.com/...>
2. On the disappointment viewing a solar eclipse from the Concorde: <http://www.greatdreams.com/...>
3. Sky and Telescope Magazine (text only): "The sky above was breathtaking: a deep blue dome streaked with violet-edged clouds and crosshatched with vapor trails": <http://www.findarticles.com/...ml>
4. Observations of moving ripples made difficult by contrail-cirrus: <http://www.meteoros.de/...>
5. Words from England: "The daytime sky is full of vapour trails, the night sky is heavily polluted with stray light from a million street lights. This is a difficult place to feel spiritual": <http://www.mememachine.cwc.net/...>
6. Jet contrails interfering with preparation for 'Messier Marathon': <http://www.npmas.com/...>
7. Concorde (artistic?) contrails Solar eclipse photograph: <http://www.d.umn.edu/...> - and - in relation to computer graphics (Spanish) <http://www.simuvuelo.org/...>
8. Naked eye observations of giant sunspot obstructed by contrails: <http://www.silive.com/...>
9. Contrails in front of aurorae pictures (unique!): <http://www.freenet.victoria.bc.ca/...>
10. A picture apparently showing contrail over the a moon-lit night sky is indeed manipulated from a day time shot: <http://www.photo.net/...>
11. Contrails interfering with solar irradiance measurements: <http://www.eosdis.ornl.gov/...>
12. The presence of contrails is good for the prediction of astronomical observing conditions for amateur astronomers (sic!): <http://www.britannica.com/...>
13. Astronomy and Contrails for kids: Contrails tell about upper-atmosphere humidity!: <http://www.intelligentchild.com/...>

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COLORADO

1. Colorado State University (much good reading): <http://www.cira.colostate.edu/...>
2. More clouds means less day-night temperature range (contrails mentioned?): <http://www.cira.colostate.edu/...>
3. Cloud detection LIDAR: <http://armuav.atmos.colostate.edu/...>
4. Problematic interpretation of satellite imagery: <http://www.cira.colostate.edu/...>
5. The ARM-UAV Home Page (on atmospheric radiation measurements, contrails mentioned somewhere): <http://armuav.atmos.colostate.edu/...>
6. University of Colorado, at Boulder: "Cirrus Cloud and Climate Modifications due to Subsonic Aircraft Exhaust": <http://paos.colorado.edu/...>
7. Cirrus Cloud and Climate Modifications due to Subsonic Aircraft Exhaust: "Recent observations of cirrus clouds have shown that clear air in the upper troposphere is often supersaturated with respect to ice": <http://lerxst.colorado.edu/...>
8. Concorde: "Locating the Plume of the Concorde": <http://stripe.colorado.edu/...>
9. Intentional generation of contrails for research: <http://armuav.atmos.colostate.edu/...>

NEVADA

1. University of Nevada: Fall streaks photo: <http://unr.edu/...>
2. University of Nevada: amazing picture: <http://equinox.comnet.unr.edu/...>

UTAH

1. University of Utah: Facility for Atmospheric Remote Sensing: <http://www.met.utah.edu/...>

WASHINGTON

1. University of Washington: <http://cargsun2.atmos.washington.edu/...>
2. University of Washington: CONVAIR-580 flights into the arctic, to study high clouds: "Aerosol measurements were obtained in arctic haze layers, some no doubt from long-range transport, and also under very clean conditions": <http://eosweb.larc.nasa.gov/...>
3. University of Washington, DC-8 research plane generating contrail: <http://www.atmos.washington.edu/...> from [click](#)

WISCONSIN

1. Wisconsin: contrails from GOES images: <http://cimss.ssec.wisc.edu/...>
2. Wisconsin: Contrails interfering with average properties measured: <http://lidar.ssec.wisc.edu/...>
3. University of Wisconsin (photo): <http://members.aol.com/...>

ELSEWHERE

1. Contrails interfering with pyranometer measurements of total irradiance; including all-sky camera photos of contrails: [http://http://rsg.optics.arizona.edu/...](http://http://rsg.optics.arizona.edu/)
2. University of Illinois: [http://vortex.plymouth.edu/...](http://vortex.plymouth.edu/)
3. University of North Carolina: Old Landsat images with several contrails: [http://www.unc.edu/...](http://www.unc.edu/)
4. American University: A sober description of "SST, Concorde, and Environmental impact": [http://www.american.edu/...](http://www.american.edu/)
5. Contrails to be reported in 'daily observations' from Florida State University Meteorology Department: [http://garnet.acns.fsu.edu/...](http://garnet.acns.fsu.edu/)
6. U Michigan (groundbased photo of contrails): [http://www.windows.umich.edu/...](http://www.windows.umich.edu/)
7. South Dakota Institute of Atmospheric Sciences: [http://www.ias.sdsmt.edu/...](http://www.ias.sdsmt.edu/)
8. Desert Research Institute: Atmospheric Sciences Center: "Emphasis is currently being placed on the role of volcanic dust and other aerosols, particularly the role of aircraft contrails, in changing the optical properties of cirrus clouds": [http://www.dri.edu/...](http://www.dri.edu/)
9. Contrail in cloud catalog of Iowa State University: [http://pals.agron.iastate.edu/...](http://pals.agron.iastate.edu/)
10. New York Institute of Photography: "In today's 'digital darkroom' the possibilities for change are even greater. Not only can tones be modified easily, but also, offending signs of civilization-a signpost, wires, or even the contrail of a passing jet, can be easily eliminated": [http://www.nyip.com/...](http://www.nyip.com/)

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1. American Geophysical Union press release of June 21, 1999: "Jet contrails to be significant climate factor by 2050": [http://www.agu.org/...](http://www.agu.org/)
2. American Geophysical Union: "On the size distribution of cloud condensation nuclei": [http://earth.agu.org/...](http://earth.agu.org/)
3. Lawrence Livermore National Laboratories: Cloud detection LIDAR: [http://128.115.47.31/...](http://128.115.47.31/)
4. Climatic impact of contrails may be 2 - 3 times larger than that of airplane emissions of CO2: [http://www4.nationalacademies.org/...](http://www4.nationalacademies.org/)
5. The National Academies: "Atmospheric Effects of Aviation": A Review of NASA's Subsonic Assessment Project Panel on Atmospheric Effects of Aviation, National Research Council 54 pages, 6 x 9, 1999. (see page 20, 21, and 43, for mention of contrails): [http://www.nap.edu/...](http://www.nap.edu/)
6. National Academy of Sciences, 1997: "...A more recent concern is that contrails and particulate emissions may increase the abundance of cirrus clouds, which could, in turn, have significant climatic impact": [http://www4.nationalacademies.org/...](http://www4.nationalacademies.org/) and: Michael Prather, on the current day impossibility of numeric prediction of the influence of contrails on climate (NRC Panel on Atmospheric Effects of Aviation / Feb. 11-12, 1999): [click](#) ... and: Board on Atmospheric Sciences and Climate (The National Research Council), March 2-3, 1999: "... It was noted that the most important impact of subsonic aviation may be from contrails, which have been recently shown to persist longer and have a greater radiative forcing impact than previously thought": [click](#)
7. Environmental Protection Agency, EPA, concern: [http://www.epa.gov/...](http://www.epa.gov/) - and - a search for 'contrails' in (Aircraft also trigger formation of condensation trails, which tend to warm the Earth's surface. Water vapor emissions also may lead to increases in the formation of high altitude (cirrus) clouds, which tend to warm the Earth. Extensive cirrus clouds have been observed to develop after the formation of persistent contrails): [click](#) ... gives, among several, this very detailed account on scattering properties of the terrestrial atmosphere: [click](#)
8. EPA on contrails: [http://www.epa.gov/...](http://www.epa.gov/) and aviation emissions: "Aircraft emissions [...] contribute significantly to global change and the depletion of the stratospheric ozone layer": [click](#)
9. EPA on cleanliness standards (contrails mentioned?): [http://www.epa.gov/...](http://www.epa.gov/)
10. National Science Foundation (NSF; Ackerman statement) "Do jet contrails forecast cloudy climate?": [http://www.nsf.gov/...](http://www.nsf.gov/)
11. The U.S. Global Change Research Information Office: "Atmospheric Effects of Aviation" (thoughts about ICAO cruise level emission standards): [http://www.gcrio.org/...](http://www.gcrio.org/)
12. National Center for Atmospheric Research: A high-altitude aircraft: The broad-winged WB-57, good for research into contrails: [http://home.ucar.edu/...](http://home.ucar.edu/)
13. National Oceanographic and Atmospheric Administration: "Higher than expected particulate matter in the exhaust of the SST Concorde": [http://www.al.noaa.gov/...](http://www.al.noaa.gov/)
14. University Corporation for Atmospheric Research, showing a contrail produced during contrail research: [http://www.ucar.edu/...](http://www.ucar.edu/) and contrails during transition to cirrus: [click](#)
15. Amazing picture of formation flying, with contrail: [http://raf.atd.ucar.edu/...](http://raf.atd.ucar.edu/)
16. American Meteorological Society: "Jet aircraft: How large a source of atmospheric pollution?" [http://www.ametsoc.org/...](http://www.ametsoc.org/)
17. Renewable Resource Data Center: Contrails interfering with measurements of solar collector energy collector efficiencies ("Both man-made and naturally occurring events can limit the amount of solar radiation at the earth's surface"): [http://rredc.nrel.gov/...](http://rredc.nrel.gov/) - and - [click](#)
18. Natural Resources Defense Council quoted in The Environmental Magazine, May-June 1997: "Global climate change is a serious concern as planes add pollutants to the stratosphere, affecting ozone formation. Contrails, or clouds formed at high altitudes from aircraft engine exhaust are especially problematic. "These cloud formations could have a serious impact on climate change," says Jennifer Stenzel of the Natural Resources Defense Council (NRDC)": [http://209.130.27.13/...](http://209.130.27.13/)
19. General Accounting Office looking into contrails and other aviation emissions, with reports expected by the summer of 2000: [click](#)
20. General Accounting Office on environmental problems near airports (report from August 30, 2000, no mention contrails, contrary to previous URL): [http://www.gao.gov/...](http://www.gao.gov/)
21. Utility PhotoVoltaic Group (no search engine) [http://www.ttcorp.com/...](http://www.ttcorp.com/) - but contrails would be equivalent to 'soiling', which is indeed taken serious, see the faq-site [click](#)
22. Contrails displayed by the National Renewable Energy Laboratory, picture taken at Golden, Colorado 1995 (the photographer seems not to have noticed the contrail): [http://www.nrel.gov/...](http://www.nrel.gov/)
23. The American Solar Energy Society (ASES) (No mention of contrails in spite they must be concerned): [http://www.ases.org/...](http://www.ases.org/)
24. Federal Aviation Authority: Contrails can be reported in the "Text Element Indicator", TEI, of the Pilot Weather Report: [http://www.faa.gov/...](http://www.faa.gov/)

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See also section on Military Weather Modification.

1. U.S. Air Force Upper Air/Contrails Climatology (UACLIMO): [http://www.neonet.nl/...](http://www.neonet.nl/)
2. Kirtland AFB photo of contrail seen from ground (?): [http://www.vs.af.mil/...](http://www.vs.af.mil/)
3. US Air Force: "Upper Air/Contrails Climatology": [http://rainbow.ldeo.columbia.edu/...](http://rainbow.ldeo.columbia.edu/)
4. In-situ Atmospheric Radiation Measurements using drones (Sandia Labs; no direct link to contrail studies, though): [http://www.ca.sandia.gov/...](http://www.ca.sandia.gov/)
5. Air Force observations of contrail frequency as function of season: [http://www-pm.larc.nasa.gov/...](http://www-pm.larc.nasa.gov/) - and - [click](#)
6. 88th Weather Squadron (including photo) on support to Langley contrail research: [http://weather.wpafb.af.mil/...](http://weather.wpafb.af.mil/)
7. Maxwell Air Force Base, Alabama: Reports of 'unidentified flying objects' may be caused by contrails: [http://www.in.tu-clausthal.de/...](http://www.in.tu-clausthal.de/)
8. Naval Postgraduate School: "Analysis of contrails and ship tracks from geostationary and polar orbiting weather satellites": [http://web.nps.navy.mil/...](http://web.nps.navy.mil/)
9. Remotely Piloted Vehicle, Vietnam War, applying "CRL - a system to suppress contrails to reduce visual detection": [http://www.55srwa.org/...](http://www.55srwa.org/)
10. "Analysis of contrails and ship tracks from geostationary and polar orbiting weather satellites": [http://web.nps.navy.mil/...](http://web.nps.navy.mil/)
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12. US Navy Aircraft Emissions Inventory: [http://code916.gsfc.nasa.gov/...](http://code916.gsfc.nasa.gov/)
13. On the formation of contrails from military aircraft, and their impact on the atmosphere: [http://www.chis.navy.mil/...](http://www.chis.navy.mil/)
14. Military weather forecasting, including contrails, using SkewT-log p Diagram: [http://www.osan.af.mil/...](http://www.osan.af.mil/)
15. Military Pilots need to know where contrails are going to form, so they won't give away their position to the enemy: [http://www.wnt.cnet.navy.mil/...](http://www.wnt.cnet.navy.mil/)
16. US military discussion of contrails: [http://www.met.nps.navy.mil/...](http://www.met.nps.navy.mil/)
17. Stealthy performance of jet fighters requires that engines must not produce contrails: [http://www.stormloader.com/...](http://www.stormloader.com/)
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20. On military remote and proximity sensing (only vaguely tied to contrails, but an important document nevertheless): [http://tuvok.au.af.mil/...](http://tuvok.au.af.mil/)
21. Contrails in military weather forecast (Kirtland AFB) [http://www.kirtland.af.mil/...](http://www.kirtland.af.mil/)

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1. NASA facts on contrails: [http://oea.larc.nasa.gov/...](http://oea.larc.nasa.gov/)
2. On the greenhouse effect: [http://asd-www.larc.nasa.gov/...](http://asd-www.larc.nasa.gov/)
3. Clouds and the Energy Cycle: [http://eosps.gsf.nasa.gov/...](http://eosps.gsf.nasa.gov/)
4. James Hansen, of NASA, on Global Warming and contrails: [http://www.giss.nasa.gov/...](http://www.giss.nasa.gov/) - and - [click](#) - see also this Swiss discussion: [http://www.weltwoche.ch/...](http://www.weltwoche.ch/)

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1. Airplane contrail seen during Gemini 8 rocket lift-off: [http://images.jsc.nasa.gov/...](http://images.jsc.nasa.gov/)
2. Post-blizzard view of the Mid-Atlantic states: [http://rsd.gsf.nasa.gov/...](http://rsd.gsf.nasa.gov/)
3. NASA pictures of contrails en masse (search for contrail*): [http://images.jsc.nasa.gov/...](http://images.jsc.nasa.gov/)
4. Contrails over Mono Lake, seen from ER2 high altitude research plane: [http://volcano.und.nodak.edu/...](http://volcano.und.nodak.edu/) - and - for ER-2/U2, see: [http://cloud1.arc.nasa.gov/...](http://cloud1.arc.nasa.gov/)

RESEARCH

1. Micro Pulse Lidars for research on cirrus and contrails up to 20 - km altitude: [http://time.lternet.edu/...](http://time.lternet.edu/)
2. The Different Evolution of A Contrail's Vortex System and its Secondary Wake: Lidar and Numerical Studies : [http://hyperion.gsf.nasa.gov/...](http://hyperion.gsf.nasa.gov/)
3. Mission to Planet Earth: [http://www.hq.nasa.gov/...](http://www.hq.nasa.gov/)
4. NASA Langley research: [http://spacelink.nasa.gov/...](http://spacelink.nasa.gov/) - and - "Jet Aircraft: How Large A Source Of Atmospheric pollution": [http://eosps.gsf.nasa.gov/...](http://eosps.gsf.nasa.gov/)
5. A NASA site with "an investigation of the feedback between climate and cloud optical thickness": [http://sky.arc.nasa.gov/...](http://sky.arc.nasa.gov/)
6. Tropospheric Aerosol Radiative Forcing Observational experiment TARFOX: "A Field Project of the International Global Atmospheric Chemistry Project (IGAC)": [http://geo.arc.nasa.gov/...](http://geo.arc.nasa.gov/)
7. Moffett Field atmospheric research: "An anomalous particle event observed during the 970513 POLARIS flight" (no mention of contrails): [http://geo.arc.nasa.gov/...](http://geo.arc.nasa.gov/) - and - [click](#)
8. NASA studies, using polarized LIDAR: [http://www.giss.nasa.gov/...](http://www.giss.nasa.gov/)
9. Infrared spectroscopy research on "Minor Constituents of the Earth's Atmosphere": [http://geo.arc.nasa.gov/...](http://geo.arc.nasa.gov/)
10. NASA Goddard Institute for Space Studies Research: "Could Airplanes Change the Atmosphere's Temperatures?", by Kathryn Pierce Shah and David Rind: [http://www.giss.nasa.gov/...](http://www.giss.nasa.gov/)
11. Nice picture of processes: [http://geo.arc.nasa.gov/...](http://geo.arc.nasa.gov/)
12. Atmospheric Chemistry of Combustion: [http://hyperion.gsf.nasa.gov/...](http://hyperion.gsf.nasa.gov/)
13. SUCCESS home page: [http://www-pm.larc.nasa.gov/...](http://www-pm.larc.nasa.gov/) and interim report (with ER2-image of contrail): [http://ltpwww.gsf.nasa.gov/...](http://ltpwww.gsf.nasa.gov/) and end-of-mission report: [http://cloud1.arc.nasa.gov/...](http://cloud1.arc.nasa.gov/) and End of Mission Report: [http://cloud1.arc.nasa.gov/...](http://cloud1.arc.nasa.gov/)
14. Wake vortex experiment: [http://lidardev.larc.nasa.gov/...](http://lidardev.larc.nasa.gov/)
15. Corellation between contrail sightings from ground, and jet fuel use above 7000 m: [http://techreports.larc.nasa.gov/...](http://techreports.larc.nasa.gov/)
16. Life cycle of the stratospheric aerosol: [http://sky.arc.nasa.gov/...](http://sky.arc.nasa.gov/)
17. Recognition of clouds and contrails over snow-covered surfaces: [http://asd-www.larc.nasa.gov/...](http://asd-www.larc.nasa.gov/)
18. NASA emphasises perils of contrail formation with two additional aircraft (Man destroys what he loves!): [http://oea.larc.nasa.gov/...](http://oea.larc.nasa.gov/)
19. Contrails may spread to hundreds of meters while maintaining optical depth above 0.1: [http://hyperion.gsf.nasa.gov/...](http://hyperion.gsf.nasa.gov/)
20. Stratospheric Sulfuric Acid and Black Carbon Aerosol Measured During POLARIS and its Role in Ozone Chemistry: [http://geo.arc.nasa.gov/...](http://geo.arc.nasa.gov/)

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1. Concern by the European Commission: "Rapid increase of aircraft emissions could affect atmospheric ozone and climate in the future" (Brussels, May 28, 1998): [http://europa.eu.int/...](http://europa.eu.int/) - and - [http://www.pa.op.dlr.de/...](http://www.pa.op.dlr.de/)
2. European Union versus ICAO on reduction targets for aircraft emissions: [http://ufcna.com/...](http://ufcna.com/)
3. EU research into contrails: [http://www.geod.ethz.ch/...](http://www.geod.ethz.ch/)
4. European Environmental Bureau, Memorandum to the German Presidency and the EU Member States: "Aviation has a special role to play in climate policy for a number of reasons, the complicated and manifold effects of aeroplane emissions in high altitudes being one of the main concerns. According to modest scientific estimates, the climatic impact of aviation emissions in high altitudes (i.e. the combined effects of CO₂, NO_x, water vapour and contrails) ranges at about three-times the impact of ground mobile sources" (Brussels, January 1999): [http://www.asser.nl/...](http://www.asser.nl/)
5. MOZAIK-1 (1993-1996): "The growth of air traffic forecasted for the next century raises the problem of aircraft impact on atmospheric chemistry, the emission of water vapor and aerosols might change the energy balance as well as the chemistry of the atmosphere through the formation of contrails of ice clouds (cirrus clouds)": [http://www.aero.obs-mip.fr/...](http://www.aero.obs-mip.fr/)

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1. A contrail near Lake Illawarra, Australia: [http://thunder.simplenet.com/...](http://thunder.simplenet.com/) from [click](#)
2. Problems with traffic control over Australia: "But our skies are criss-crossed by the jet trails of airliners like never before. How is all this activity controlled?": [http://science.org.au/...](http://science.org.au/)
3. Project Atmosphere Australia: "A sunset made up entirely of contrails": [http://www.schools.ash.org.au/...](http://www.schools.ash.org.au/) from [click](#)
4. Science, Australia: "The Effect of Air Traffic on Cloud Coverage and Optical Depth in the Tropopause Region", by H. JAEGER et al.:

[http://www.shm.monash.edu.au/...](http://www.shm.monash.edu.au/)

- "In the middle of the continent, dust storms can be so thick that they obscure the view of clouds and contrails (sic!): "There, in the arid centre of Australia, where there's wind there soon will be dust and stinging, driven sand. On the horizon a thin grey band became a thick one and then a wall obscuring clouds and contrails""
[http://www.synaptic.bc.ca/...](http://www.synaptic.bc.ca/)

AUSTRIAN ...up

- Vienna Airport press information: "Luftfahrt und Umwelt: Immer wieder kommt es in der Öffentlichkeit zu Fragestellungen, die das Treibstoffablassen, Kondensstreifen, Fluglärm, Triebwerke etc. betreffen. Wir hoffen, mit unserer Broschüre Unklarheiten zu beseitigen und Hintergrundinformationen zu liefern":
[http://www.viennaairport.at/...](http://www.viennaairport.at/)
- Salzburg Zeitung: [http://www.salzburg.com/...](http://www.salzburg.com/)
- Contrail in Austrian photo album: [http://www.aeiou.at/...](http://www.aeiou.at/)
- Über den Wolken - Grenzenlose Freiheit um jedem Preis? [http://www.global2000.at/...](http://www.global2000.at/) " ... Und der zu Eisteilchen gefrorene Wasserdampf von Flugzeugabgasen, der als Kondensstreifen sichtbar ist, wirkt gleichfalls als Treibhausgas": [http://www.global2000.at/...](http://www.global2000.at/)
- An extremely rare occurrence of contrails in a civilian weather forecast (for Vienna, 28 January 2000): "Außer den Kondensstreifen der Flugzeuge zeigen sich kaum Wolken am Himmel": [http://www.unet.univie.ac.at/...](http://www.unet.univie.ac.at/)
- Austrian worries about contrails and environment: [http://www.bund-naturschutz.de/...](http://www.bund-naturschutz.de/)
- Austrian calendar of meetings relevant to atmospheric research: [click](#)

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- A most unusual cloud phenomenon, with contrail: [http://www.trifide.com/...](http://www.trifide.com/)

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- A Brazilian site: [http://www.coginst.uwf.edu/...](http://www.coginst.uwf.edu/)

BRITISH ...up

- A superb British site with systematic description of contrails: [http://www.geocities.com/...](http://www.geocities.com/)
- British Petroleum cloud atlas (one contrail seen): [http://www.airbp.com/...](http://www.airbp.com/)
- "Fuzzy integral" detection of contrails: [http://www.ps.ucl.ac.uk/...](http://www.ps.ucl.ac.uk/)
- Geological mapping in the presence of contrails: [http://www.bmva.ac.uk/...](http://www.bmva.ac.uk/) - and - [click](#)
- European Research into contrails: [http://www.ps.ucl.ac.uk/...](http://www.ps.ucl.ac.uk/)
- Second European Stratospheric Arctic and Mid-latitude Experiment, SESAME (Concorde flights from France and other aircraft departing from Kiruna):
[http://www.atm.ch.cam.ac.uk/...](http://www.atm.ch.cam.ac.uk/)
- LIDAR measurements of cirrus and contrail-cirrus: [http://www.nrpp.rcru.rl.ac.uk/...](http://www.nrpp.rcru.rl.ac.uk/)
- How to distinguish between satellite imagery of contrails and ship trails: [http://www.weather.org.uk/...](http://www.weather.org.uk/)
- Meteorology: "Effect of Cirrus Cover on Outgoing Thermal Radiation": [http://cnet0079.doc.ic.ac.uk/...](http://cnet0079.doc.ic.ac.uk/)
- "How to heat the Planet during your vacation travel" (This is a serious ecology page!): [http://www.benjhm.free-online.co.uk/...](http://www.benjhm.free-online.co.uk/) - and - Ben Matthews: Calculate greenhouse emissions for any flight! Kerosene composition (redundant): $2C_{13}H_{28} + 4O_2 \Rightarrow 26CO_2 + 28H_2O$ - Report from Kyoto: [click](#) - and - No regulation of flight altitude emissions: [click](#)
- UK Department of the Environment on contrail research: (check for above redundancy): [http://www.environment.detr.gov.uk/...](http://www.environment.detr.gov.uk/)
- British meteo-amateur showing contrails in weather satellite imaging: [http://www.davidtaylor.freeserve.co.uk/...](http://www.davidtaylor.freeserve.co.uk/)
- NOAA picture of contrails NW of Ireland: [http://www.ibatc.demon.co.uk/...](http://www.ibatc.demon.co.uk/)
- NOAA photo: "Glorious sunrise with a bizarre contrail": [http://www.photolib.noaa.gov/...](http://www.photolib.noaa.gov/)
- Contrail prediction: [http://www.meto.govt.uk/...](http://www.meto.govt.uk/)
- The Guardian: "A Country Diary" : "Not a sound was heard all day even from the buzzard that soared just above our heads for several minutes and we could not hear the unseen aircraft that kept crossing the sky, leaving their long contrails etched across the blue": [http://www.guardianunlimited.co.uk/...](http://www.guardianunlimited.co.uk/)
- Contrail photograph on a UK site: "A photo of the sunset from our flat. The long streaks in the sky are contrails left by jets landing at Heathrow that fly over head at our flat every 2 minutes or so": [http://www.drsteward.ndirect.co.uk/...](http://www.drsteward.ndirect.co.uk/) from [click](#)

CANADIAN ...up

- Contrail conspiracy (see below) theories promoted on the web site of the Consumer Health Organization of Canada: "A five Step Process to boost your natural immunity", by: Horowitz, Leonard, D.M.D., M.A., M.P.H.: [http://www.consumerhealth.org/...](http://www.consumerhealth.org/)
- A contrail from the Top Of The World, Alert, Canada: [http://www.cslub.uwaterloo.ca/...](http://www.cslub.uwaterloo.ca/)
- Picture of contrail over Canada: [http://www.quebecel.qc.ca/...](http://www.quebecel.qc.ca/)
- Photos of contrails over Manitoba (a conspiracy site, really): [http://www.angelfire.com/...](http://www.angelfire.com/)
- Contrail photos from Vancouver, BC, May 21, 1999: [http://persweb.direct.ca/...](http://persweb.direct.ca/) ... with update [click](#)
- Contrails over Ontario, Canada, April 22, 1999: [http://www.vaxxine.com/...](http://www.vaxxine.com/)
- Numerous contrails fusing into a bank of clouds stretching for more than 800 miles (text only): [http://listproc.mbnet.mb.ca:8080/...](http://listproc.mbnet.mb.ca:8080/)
- Institute of Space Research, University of Calgary (nice animations of aurora observations from satellite): <http://www.phys.ucalgary.ca/>
- Dominion Radio Astrophysical Observatory, National Research Council: "Manmade cirrus clouds are quite common. ... An interesting experiment is to measure the air temperature on a day when there is a lot of aircraft cirrus. Eventually the ice crystals from the jet exhaust form a milky film over the whole sky, and the ground temperature can drop by several degrees": [http://www.drao.nrc.ca/...](http://www.drao.nrc.ca/)
- Lots of contrails in a German tourists photos from Canada: [http://www.genista.de/...](http://www.genista.de/)
- Space-borne photos of contrails over Alberta: [http://www.portaec.net/...](http://www.portaec.net/)
- Seeing contrails all the way from Kingston, Ontario, to Toronto: [http://www1.kingston.net/...](http://www1.kingston.net/)
- Research in contrail reduction: [http://www.polymtl.ca/...](http://www.polymtl.ca/)

DANISH ...up

- Miljøforeningen: [http://www.pollution.dk/...](http://www.pollution.dk/)
- "Vejret", from "Dansk Meteorologisk Selskab", a North Atlantic contrail field is shown on the front page of the May 1997 issue, and a North Sea AWACS contrail on the front page of the November 1998 issue. In the November 1998 issue, Axel Walloe Hansen has an article on contrails - incidentally the first on in Danish print.
- Contrails over a royal meeting (the inauguration of the Oeresundsbro, August 14, 1999; see the upper right part): [http://www.oresundskonsortiet.com/...](http://www.oresundskonsortiet.com/) - quoted from [click](#) (web site restructured later)
- Contrails one of the most frequent explanations for UFOs (in Danish): [http://www.netby.net/...](http://www.netby.net/)
- Contrails discussed between the Danish Parliament and the Danish minister for Environment and Energy, November 26, 1999: [http://www.folketinget.dk:80/...](http://www.folketinget.dk:80/)

6. Danish Society for the Conservation of Nature: "Luk naturen ind i din stue: Danmark er ikke et stort land. Ca. 43.000 km². Til gengæld har vi en kystlinje på ikke mindre end 7.300 km. En strækning, som svarer til afstanden mellem Danmark og det sydlige Angola i Afrika. Alligevel er naturen begrænset i Danmark. Trafikstøj og hundeglam rumler altid i baggrunden, mens flyvemaskiner trækker deres kondensstriber henover himmelbuen": <http://www.dn.dk/...>
7. A Danish contrail-research project starting July 1, 2000: <http://www.enhedslisten.dk/...>
8. H.Pedersen: "Kondensstriber fra fly bidrager til Jordens skydaekke": "Vejret", September 2000, p.1 - 6
9. H.Pedersen: "Kondensstriber: en trussel mod astronomien": "Kvant", October 2000, p.35-36
10. "The Copenhagen Global Change Initiative": To discuss contrails as a factor in global climate: <http://www.cogci.dk/...>
11. A ground-based observation of an AWACS contrail from September 21, 2000, over Jutland, Denmark: "Mystiske skyer over Jylland Et par bekymrede mennesker fra midt Jylland kontaktede redaktionen og forklarede om mystiske jetstriber på himlen. Hurtigt fik jeg fat i en bil og ud for at se efter. Ganske rigtigt så jetstriberne sjove ud, og mindede mest af alt om en SAS pilot der var faldet i søvn over styrepinden i sit fly, og nu lå og fløj rundt i cirkler. Jeg vejrede nu sensationen: var de mystiske korncirkler på markerne nu også et luftfænomen? Nej naturligvis havde dette fænomen en naturlig forklaring. Det drejede sig om striber efter et stort tankfly som lå og kredede over Jylland i forbindelse med en netop overstået flyøvelse i Karup. Men flot så det ud alligevel!": <http://plr.hok.dk/...>
12. Danish Environment & Energy Newsletter from the Ministry of Environment and Energy: "New climate research indicates that aircraft emissions of CO₂ at great heights have three times as great a climatic effect as corresponding CO₂ emissions at ground level. Air transport must therefore be considered a major contributor to climate change. If this development continues, moreover, air transport could one day end up contributing more than road transport!": <http://www.mex.dk/...>
13. Petition to the Danish Parliament, Folketinget: <http://www.folketinget.dk/...>

DUTCH ... up

1. Contrail studies by the Dutch Meteorological Institute, including photos: <http://www.knmi.nl/...> - and - [click](#) - and - [click](#)
2. Contrails Are Bad News (a much concerned Dutch site, see it, read it!): <http://www.seaportbeach.nl/...>, relocated (2002) to <http://www.contrails.nl/>
3. Contrail photos: <http://haven.www.cistron.nl/...>
4. Nice pictures from Holland: <http://gene.wins.uva.nl/...>
5. A Dutch (language) page on contrails: <http://www.kijk.nl/...>
6. A Dutch language page NCR Handelsblad: <http://www.nrc.nl/...>

FRENCH ... up

1. Onera: "Le développement de l'aviation et de son utilisation commerciale au cours des dernières décennies oblige à se poser la question de l'impact d'une telle flotte pour l'environnement et pour la santé": <http://www.onera.fr/...>
2. Olivier Boucher: Laboratoire d'Optique Atmosphérique, U.F.R. de Physique, Université de Lille-I, France: "Is the Observed Trend in Cirrus Occurrence due to Aviation?": <http://www-loa.univ-lille1.fr/...>, ... and <http://www-loa.univ-lille1.fr/...>, ... and <http://ens.lycos.com/...>
3. Olivier Boucher's paper promoted in La Météorologie, n° 26 (juin 99): <http://www.smf.asso.fr/...>
4. Photograph of contrail at Fontainebleau, France: <http://www.buchananfamily.freeserve.co.uk/...>
5. A French question about contrails: <http://www.cybersciences.com/...>
6. Nicolas Schaeffer: On French research into contrails: <http://topaze.univ-mlv.fr/...>
7. CNRS: Study of Concorde emissions, including contrail: "Première tentative d'analyse des effluents et de la traînée de condensation émis par le Concorde": <http://www.cnrs.fr/...>
8. Olivier Boucher: "Condensation trails (or contrails) which appear in the sky behind an aircraft are the most visible, and maybe the most significant, effect of aviation on the atmosphere and Earth's climate. Here we present the classical theory of contrail formation, as well as recent work on the microphysical and optical properties of contrails and their potential impact on cirrus cloudiness and the radiation budget": <http://www.smf.asso.fr/...>
9. French elementary question on contrails: "La grande majorité des nuages sont formés naturellement quand l'air humide monte et se refroidit. Toutefois, les avions avec leurs traînées de condensation (contrails) produisent une petite fraction de nuages": <http://www.ac-grenoble.fr/...>
10. Five contrails dominate a photograph accompanying an article: "Le Chaos programme du Ciel Européen" in La Recherche, No. 319, April 1999, p.52 <http://www.larecherche.fr/...>
11. Research into contrails, 1997: <http://earth.agu.org/...>

GERMAN ... up

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- [Political Initiative](#)
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Political Initiative ... up

1. Proposal from the Green Party to the German Bundestag regarding "contrail emissions": <http://www.loske.de/...>
2. A highly recommended German page on the environmental effects of aviation: <http://www.umweltministerium.bayern.de/...>

DLR, Oberpfaffenhofen ... up

1. H. Mannstein, DLR: "Contrail observations from space using NOAA-AVHRR data": <http://www.op.dlr.de/...>
2. Contrail Detection Algorithm, use on Denmark/Germany: <http://www.op.dlr.de/...>
3. Reference to paper on the transition from contrails into cirrus: Schroeder et al. in Journal of the Atmospheric Sciences : 57 : No.4 : 2000 : pp.464-480 <http://www.op.dlr.de/...> - and <http://www.meto.gov.uk/sec1>
4. Southern Germany contrails: <http://www.dfd.dlr.de/...>
5. Ulrich Schumann, DLR: "Observed contrail-cirrus formation conditions and implications": <http://hyperion.gsfc.nasa.gov/...>
6. DLR Europe images: <http://www.dfd.dlr.de/...>
7. R.Sussmann et al.: "The Different Evolution of A Contrail's Vortex System and its Secondary Wake: Lidar and Numerical Studies": <http://hyperion.gsfc.nasa.gov/...>

Max Planck Institutes ... up

1. Max-Planck-Institut fuer Meteorologie: <http://sop.dkrz.de/mpi/...>
2. Max-Planck-Institut für Meteorologie: Contrails the cause of temperature increases over Europe and North America: "Kondensstreifen verursachen signifikante Temperaturerhöhungen über Europa und Nordamerika" (quoting Ponater et al. 1996, Ann. Geophysicae 14, 941-960): <http://www.rz.shuttle.de/...>
3. Max-Planck-Institut für Kernphysik: "Die Bildung von Kondensstreifen aus Flugzeugabgasen in der oberen Troposphäre kann ebenfalls Einfluß auf das Klima nehmen, da dadurch die Rückstreuung von Sonnenlicht zunehmen kann. Bei der Bildung von Kondensstreifen spielt vermutlich Schwefelsäure eine entscheidende Rolle": <http://www.mpi-hd.mpg.de/...>
4. Large Eddy Simulation: <http://www.mpimet.mpg.de/...>
5. Remote Sensing of Cloud Parameters from Multispectral Radiances in the Visible and Near-Infrared: <http://www.mpimet.mpg.de/...>
6. "Near field measurements on contrail properties from fuels with different sulfur content" (by Petzold, et al., DLR): <http://www.mpg.de/...>

Other German Sites ... up

1. German Institute for Atmospheric Physics: "In-situ cloud microphysical measurements": <http://w3.gkss.de/...>
2. Contrails studied in Hamburg: <http://link.springer.de/...>
3. Bestimmung der Kondensstreifenbewölkung in Süddeutschland mit Hilfe von Satellitenmessungen: <http://www.bayfor.klim.uni-muenchen.de/...>
4. The German Federal Environmental Agency: "Pressemittteilung Nr. 07/96: Der Ausstoß an Wasserdampf führt zur Bildung von Kondensstreifen, die wiederum den Strahlungshaushalt der Erdatmosphäre beeinflussen und nach heutigen Erkenntnissen zu einer zusätzlichen Erwärmung beitragen können": <http://www.umwelthundesamt.de/...>
5. Technical University Berlin: Calculate the cost of flying: "Der alte Traum vom Fliegen - Was aber wäre, wenn alle Menschen fliegen würden? Hier kann jeder seinen individuellen Beitrag zum Treibhauseffekt selbst berechnen": <http://user.cs.tu-berlin.de/...>
6. Geo Magazin (October 1997): "Ozonkiller im Anflug": <http://www.geo.de/...>
7. "Wie wir bereits erwähnten, verursachen Flugzeuge Kondensstreifen, die zur Familie des Cirrus gehören. Diese sind oft auch auf dem Satellitenbild gut zu erkennen. Meist handelt es sich um parallel angeordnete Linien, sie zeigen die Luftstraßen. Durch Satellitenbilddauswertung wurde der prozentuale Anteil der durch Flugzeuge hervorgerufenen Wolken an der Gesamtwolkenmenge ermittelt: Er liegt global bei 0,5%, lokal jedoch oftmals sehr viel höher. Das entspricht einer zusätzlichen natürlichen Eiswolkenbedeckung von 15-20%. Dies ist eine nicht zu vernachlässigende Wolkenmenge in großer Höhe, wo sie aufgrund von geringen Austauschprozessen nur langsam aufgelöst werden kann. Damit sind diese zusätzlichen Cirren ein Mitverursacher des vom Menschen gemachten Treibhauseffektes": <http://w3.gkss.de/...>
8. Hannover University contrail research: "Im Rahmen des DFG Schwerpunktes 'Luftfahrt' ging es in einem Projekt darum, den Einfluß des Nachlaufwirbels eines Flugzeuges auf die Vermischung der Triebwerksabgase mit der Umgebungsatmosphäre zu untersuchen. Mit Hilfe von numerischen Simulationsmodellen wurde das Verhalten dieser Wirbelschleppen (sichtbar als Kondensstreifen) bei verschiedenen Wind- und Temperaturverhältnissen in der unteren Stratosphäre (in 10-12km Höhe) simuliert. Gleichzeitig wurde die Einmischung der Triebwerksemissionen in die Wirbel und der Transport in die Umgebung der Flugbahn berechnet": <http://www.ft.uni-hannover.de/...>
9. Erlangen-Nuernberg University: "Der durch Flugzeuge emittierte Wasserdampf ist zwar im Vergleich zu der Gesamtmenge des troposphärischen Wassers nur eine winzige Menge. Im Bereich der Troposphäre und unteren Stratosphäre entstehen hieraus jedoch sofort winzige Eiskristalle; diese formen sich zu Kondensstreifen, aus welchen sich Eiswolken (sog. Cirren) bilden können. Diese Cirruswolken tragen beträchtlich zum Treibhauseffekt bei, da sie die Sonneneinstrahlung nahezu ungehindert zum Erdboden durchlassen, die von der Erde abgestrahlte Wärmestrahlung jedoch sehr effektiv absorbieren. So ergibt sich bei einer nur zweiprozentigen Erhöhung des Bedeckungsgrades durch Cirruswolken eine Erhöhung der Globaltemperatur um -1°C": <http://www.rzr.uni-erlangen.de/...>
10. Stuttgart Observatory, January 1999: "Mit dem Bevölkerungswachstum und dem technischen Fortschritt wuchsen die Ansprüche an Komfort und Sicherheit. Die Produkte der Beleuchtungsindustrie erfüllen alle Kundenwünsche innen und außen an Gebäuden jeder Art bis hin zu Flutlicht an Sportanlagen und Skybeamer an Freizeiteinrichtungen in den abgelegenen Regionen. Kein Fleck ohne aufdringliche Werbung als Dauerbrenner auch bei Nacht, selbst wenn diese durch die eigene konkurrierende Überfülle kaum noch aufgenommen werden kann. Nachtflüge von Linien- und Charterflugzeugen sorgen für Emissionen in großen Höhen, die als Kondensstreifen durch Lichtreflektion zur Nachtaufhellung beitragen": <http://www.sternwarte.de/...>
11. Institute for Meteorology and Climate Research (IMK), Research Centre Karlsruhe: "Physikalisch-chemische Eigenschaften und heterogene Chemie atmosphärischer Kryoaerosole": <http://imk-aida.fzk.de/...>
12. "Kondensstreifen über Mitteleuropa: An manchen Tagen besteht die Bewölkung fast ganz aus Kondensstreifen, also künstlichen Wolken. Ausgebreitete Kondensstreifen sind klimawirksam. Sie sind mit minus 50°C bis minus 60°C viel kälter als die Erdoberfläche (ca.15°C). Damit wird die Wärmeabstrahlung in den Weltraum stark reduziert. Das ist ein Beitrag zum Treibhauseffekt": <http://imkpedemo.fzk.de/...>
13. "Denn eines ist klar: Baldmöglichst müssen Schritte unternommen werden, damit der Trend bei der Entwicklung des Flugverkehrs gebremst wird. Dabei sollen ein Zeitplan für die Allokation der Flugverkehrsemissionen verabschiedet, der "Kyoto-Korb" der Treibhausgase um Stickoxide und Kondensstreifen erweitert, international auf eine langfristig anhaltende Erhöhung des Kerosinpreises gedrängt, ein Bann für den Einsatz neuer ziviler Überschallflugzeuge getroffen und die Umweltkennzeichnung von Flugreisen eingeführt werden": <http://oneworldweb.de/...>
14. UPI Umwelt- und Prognose - Institut e.V. : Stunning picture of contrails, and details of growth in German aviation 1960 - 1996: "Die durch Flugzeuge entstehenden Kondensstreifen verbreitern sich und wandeln sich innerhalb von 20 bis 100 Minuten in Cirruswolken um. Der frühmorgens meist noch blaue Himmel geht im Laufe des Vormittags durch die Kondensstreifen in eine weißgraue Cirruswolkenbedeckung über": <http://upi-institut.de/...>
15. "Kondensstreifen von Flugzeugen prägen das Klima" (Contrails influencing climate - soot from airplane exhaust making snow-cover in the German and Austrian Alps dark, hence advancing glacier melt-off; July 2, 1997): <http://www.berlinonline.de/...> and [click](http://www.click)
16. Less aviation, less damage to the atmosphere: <http://www.stadtilletissen.de/...>
17. "Flugzeuge schädigen das Klima auf dreifache Weise: [...] 3. über die Bildung dünner Eiswolken, den allseits bekannten Kondensstreifen, die ebenfalls zum Treibhauseffekt beitragen. Diese Beiträge zum Klimakollaps erbringen auch Flüge ab dem Dortmunder Flughafen": <http://www.koeln-online.de/...>
18. Contrails useful for the evaluation of nuclear tests (sic!): <http://www.mabel.com/...>
19. "Flugzeugbau ohne Zukunft?": <http://soziales.freepage.de/...>
20. Contrails in cloud movies (not inspected for lack of software); in one of the captions, it is said: "A contrail in the lower part of the image was moving north (downward in the image) and spreading to a band-shaped cloud structure that can hardly be discriminated from a natural cloud pattern": <http://www.deutscher-wetterdienst.de/...>
21. Lufthansa: contrails have no influence on climate: "Insgesamt gehen Wissenschaftler heute davon aus, daß die Wasserdampfemissionen des Luftverkehrs keinen Einfluß auf das Klima haben" (sic!): <http://lufthansa-umwelt.de/...>
22. Lufthansa: Modern aircraft may produce contrails at lower altitude than before: <http://umwelt.lufthansa.com/...>
23. Lufthansa: "Contrails are a greater factor in greenhouse effects than aviation's release of carbon dioxide": [click](http://www.click)
24. Condor: "Contrails have a negligible influence on global temperature" (sic!): <http://www.condor.de/...>
25. Stuttgart school information: <http://arktur.ks1.s.bw.schule.de/...>
26. Jesse H. Ausubel, The Rockefeller University, New York: "Transport now covers Earth with asphalt ribbons and roars through the air leaving contrails that could prove harmful": <http://www.maglev.com/...>
27. Naturschutz in Bayers: Aber auch in der Luft über Österreich geht es hoch her. Der rapide steigende Flugverkehr bewirkt, daß Österreich bereits 500000 mal jährlich überfliegen wird und ganze Alpenregionen, wie etwa Gastein, ab Mittag von Kondensstreifen bewölkt sind. <http://www.bund-naturschutz.de/...>
28. Über den Wolken muß die Freiheit wohl grenzenlos sein?: "Der Wasserdampf gefriert und bildet als Kondensstreifen eine glasdachartige Wolkendecke, die die Sonnenstrahlen durchläßt, aber die Wärmestrahlung zurückhält und damit zum Treibhauseffekt beiträgt": <http://kirchen.fidelitas.de/...>
29. Aviation a problem for the national park "Naturpark Nordeifel", Germany. A very telling contrail picture included: <http://www.fluglaerm.de/...>
30. Contrails a problem for the interpretation of satellite based Geographical Informations-Systems (GIS) <http://www.nav.uni-stuttgart.de/...>
31. A long lost sunset - contrail picture site: <http://www.meteoros.de/...>
32. A German airport-noise initiative: "Blauen Himmel gibt es gar nicht mehr. Nur noch Kondensstreifen und Lärm. Ist das noch Wohnqualität?": <http://members.aol.com/...>
33. German page on total emission of aviation: "Besonders entlang der Flugstraßen wachsen diese (Kondensstreifen, hp) zu kilometerbreiten Wolkentepichen zusammen und ähneln in ihrer Wirkung dem Glasdach eines Treibhauses": <http://home.t-online.de/...>
34. "...Und dann wach ich auf. ... Seit diesem Traum hasse ich Flugzeuge. Allein schon wenn ich einen Kondensstreifen am Himmel seh, krieg ich epileptische Anfälle": <http://www.vilstal.net/...>
35. Contrails used in a 1996 calendar from the "Deutsche Meteorologische Gesellschaft" <http://www.schremmer.purespace.de/...>
36. Year 2000 Calendar with contrails, from Fachbereich Geoökologie, Universität Bayreuth: <http://www.geo.uni-bayreuth.de/...>
37. Recent satellite picture, with contrails, from Karlsruhe: "Kondensstreifen; 20. März 2000, 7:54 UTC, NOAA VIS Dünne Schleierwolken liegen über dem Norden Baden-Württembergs und Bayerns. Daneben lassen sich zahlreiche kreuz und quer verlaufende streifenartige Strukturen ausmachen: Es sind Kondensstreifen. Mit einer Warmfront wurde feuchtere Luft herangeführt, in der sich die Kondensstreifen lange halten konnten, bevor sie wieder verdunsteten": <http://www-imk.physik.uni-karlsruhe.de/...>
38. Aerokurier: On the three-aircraft contrail experiment done in 8440 m height over Dinkelsbühl: <http://www.aerokurier.rotor.com/...>
39. The 1994 project: "Berechnung der klimatischen Wirkung von Kondensstreifen": <http://www.abayfor.de/...>
40. "Die Anthropogene Klimabeeinflussung": A German site on the climatic influence of air-traffic: "The importance of contrails, soot, sulfuric acid droplets and other particles, and related change in cloudiness cannot yet be fully assessed": <http://www.rzr.uni-hamburg.de/...>

ICELANDIC ... up

1. Photo of a contrail over an Icelandic glacier: <http://fjarhitun.is/...>

IRISH ... up

1. A seal colony at Cold Island / Carbery Island, Ireland: "Even overhead air traffic is so high that you will only see vapour trail": [http://www.westcorkweb.ie/...](http://www.westcorkweb.ie/)
2. Contrails (???) mentioned in an Irish text: [http://193.1.228.3/...](http://193.1.228.3/)
3. Contrails west of Ireland: [http://www.tech-pro.freeserve.co.uk/...](http://www.tech-pro.freeserve.co.uk/) with the contrails seen on: [click](#) - and [click](#)

NORWEGIAN [... up](#)

1. A Norwegian site with a contrail photo: [http://www.nilu.no/...](http://www.nilu.no/) from [click](#)
2. Elementary weather site, explaining contrails: [http://home.newmedia.no/...](http://home.newmedia.no/)
3. Science: "Contrails trigger the formation of high cirrus clouds. The radiative influence of these clouds is not yet fully understood. Today, the global mean coverage by line-shaped contrails is estimated to be about 0.1%. Scenarios for 2050 project an increase of this number to 0.47%. A problem with determining the potential impact of air traffic induced clouds is the inability to compare them to undisturbed conditions. Due to transport from the major air routes, vast areas of the upper troposphere are already influenced": [http://www.geofysikk.uio.no/...](http://www.geofysikk.uio.no/)
4. A Norwegian text on global warming: [http://www.apollon.uio.no/...](http://www.apollon.uio.no/)

RUSSIAN [... up](#)

1. A DLR investigation mirrored from a Russian site: Thomas Gerz: "Large Eddy Simulation of Aircraft-Induced Vortices in the Atmosphere": [http://www.ipme.ru/...](http://www.ipme.ru/)
2. Olga Popovitcheva: "Growing evidences from the field observations [hint] that a perennial soot aerosol layer [originating] from air traffic exists at 10-11 km altitudes. Soot particles are recognized as playing possibly important role in a global atmosphere phenomena such as cloud formation, radiation Earth's balance, chemical transformation of the gas composition clearly implicated in the stratospheric ozone depletion. Recent studies hint that engine soot aerosols as small as 20 nm are responsible for ice formation in the aircraft contrail": [http://www.crmc2.univ-mrs.fr/...](http://www.crmc2.univ-mrs.fr/)

SOUTH AFRICAN [... up](#)

1. Contrails over South Africa: [http://www.capetownskies.com/...](http://www.capetownskies.com/) - from [click](#)
2. At my petition, the proprietor of the former site, Mr. Gordon Richardson of Cape Town, has kindly supplied these comments and links: "Cape Town does not have any overflights (it is not en-route to anywhere else in the world), and I have only a handful of contrails in my photos. Here are the most recent ones: [http://www.capetownskies.com/...](http://www.capetownskies.com/) - and - [click](#) . On that day the airport was closed due to fog, and the planes were circling overhead before diverting to alternate landing zones. We also had some during the Rugby World cup in 1995 when the airport was busy: [click](#) . Here is one taken by a friend of mine: [click](#) . When I was in Europe I was amazed at the number of contrails! [click](#) . Some natural phenomena can look like contrails, or shadows of contrails. This photo I took in 1995 is almost certainly natural: [click](#) . This photo I took in July is also natural IMO: [click](#)

SWEDISH [... up](#)

1. A Swedish site, with a contrail photo: [http://www.lp.se/...](http://www.lp.se/)
2. Contrails are not UFOs: [http://home.swipnet.se/...](http://home.swipnet.se/)

SWISS [... up](#)

1. A technical site, on Photogrammetry and Remote Sensing applied to contrails: [http://www.geod.ethz.ch/...](http://www.geod.ethz.ch/)
2. Climate Press: "Mehr Luftverkehr bringt wachsende Umweltfolgen mit sich": [http://130.92.225.40/...](http://130.92.225.40/)
3. CH-FORSCHUNG (a printed publication?): "Stark wachsender Flugverkehr beeinflusst zunehmend das Klima": [http://www.ch-forschung.ch/...](http://www.ch-forschung.ch/)
4. Weathermen should not forecast high clouds but say 'contrails': "Darum wäre es sehr wünschenswert, wenn am Meteedienst nicht von 'hohen Wolkenfeldern' oder 'harmlosen Schleierwolken' gesprochen wird, sondern im Klartext, von Flugzeugkondensstreifen! "Oft überziehen ja die Kondensstreifen ganze Landesteile und verschleiern den Himmel europaweit": [http://www.flugemissionen.ch/...](http://www.flugemissionen.ch/)
5. Tages-anzeiger (February 9, 1996): Letter from a reader: "Bewölkung durch Flugzeuge: ...Das Wichtigste, was uns schon lange direkt betrifft, sind sonnenverdeckende Himmelsbewölkungen, wenn bei schönem Wetter die Kondensstreifen von Flugzeugen hängenbleiben, sich vergrössern, verdichten und schliesslich die Sonne verdecken": [http://tages-anzeiger.ch/...](http://tages-anzeiger.ch/)
6. Tages-anzeiger (January 7, 1999): "Mehr Wolken wegen der Jets" (quoting O.Boucher's paper in Nature): [http://tages-anzeiger.ch/...](http://tages-anzeiger.ch/)
7. Swiss search for contrails (21 hits on July 18, 2000): [http://www.sear.ch/...](http://www.sear.ch/)
8. Swiss worries about contrails (much numeric data): [http://www.sun21.ch/...](http://www.sun21.ch/)
9. Swissair's environmental concern: [http://www.swissair.com/...](http://www.swissair.com/)

TAIWANESE [... up](#)

1. TAO Journal volume 12, issue no. 1 has several papers on contrails: <http://tao.gcc.ntu.edu.tw/>

THAI [... up](#)

1. Summary of Minnis' paper in Geophysical Research Letters, 1 July 1999: [http://einstein.sc.mahidol.ac.th/...](http://einstein.sc.mahidol.ac.th/)

INTERNATIONAL ORGANISATIONS [... top of document](#)

1. IATA - The International Air Transport Association: no mention of 'contrails', 'environment', etc., in the site index, October 1999) [http://www.iata.org/...](http://www.iata.org/)
2. ICAO Journal vol.56 May 2001 has a discussion on environmental problems, mostly noise issues: [http://www.icao.int/...](http://www.icao.int/)
3. ICAO: On the number of passengers carried: [http://www.icao.int/...](http://www.icao.int/)
4. ICAO: Civil Aircraft Emissions are only regulated what regards taxiing, take-off and landing, not during cruise, and only what regards CO, NOx, and unburned fuel: [http://www.icao.int/...](http://www.icao.int/)
5. OECD: On fuel taxation as a means of controlling contrail formation (pdf): [http://www.oecd.org/...](http://www.oecd.org/)
6. Intergovernmental Panel on Climate Change: "Aviation and the Global Atmosphere", ed. J.E.Penner et al., Cambridge University Press, 1999. This is the major work on the influence of aviation, on the atmosphere, and expected to become a standard reference work for years to come. The physics of contrails is described in great detail. The 'Summary for Policy Makers': can be retrieved as a pdf-document from: <http://www.ipcc.ch/> - for a translation to Danish, see [Luftfart og den Globale Atmosfaere](#)
7. United Nations Environment Programme, discussion of the IPCC report "Aviation and the Global Atmosphere", in relation to ozone emissions: [http://www.unep.ch/...](http://www.unep.ch/)
8. "The Ozone Secretariat" under UNEP discussing contrails triggering cirrus cloudiness and thereby climate change: [http://www.unep.org/...](http://www.unep.org/)
9. IPCC report press release [http://www.ipcc.ch/...](http://www.ipcc.ch/)
10. IPCC WGI Newsletter: [http://www.meto.govt.uk/...](http://www.meto.govt.uk/)

11. Discussion of the IPCC report: <http://www.iisd.ca/...>
12. The full text of the IPCC report: "Aviation and the Global Atmosphere": <http://www.grida.no/...>
13. IPCC report on Amazon.com: <http://www.amazon.co.uk/...>
14. For a critical review of the IPCC report: <http://www.felsef.org/...>
15. US comments to an early draft of the IPCC report: <http://www.state.gov/...>
16. On aviation and shipping as integrals players in globalization: (contrails and IPCC report discussed): <http://www.m-a-g.fsnet.co.uk/...>
17. World Meteorological Organization: WWW Global Observing System (contrails not specifically mentioned): <http://www.wmo.ch/...>
18. World Meteorological Organization: In situ measurements of upper-level atmospheric water using commercial airplanes: Second Meeting of the AMDAR Panel, Geneva, Switzerland, 19-22 October 1999: "The meeting noted the potential importance of high-level humidity reports in any future efforts to reduce the formation of unnecessary contrails that may have an adverse impact on the environment": <http://www.wmo.ch/...>
19. World Meteorological Organization: 1988 Cape Town meeting: "Water vapour emission from aircraft might influence both the chemistry of the ozone layer and the greenhouse properties of the upper troposphere. Contrails formed by water vapour from subsonic jets might also act like thin cirrus clouds leading to possible global warming": <http://www.wmo.ch/...>
20. World Meteorological Organization: European Workshop "Aviation, Aerosols, Contrails and Cirrus Clouds" Frankfurt, Germany, from 10-12 July 2000: <http://www.wmo.ch/...>
21. United Nations Framework Convention on Climate Change: "Aircraft emit gases and particles directly into the upper troposphere and lower stratosphere where they have an impact on atmospheric composition. These gases and particles alter the concentration of atmospheric greenhouse gases, including carbon dioxide (CO₂), ozone (O₃) and methane (CH₄); trigger formation of condensation trails (contrails); and may increase cirrus cloudiness - all of which contribute to climate change": <http://www.unfccc.de/...> - and - [click](#) - and - [click](#)

NON-GOVERNMENTAL ORGANISATIONS ... [top of document](#)

1. Economic Instruments to Reduce Aviation-related Air Pollution and its Consequences for Developing Countries: <http://www.inzet.nl/...>
2. Artificial clouds: <http://startbahn.de/html/...> - satellite pictures: [click](#)
3. GermanWatch: Die Technik hält den Trend nicht auf - Regierungen müssen handeln "... Denn nicht nur die CO₂-Emissionen sind beim Flugverkehr ein Problem, sondern zusätzlich noch der Stickoxidausstoß und die Kondensstreifenbildung. Insgesamt bewirken diese anderen Stoffe, daß der Treibhauseffekt durch die Flugzeugabgase um das Zwei- bis Vierfache höher ist als der reine CO₂-Effekt": <http://www.comlink.apc.org/...>
4. Fuel taxation to limit influence of aviation on climate: <http://www.germanwatch.org/...> and ... Klimaschutz nach Kyoto: "Der Teufel steckt im Detail": [click](#)
5. German Association of Environmental Organisations: Forum Umwelt & Entwicklung: Klimakiller Flugverkehr: "Die Emissionen in Flughöhe haben - durch eine Reihe komplexer Prozesse in der Atmosphäre (CO₂, NO_x, Wasserdampf und Kondensstreifen) - nach derzeitigem Stand der Wissenschaft mindestens die dreifache Treibhauswirkung (pro Liter Treibstoff) gegenüber der Emissionen am Boden": <http://oneworldweb.de/...>
6. 'Airfields Environment Trust': <http://www.gael.net/...>
7. The Earth Island Journal - Summer 1998: (on O'Hare emissions): <http://eltoroairport.org/...>
8. Union of Concerned Scientists (a very general description of global warming and its causes; no mention contrails): <http://www.ucsusa.org/...>
9. "62 million civil and military flights a year in USA: "US air corridors see 20 percent increase in cloud cover" (quoting P. Minnis and U. Schumann): <http://www.earthsystems.org/...>
10. Curtis Runyan: Environmental News Network: September 30, 1998: "New research indicates that the wispy condensation trails left behind in the sky by airplane jets may have a larger impact on the Earth's climate than scientists had earlier thought. ... In effect, instead of simply dissipating as previously thought, the planes' thin contrails turn to large cirrus clouds -- the kind of clouds that tend to trap heat in the upper atmosphere": <http://www.enn.com/...>
11. Gar Smith: Environmental News Network: December 9, 1997: Viewed from space, there are four unmistakable signs that Earth is inhabited by humans: sprawling cities, forest fires, disappearing lakes and aircraft contrails": <http://www.enn.com/...>
12. Planet Ark, February 11, 1999: "The aviation industry needs to start developing aircraft which will fly 'lower and slower', an International Air Transport Association (IATA) legal symposium was told this week. ... Manfred Werber, senior adviser on climate and transport for the Bonn-based non-governmental environmental organization Germanwatch, said the restrictions may be needed to reduce the effects of contrails (vapour trails) on global warming. ... "There is already some scientific evidence of the threat from contrails, especially in certain regions such as the Alps. For the climate, it is better to fly lower": <http://www.planetark.org/...>
13. Greenpeace does not care, see message 28267 of: <http://clubs.yahoo.com/...>
14. On Ralph Nader's proclaimed reluctance to consider aviation's environmental consequences, in spite that it is a campaign goal for his organization: <http://pages.prodigy.com/...>
15. The Center For Security Policy - Washington Times (November 25, 1997): Fred Singer admitting 'regional' effects of contrails: <http://www.security-policy.org/...> - and - Fred Singer explaining atmospheric heating: "Growing air traffic is changing the chemical composition of the lower stratosphere and may be producing sufficient contrails and cirrus clouds to show climate effects": <http://www.sepp.org/...> - and - "New analysis shows air traffic influence on climate confounding IPCC global warming estimates": <http://www.sepp.org/...> - and - [click](#) - and - [click](#)
16. More on Singer, from UCAR: <http://www.dir.ucar.edu/...> - and Greenpeace: <http://www.greenpeace.org/> - and 'junkscience': <http://www.junkscience.org/>

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THE PROBLEM ... [up](#)

1. Lockheed mentioning contrails as one of the seven observable signatures of F-117 Stealth: "There are seven types of observable signatures: radar, infrared, visual, contrails, engine smoke, acoustics, and electromagnetic emissions": <http://www.plweb.at/lockheed/...>

SPECIAL FUELS ... [up](#)

1. Adding a corrosive and hard-to-handle acid to the jet fuel, can help getting rid of contrails from the "Stealth" bomber: <http://www.letsfindout.com/...>
2. CS₂: a potential, but corrosive and dangerous, propellant according to U.Schumann: "On conditions for contrail formation from aircraft exhausts", Meteorol.Zeitschrift, vol 5, p.4-23. (1996)
3. B-2 bomber contrail visibility: "Chloro-flourosulphonic acid is injected into the exhaust plume to suppress the formation of contrails": <http://www.airpower.co.uk/ency/B/B-2.asp>

FORECASTS ... [up](#)

1. US Air Force Global Weather Center was the first to produce automated contrail forecasts, in 1958: <http://www.airweaassn.org/...>
2. US military forecast of contrail conditions: <http://www.confex2.com/...> - and - <http://www.vs.af.mil/...> - and - <http://rainbow.ldeo.columbia.edu/...> - and - <http://www.af.mil/...> - and - <http://www.nwas.org/...> - and - <http://www.vsb.e.plh.af.mil/...> - and - <http://www.vsb.e.plh.af.mil/...> - and - <http://rainbow.ldeo.columbia.edu/...>
3. Stealth technology: <http://www.colinmil.mcmil.com/...>
4. Budget item for Stealth contrail prediction: <http://209.207.236.112/...>
5. Sample military weather forecast with contrail mention (sometimes?): <http://www.29palms.usmc.mil/...>

VERIFICATION [... up](#)

1. Military protection against contrail formation: "Founded in 1980, Ophir has begun production deliveries of a military standard lidar system to be fitted to USAF B-2 Block 30 bombers. It alerts crews when the aircraft is leaving a contrail": [http://www.awgnet.com/...](http://www.awgnet.com/)
2. Ophir company home page on the device (which may also detect soot): <http://www.ophir.com/airborne.htm>
3. Budget item for "5 contrail management systems" for B2 bombers: [http://www.defenselink.mil/80/...](http://www.defenselink.mil/80/)
4. 'Popular Science' quoted for the following (partial) text on Stealth: "We had no problem acquiring the aircraft from about a mile away," the technician recalls, "but at distances over two miles it became harder and harder to spot. Although it was a crude system, it was pretty impressive. Trying to pick out the aircraft against a clear, blue sky was next to impossible. The only time we could easily spot the aircraft was when it produced an unexpected contrail" (Contrails form when the water vapor in aircraft exhaust freezes. On the B-2 and F-117, anti-contrail systems inject chemicals into the exhaust stream to break water into droplets too small to be seen)": [http://www.perseids.com/...](http://www.perseids.com/)
5. Contrail suppression not perfect in Stealth (Gulf War): [http://csf.colorado.edu/...](http://csf.colorado.edu/)
6. S.J. Moss: Meteorological Applications - 1999 papers, vol 6, no. 3: "The testing and verification of contrail forecasts using pilot observations from aircraft", p.193.

MILITARY WEATHER MODIFICATION [... up](#)

1. Military use of weather ("Owning the Weather in 2025"): [http://www.au.af.mil/au/...](http://www.au.af.mil/au/)
2. Weather Analysis and Modification System: [http://www.au.af.mil/au/...](http://www.au.af.mil/au/)
3. Military cloud seeding for weather modification, creation and suppression of contrails: [http://www.tecom.army.mil/...](http://www.tecom.army.mil/) - and - [click](#) - and - [click](#) - and - [click](#)
4. 'Conspiracy' site with mention of 2.5 M\$ budget item for weather modification; link to source of information is defunct, though: [http://jclearly.hypermart.net/...](http://jclearly.hypermart.net/)
5. Military Weather Modification: <http://afpubs.hq.af.mil/>

CIVIL CLOUD SEEDING [... up](#)

1. Concern for environmental effects of cloud seeding programmes: "More attention should be directed toward an understanding of the long-term, 'downwind' effects of concentrated cloud-seeding": [http://twri.tamu.edu/...](http://twri.tamu.edu/)
2. Civil weather modification: "When hailstorms threaten central Alberta, aircraft scramble into the skies armed with chemical flares, to strip the icy danger from the clouds": [http://www.cangeo.ca/...](http://www.cangeo.ca/)
3. Active weather modification (no proof of anthropogenic influence on climate, sic!): [http://rams.atmos.colostate.edu/...](http://rams.atmos.colostate.edu/)
4. Discussion of Israeli cloud seeding: [http://cargsun2.atmos.washington.edu/...](http://cargsun2.atmos.washington.edu/)
5. 1954 Arizona rain making: "Color films of wafting checkerboard jet contrails are still sitting in a half-forgotten file in the Physics and Atmospheric Science Building at the University of Arizona": [http://www.newpower.org/...](http://www.newpower.org/)
6. Redundant to previous: Rain making in Arizona: "The University of Arizona's weather modification study was well underway, and Air Force jets crisscrossed the sky, leaving contrails at various levels of the sky in conjunction with the time-lapse photography. Reich reported Air Force jets appearing during his cloudbusting operations on the way out west, and had been using the contrails in his own atmospheric studies in Tucson. "Whether the Air Force had actually such problems in mind, I cannot tell." As the 16-mm films of the IAP's experiments show, these problems were definitely in the Air Force's mind. Color films of wafting checkerboard jet contrails are still sitting in a half-forgotten file in the Physics and Atmospheric Science Building at the University of Arizona": [http://www.geocities.com/...](http://www.geocities.com/)

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TEXT BOOKS [... up](#)

1. Text book with contrail analysis: "Dynamics of Meteorology and Climate", by Richard S. Scorer, Wiley, Chichester, 1997.

INFLUENCE ON CLIMATE [... up](#)

1. 35-page pdf - report by Minnis et al.: [http://albedo.larc.nasa.gov/1123/...](http://albedo.larc.nasa.gov/1123/)
2. Estimates of Contrail-Induced Temperature Changes, by Patrick Minnis, et al.: [http://hyperion.gsfc.nasa.gov/...](http://hyperion.gsfc.nasa.gov/)
3. Institute for Global Communication: "Since the take-off of jet travel in the 1960's, says NASA atmospheric scientist Patrick Minnis, average cloudiness has increased by 5 percent over the United States and by about 2 percent over Europe" (link defunct by July 17, 1999): [http://www.igc.org/...](http://www.igc.org/)
4. "Every 42 seconds a plane takes off or lands at O'Hare airport in Chicago, IL. It's the busiest airport in the world, and scientists have noticed that the more planes there are, the cloudier and rainier the airport gets. Why? Exhaust from plane engines contains a lot of water vapour. The water vapour condenses to form a contrail, or long thin cloud that trails behind planes. These contrails join together to make wispy clouds which block the sun, and may bring cooler, rainier weather to Chicago": [http://www.owl.on.ca/...](http://www.owl.on.ca/)
5. Australia: Contrails may increase UVB-radiation near big airports: [http://www.photobiology.com/...](http://www.photobiology.com/)
6. NOAA: "Temperature range narrowing between daytime highs and nighttime lows" (no mention of contrails): [http://www.noaa.gov/...](http://www.noaa.gov/)
7. Travis et al. Journal of Applied Meteorology: Vol. 36, No. 9, pp. 1211-1220: "An Empirical Model to Predict Widespread Occurrences of Contrails": "... Lee and Johnson concluded that contrails are the most likely cause of the statistically significant decrease in the number of cloudless days found in 44 of 45 cities in the United States for the period 1950 ??, compared with the period 1900 ?? . Henderson-Sellers suggests a similar cause for at least part of the record of cloud cover increases identified for North America. Moreover, all sky camera observations taken from Champaign, Illinois, and Albany, New York, have shown that contrails were present on about 30% of days when the upper cloud fraction could be seen. Thus, in regions where jet air traffic is most abundant, contrails may be an important influence on climate at the earth's surface": [http://ams.allenpress.com/...](http://ams.allenpress.com/)
8. Embry-Riddle Aeronautical University: "Contrails causing reduction in daily temperature amplitude": [http://www.pr.erau.edu/...](http://www.pr.erau.edu/)
9. Cirrus covers 30 percent of the Earth's surface, but amount of sub-visible cirrus is unknown: [http://www.aero.jussieu.fr/...](http://www.aero.jussieu.fr/)
10. "Jets Create Serious Cirrus Clouds", citing Geophysical Research Letters (one cloud expanded into an area of 35,000 square kilometers, and some lasted 17 hours): [http://www.apnet.com/...](http://www.apnet.com/)
11. Stratospheric dehydration by thin cirrus clouds: [http://128.102.124.15/...](http://128.102.124.15/)
12. "End To Mild Trend Not In Sight" (is this the way weather forecasts are to be in the future?): [http://www.channel10000.com/...](http://www.channel10000.com/)
13. "Potential radiative impact of contrail coverage over continental USA estimated from AVHRR data" by R. Palikonda, et al.: [http://www.confex2.com/...](http://www.confex2.com/)
14. "How's the Air Up There?" - NASA Scientists Tail Aircraft in Search of Clues (July 6, 1996): [http://www.voyagepub.com/...](http://www.voyagepub.com/)
15. Rising cirrus cover over northern mid-latitudes: "It is postulated that an undetermined fraction of jet contrails evolves to take on characteristics of natural cirrus clouds": [http://hyperion.gsfc.nasa.gov/...](http://hyperion.gsfc.nasa.gov/)
16. Contrails lead to global heating: "Modeled impact of cirrus cloud increases along aircraft flight paths", by D. Rind, P. Lonergan and K. Shah: [http://hyperion.gsfc.nasa.gov/...](http://hyperion.gsfc.nasa.gov/)
17. NASA research on "Radiative effects of jet contrails": [http://atmos.uah.edu/...](http://atmos.uah.edu/)

18. Contrails as cause of global warming (0,05 degrees from 1880 to 1997): <http://users.erols.com/...>
19. Estimated climate forcings between 1850 and the present. Buenos Aires, etc.: <http://www.pageplanet.com/...>
20. Monitoring cirrus (not about contrails): <http://asd-www.larc.nasa.gov/...>
21. Global Climate Change Digest (October 1992, no mention contrails): "Present knowledge suggests that nearly the entire population of cloud condensation nuclei over continents is anthropogenic": <http://www.globalchange.org/...>
22. Owen Toon: Multidimensional modeling of cirrus clouds and marine stratocumulus clouds for climate studies: <http://www.nersec.gov/...>
23. Japanese research into cloud/radiation physics (contrails not mentioned): <http://www.mri-jma.go.jp/...>
24. Rex J. Fleming: "The Use of Commercial Aircraft as Platforms for Environmental Measurements" (no mention contrails): <http://www.joss.ucar.edu/...>
25. The influence of increased jet airline traffic on the amount of high level cloudiness in Alaska": <http://climate.gi.alaska.edu/...> - see also Nakanishi et al.: "The influence of increased jet airline traffic on the amount of high level cloudiness in Alaska." Theoretical and Applied Climatology 68: 197-205, cited on (of all): <http://co2science.org/journal/2001/v4n28c2.htm>
26. On the secular decrease of sunshine hours in Venezuela (no mention contrails): <http://www.confex2.com/...>
27. Contrails are wider than derived from linear features on satellite imagery; concluded by R. Palikonda et al. in the paper: "Remote Sensing of Contrails and Aircraft Altered Cirrus Clouds": <http://searchpdf.adobe.com/...>

SCIENTIFIC PUBLICATIONS ...up

The following is just a tiny selection of a vast body of research.

1. Appleman, H. (1953): "The formation of exhaust condensation trails by jet aircraft": Bull. Amer. Meteor. Soc., 34, 1420.
2. Georgi, J., 1960 (Presumed to be the first scientific report of a jet contrail expanding into cirrus): Zeitschrift Meteorologie, 14, p.102.
3. Peter M. Kuhn: "Airborne Observations of Contrail Effects on the Thermal Radiation Budget": "... One aspect of weather pollution in the atmosphere is the generation of contrails. The spreading out of jet contrails into extensive cirrus sheets is a familiar sight. Often, when persistent conditions exist from 25,000 to 40,000 ft, several long contrails increase in number and gradually merge into an almost solid interlaced sheet": Journ. of the Atmospheric Sciences, 27, 937 (1970).
4. Changnon, S., 1981, "Midwestern Cloud, Sunshine and Temperature Trends since 1901: Possible Evidence of Jet Contrail Effects", Journal of Applied Meteorology, vol 20, p496.
5. Lecture Notes in Engineering: Air Traffic and The Environment, U.Schumann editor, Springer 1990, several papers on contrails.
6. Bakan, S., M. Betancor, V. Gayler, and H. Grafl, "Contrail frequency over Europe from NOAA-satellite images", Ann. Geophysicae, 12, 962-968, 1994.
7. Schumann, U., 1996, "On conditions for contrail formation from aircraft exhausts", Meteorol. Zeitschrift, 5, 4-23.
8. Scientific publications: Ponater, M., Brinkop, S., Sausen, R. and Schumann, U. (1996): Simulating the global atmospheric response to aircraft water vapour emissions and contrails. A first approach using a GCM, Annales Geophysicae, 14, 941-960.
9. American Geophysical Union: Many papers on contrails: <http://earth.agu.org/...>
10. Liou, K.N., Ou, S.C., and Koenig, G., TBD, "Air Traffic and the Environment", U.Schumann, ed., Lecture Notes in Engineering, Springer, p.154-169.
11. Strauss, B., R. et al. (1997): "On the regional climatic impact of contrails: microphysical and radiative properties of contrails and natural cirrus clouds", Ann. Geophysicae, 15, 1457-1467: <http://www.lrz-muenchen.de/...>
12. Mims, F.M. and D.J. Travis, 1997, "Reduction of solar irradiance by 3-5% when a contrail passes over the Sun": EOS, 78, 1997 Oct 14.
13. Minnis, P., et al., 1998, Geophys. Res. Letters, 25, p.1157-1160.
14. Sausen, R., et al., 1998, "A Diagnostic Study of the Global Distribution of Contrails Part I: Present Day Climate", Theor. Appl. Climatol. 61, p.127-141.
15. Schumann, U., et al., 1998, Atmospheric Environment, 32, p.3097-3103.
16. Smith, W.L., et al., 1998, Geophys. Res. Letters, 25, p.1137-1140.
17. Hofmann, D.J., et al. (1998), "An analysis of 25 years of balloonborne aerosol data in search of a signature of the subsonic commercial aircraft fleet" Geophysical Research Letters 25(13):2433-2436: <http://cmdl.noaa.gov/...>
18. Boucher, O., 1999, Nature, 397, p.30.
19. Mannstein, H., et al., 1999: "Operational detection of contrails from NOAA-AVHRR-data", Int.J.Remote Sensing, 20, 1641-1660.
20. Schumann, U., 1999, "Contrail Cirrus", DLR Report No. 114; to appear in "Cirrus", edited by D.Lynch, Oxford University Press, in press.
21. Randall R. Friedl, 1999, Science, 286, p.57-58
22. John H. Seinfeld, "Clouds, Contrails and Climate", Nature, 26 February 1998, at 837, 838
23. "Center for the Study of Carbon Dioxide and Global Change" (be careful with that organisation!): "Jet Aircraft Contrails Reduce the Diurnal Amplitude of Earth's Surface Air Temperature", by Meerkotter, R., Schumann, U., Doelling, D.R., Minnis, P., Nakajima, T. and Tsuchima, Y. 1999. "Radiative forcing by contrails". Annales Geophysicae 17: 1080-1094.: <http://co2science.org/...>

CONFERENCES ...up

1. 1996 International Radiation Symposium: "Current Problems in Atmospheric Radiation": <http://www.gi.alaska.edu/...>
2. NASA: "The Atmospheric Effects of Aviation", Virginia Beach, Virginia, March 10 - 14, 1997: <http://www.coastalpost.com/...>
3. American Meteorological Society: "Conference on Cloud Physics", August 1998: <http://www.atmos.uiuc.edu/...>
4. Aerospace Corporation, LA, October 1998: <http://www.aero.org/...>
5. "International Symposium on aviation and the global atmosphere", The Netherlands, on 23/24 June 1999. <http://www.knmi.nl/...>
6. "Atmospheric Effects of Aviation", 1999: <http://hyperion.gsfc.nasa.gov/...> and <http://eiger.mae.wvu.edu/...>
7. American Meteorological Society: "10th Conference on Atmospheric Radiation", June 1999: <http://www.confex2.com/...>
8. Slovakian Conference (ultimate link lost; also date): <http://www.dpp.fmph.uniba.sk/...>
9. "Black carbon in the Environment": 9th Goldschmidt Conference August 22-27 1999, Cambridge, Massachusetts: <http://www.ruf.uni-freiburg.de/...>
10. AMS: 12th Symposium on Global Change Studies and Climate Variations <http://ams.confex.com/...>
11. European Workshop on 'Aviation, Aerosols, Contrails, and Cirrus Clouds', 10-12 July 2000, Seeheim-Jugenheim, Germany: <http://www.op.dlr.de/...> - see also <http://imk-aida.fzk.de/...> and <http://www.wmo.ch/...> and: Seeheim meeting abstracts: Wendling: "It will be shown that overall contrail clouds tend to heat the earth atmosphere system and will increase the surface temperature": <http://www.op.dlr.de/...> or [click](#)

LECTURES ...up

1. Lecture by Professor Peter Jonas (UMIST), Thursday 25 March 1999: "Aircraft - Do they have an effect on the Climate": <http://saturn.phy.umist.ac.uk:8000/...>
2. Goddard Space Flight Center, 1998: "Aerosols and Climate: Unsolved Problems, from the Possible Impact of Aviation on Climate to the Faint Young Sun Paradox": <http://hea-www.gsfc.nasa.gov/...>
3. H.Kelder: "Effect van vliegtuig-emissies op de atmosfeer": <http://www.phys.tue.nl/...>
4. R. Meyer: Regionale Kondensstreifenbedeckung aus Satellitendaten und ihr Einfluss auf den Strahlungshaushalt, at DLR, Oberpfaffenhofen, July 31, 2000: <http://www.op.dlr.de/...>
5. January 22, 1999 at Williams College, Mass: Annabel Muentner: "Airplane Condensation Trails: What's so interesting about those white lines in the sky?" <http://www.wilsonswebdesign.com/...> and <http://www.williams.edu/...>
6. Manfred Reinhardt: "Observation of Contrails: Yesterday and Today": (UCAR, March 2000?): <http://www.ucar.edu/...>
7. Stefan Borrmann: 14 March 2001: "The Atmospheric Ice Phase: Microphysics and Heterogeneous Chemistry of Cirrus, Contrails and Polar Stratospheric Clouds": <http://www.phys.uu.nl/...>

SUMMER SCHOOLS ...up

1. Summer school 22 - 31 August 1999, Bergen, Norway: <http://www.geofysikk.uio.no/...>

SOME WHO CARE ...up

1. Arnott: [http://www.dri.edu/...](http://www.dri.edu/)
2. Darrel Baumgardner: [http://raf.atd.uncar.edu/...](http://raf.atd.uncar.edu/)
3. A. Carleton, Penn State: [http://www.geog.psu.edu/...](http://www.geog.psu.edu/)
4. Sundar A. Christopher: [http://www.atmos.uah.edu/...](http://www.atmos.uah.edu/)
5. Alistair Fraser (including a long contrail photograph): [http://www.ems.psu.edu/...](http://www.ems.psu.edu/)
6. Bo-Cai Gao: [http://search.msn.com/...](http://search.msn.com/)
7. Professor Roy M. Harrison: [http://www.bham.ac.uk/...](http://www.bham.ac.uk/)
8. Everett Joseph: [http://www.physics1.howard.edu/...](http://www.physics1.howard.edu/)
9. Sonia M. Kreidenweis: [http://sprite.atmos.colostate.edu/...](http://sprite.atmos.colostate.edu/)
10. Adam Lapensky: "The Importance of Contrail Studies": [http://www.d.umn.edu/...](http://www.d.umn.edu/)
11. Dr. Reinhard Loske, member of the German Bundestag: <http://www.loske.de>
12. Ottmar Raeymaeckers has a highly recommended page on the environmental effects of aviation, including contrails: [http://www-personal.umich.edu/...](http://www-personal.umich.edu/) - now linked from Sweden: [http://www.student.nada.kth.se/...](http://www.student.nada.kth.se/)
13. David C. Rogers: [http://lamar.colostate.edu/...](http://lamar.colostate.edu/)
14. Kenneth Sassen: [http://www.arm.gov/...](http://www.arm.gov/)
15. Jim Scanlon, a concerned journalist: [http://www.coastalpost.com/...](http://www.coastalpost.com/) - and - [click](#)
16. Professor Ulrich Schumann, DLR: [http://www.op.dlr.de/...](http://www.op.dlr.de/)
17. Smith, an astrophysicist doing contrail research: [http://epsc.wustl.edu/...](http://epsc.wustl.edu/)
18. Michael Theroux: "Scientific Studies Regarding Aircraft Contrails and Cloud Formation": [http://www.borderlands.com/...](http://www.borderlands.com/)
19. David J. Travis: [http://facstaff.uww.edu/...](http://facstaff.uww.edu/)
20. Contrail Concerned: Michael K. Walters: [http://www.au.af.mil/...](http://www.au.af.mil/)
21. Gerd Wendler: [http://climate.gi.alaska.edu/...](http://climate.gi.alaska.edu/)
22. Fangqun Yu: [http://www.atmos.ucla.edu/...](http://www.atmos.ucla.edu/)
23. Contrail-concerned: Dr. Alexander Zadorozhny: [http://www.phys.nsu.ru/...](http://www.phys.nsu.ru/)

=== Not sorted alphabetically

1. John H. Seinfeld: [http://vayu.che.caltech.edu/...](http://vayu.che.caltech.edu/)
2. Stephan Borrmann: [http://www.mpcch-mainz.mpg.de/...](http://www.mpcch-mainz.mpg.de/)
3. Dr. Andrew B. Horn: [http://www.ssci.liv.ac.uk/...](http://www.ssci.liv.ac.uk/)
4. Dr. Johannes Staehelin: [http://www.ngzh.ch/...](http://www.ngzh.ch/)

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 - ['Conspiracy' Sites \(with subindex\)](#)
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APOLLO-SOYUZ ...up

1. A rare image of contrails influencing lower, tropospheric clouds (see elsewhere about dissipating contrails): [http://www.ksc.nasa.gov/...](http://www.ksc.nasa.gov/)

GOES ...up

1. GOES-8 contrails, with shadows, over Indiana: [http://orbit-net.nesdis.noaa.gov/...](http://orbit-net.nesdis.noaa.gov/)
2. GOES-8: Contrails detected near Florida in an "infrared split window", 11-12 μm , but almost invisible in visible light, 0.65 μm , near Florida: "The ability to do this in the far infrared means that the channels could be used at night to see contrails, too. It is surprising the resolve the contrails from the GOES Imager at 4 km resolution": [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
3. GOES-8: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
4. GOES-8: "Contrails burn cirrus movie May": [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
5. Contrails headed for Haiti midday on Sunday, Sept. 18, 1994: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
6. Jet contrails all over Ohio on Xmas day December 28, 1994: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
7. GOES-8 views the Earth limb 2 hours before sunset, July 28, visible light, at high resolution, with a nice contrail : [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
8. GOES-8: Contrails and fog near Vancouver, visible light: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/) and infrared [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
9. Many GOES-8 contrail results (images, animation, interpretation) can be found on: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
10. "Contrails to the limb", September 19, 1997: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
11. GOES-9: "Snow fields in South Dakota at 1845 UTC, 26 October 1995. The GOES-9 visible image was reprocessed with simple image-enhancement tools to present the fine-scale features of the river valleys north and south of the Dakota-Nebraska border. There are clouds above the snow field which cast shadows, including cirrus contrails so thin that you cannot see the clouds themselves, only the long, thin linear shadows across the snow field": [http://rsd.gsfc.nasa.gov/goesb/...](http://rsd.gsfc.nasa.gov/goesb/)
12. GOES-10 fast-scan of contrail formation in Mississippi (5MB QT movie), 27 March 1998: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)

LANDSAT AND ERTS ...up

1. Joseph (1975): "Study of contrails observed from the ERTS-1 satellite", Journ. Geophys. Res. 80, 366-372. This paper has references to several earlier satellite observations of contrails.
2. On the use of Landsat 1 for contrail recognition: [http://www.nr.usu.edu/...](http://www.nr.usu.edu/)

3. Contrails in Landsat-7 imagery: <http://science.nasa.gov/...>

NEAR ... up

1. First of its kind: the interplanetary spacecraft NEAR was used to image what appears to be the remnant of a jet contrail over the Saudi Arabian desert. As NASA points out, this is one of the first instances where terrestrial civilization has been detected by an interplanetary probe [however, the clouds appear natural to the keeper]: <http://near.jhuapl.edu/...>

NOAA ... up

1. General info on NOAA satellite products: <http://www.itc.nl/...>
2. NOAA Aeronomy Laboratory: Effects of aircraft on the atmosphere: "For both subsonic and supersonic aircraft, there are many questions about how the exhaust gases and particles might influence the atmosphere": <http://www.al.noaa.gov/...>
3. Contrails are only visible in NOAA AVHRR 1-km imaging if already 0.5 km wide: <http://www-pm.larc.nasa.gov/...>
4. Satellite picture of contrails over Virginia: <http://www.datasys.net/...>
5. Jet Contrails over northeast US, June 4, 1999 (NOAA 14): <http://fermi.jhuapl.edu/...>
6. NOAA winter image of Great Lake region. The web site does not mention contrails, but NOAA has confirmed to me that the many linear features are indeed contrails or contrail shadows: <http://hazard1.wwb.noaa.gov/...>
7. "Satellite Picture of the Week", including shadows of contrails cast on lower clouds; notice regular spacing of contrails over the North Atlantic: <http://www-imk.physik.uni-karlsruhe.de/...> - and - [click](#)
8. Spiral-shaped contrail, 14 turns, most likely from an AWACS plane, over the North Sea, (the web site does not specify the spacecraft, but Dundee Satellite Receiving Station has confirmed this to be a NOAA image, from April 15, 1993, and supplied other archive images of the event): <http://www.win.net/...>
9. Fresh contrails over Kansas in MODIS NOAA 14 data (scroll to bottom of image) <http://ltpwww.gsfc.nasa.gov/...> and [click click](#)
10. Lots of contrails on June 4, 1999 NOAA picture of the North East of the USA: <http://fermi.jhuapl.edu/...> with details on: [click](#)
11. NOAA Contrails over the Baltic: <http://www.rummet.dk/...>

SEAWIFS ... up

1. Contrails visible just west of Chicago in the August 20, 1999 SeaWiFS image of the Great Lakes region: <http://seawifs.gsfc.nasa.gov/> - and - possible contrail in image of Turkey: [click](#)
2. Contrails over Florida in the "Astronomy Picture of the Day": <http://antwrp.gsfc.nasa.gov/...>
3. "Image of the Week" on October 16 2000: "Jet Contrails Sweep Across Lake Superior": <http://www.eoscenter.com/...> also used on chemtrail site: <http://www.angelfire.com/...>
4. SEAWIFS: Numerous contrails over the North Atlantic (East of Iceland): <http://visibleearth.nasa.gov/...> from [click](#)
5. SEAWIFS: Contrails crossing Canary Islands: <http://visibleearth.nasa.gov/...> from [click](#)
6. Check: <http://visibleearth.nasa.gov/...>

TERRA SPACECRAFT ... up

1. MODIS instrument good for contrail-cirrus detection: "MODIS will produce the first highly detailed global maps of cirrus cloud cover, which will significantly improve the ability of scientists to track changes in the amount of cirrus over time. According to recent research, cirrus clouds - and their atmospheric warming influence - may be increasing over areas with heavy air traffic as the contrails produced by jet exhaust form cirrus clouds": <http://pao.gsfc.nasa.gov/...>
2. EOS-Terra MODIS imagery: "Note pattern of extensive jet aircraft contrails over San Francisco and central California": <http://www.seospace.com/...>

SPACE SHUTTLE ... up

1. According to one NASA site, the first photograph taken from the Space Shuttle of an airplane generating a contrail, was obtained during STS 26 (September 1988) (text only): <http://www.ksc.nasa.gov/...> (NOTE: this is inconsistent with the legend of a 1983 photo from STS 9, roll 46, frame 1814: <http://eol.jsc.nasa.gov/...>)
2. Impressive contrails over Crete and Turkey: <http://www.southwestern.edu/...>
3. A 30 km wide contrail in ISIR Space Shuttle imaging: <http://isir.gsfc.nasa.gov/...> - and - [click](#)
4. ISIR - Space Shuttle - STS 85 producing good results on contrails: <http://www.rumford.com/...>
5. Contrail over Bangladesh: <http://images.jsc.nasa.gov/...>
6. Inspection of NASA image archive gives contrails in picture <http://images.jsc.nasa.gov/...> [click click](#)
7. Space Shuttle image of a contrail and its shadow near the mouth of the Ebro river, Spain: <http://capita.wustl.edu/...>
8. Space Shuttle, MIR, and contrails (Note that NUMEROUS other photos from the collections of Space Shuttle flights show contrails): <http://images.jsc.nasa.gov/...> - and - [click](#)
9. NASA photo index finds 390 contrail images, in Space Shuttle hand-held imagery, <http://eol.jsc.nasa.gov/> - The data file has been sorted chronologically: <http://www.astro.ku.dk/~holger/IDA/STSHH.html>
10. New and aged contrails, seen over Denmark (Space Shuttle hand-held photo): <http://images.jsc.nasa.gov/...> - and - [click](#) - and - [click](#) - and - [click](#) - and - [click](#)
11. Space Shuttle, and contrails, here there, everywhere: <http://images.jsc.nasa.gov/...>
12. EarthKAM: Superb Space Shuttle Photo of contrails: <http://earthkam.sdsc.edu/...>
13. EarthKAM: <http://earthkam.sdsc.edu/...>
14. The Great Wall of China is the purpose of this picture, but what one sees, is a contrail: <http://earthkam.sdsc.edu/...>
15. Earthkam: over England: <http://earthkam.sdsc.edu/...>

SPOT ... up

1. SPOT images: Solar eclipse August 11 1999: look carefully at one of the two Spot Images images released by CNES, and see lots of contrails over the Dutch coast, and over the Paris area: <http://www.cnes.fr/...> ... For a section of this image: <http://www.astro.ku.dk/~holger/IDA/S/page00511.html>

TIROS ... up

1. Contrail over Denmark and Sweden (TIROS?): <http://visibleearth.nasa.gov/...>

SATELLITE DATA ARCHIVES & REAL TIME

SATELLITE ... up

Look yourself for contrails in current satellite imagery!

1. Satellite images of Earth, real-time: [http://www.imk.physik.uni-karlsruhe.de/...](http://www.imk.physik.uni-karlsruhe.de/)
2. Latest NOAA pictures of the entire face of the Earth and nice films (link not directly to proper page): [http://asd-www.larc.nasa.gov/...](http://asd-www.larc.nasa.gov/)
3. Meteosat: [http://www.nottingham.ac.uk/...](http://www.nottingham.ac.uk/)
4. Dundee Satellite Receiving Station. Many NOAA images show contrails. The following selection has been provided by Neil Lonie. Contrails are best visible in either channel 2 (visual) or channel 4 (infrared); clarity is best without the grid: [click](#) West of Scotland (see the vis channels) [click click click click click click click](#) Bay of Biscay/Atlantic areas (see the vis channels) [click](#) Bay of Biscay/Atlantic areas (see the vis channels) [click](#)
5. SPOT satellite vegetation index (password is listed); some picture show contrails, in spite of the low (6 km) resolution of these public data: <http://cat.vgt.vito.be> - see also: <http://sirius-ci.cst.cnes.fr:8080/>
6. NOAA-14 observations of Denmark: [http://www.dmi.dk/...](http://www.dmi.dk/) with example of contrail sightings: <http://www.astro.ku.dk/~holger/IDA/S/PHOTOS/dmi.jpg>

CONTRAILS FROM SPECIFIC AIRCRAFT ... up

1. Airbus 300: [http://blacurs.aiss.uic.edu/...](http://blacurs.aiss.uic.edu/)
2. Airbus 310: [http://www.pa.op.dlr.de/...](http://www.pa.op.dlr.de/)
3. Antonov 225 - Buran - contrails: [http://www.west.net/...](http://www.west.net/)
4. YF 22 contrails (or wing-tip contrails): [http://members.visi.net/...](http://members.visi.net/)
5. AWACS: [http://meltingpot.fortunecity.com/...](http://meltingpot.fortunecity.com/) - and - [http://www.code-red.com/...](http://www.code-red.com/)
6. B747: [http://www.corazon.com/...](http://www.corazon.com/) - and - [http://www.pa.op.dlr.de/...](http://www.pa.op.dlr.de/) - and - [http://www.chris.brady.ukgateway.net/...](http://www.chris.brady.ukgateway.net/)
7. B747-400: [http://www.chris.brady.ukgateway.net/...](http://www.chris.brady.ukgateway.net/)
8. B-36: Margaret Bourke-White is said to have published a contrail picture from this aircraft in LIFE magazine, in 1951: [http://www.airspacemag.com/...](http://www.airspacemag.com/)
9. The LIFE Magazine photograph explained, and more: [http://freepages.military.rootsweb.com/...](http://freepages.military.rootsweb.com/)
10. B-47 described (text only) as leaving a brown contrail: [http://www.airpower.maxwell.af.mil/...](http://www.airpower.maxwell.af.mil/)
11. Smoke and contrails from B52 (links lost?) [http://webusers.anet-stl.com/...](http://webusers.anet-stl.com/) - and - [http://www.airspeed.ndirect.co.uk/...](http://www.airspeed.ndirect.co.uk/) - and - [http://www.csd.uwo.ca/...](http://www.csd.uwo.ca/) - and - [http://www2.southwind.net/...](http://www2.southwind.net/)
12. B52 + X15: [http://www.dfrc.nasa.gov/...](http://www.dfrc.nasa.gov/)
13. Beech 1900: Clover leaf contrail produced during training with a Beech 1900 aircraft: [http://www.newsminer.com/...](http://www.newsminer.com/)
14. DC8: [http://telsci.arc.nasa.gov/...](http://telsci.arc.nasa.gov/)
15. Lockheed 1011: [http://blacurs.aiss.uic.edu/...](http://blacurs.aiss.uic.edu/)
16. Royal Navy Sea Harriers: [http://www.mil.fi/...](http://www.mil.fi/)
17. Smoke from F4 Phantoms at take-off: [http://www.nmsu.edu/...](http://www.nmsu.edu/)
18. RC-135: [http://www.harborside.com/...](http://www.harborside.com/)
19. Contrail from Stealth Bomber photographed by meteorite hunter: [http://www.meteorite.com/...](http://www.meteorite.com/)
20. USAF Thunderbirds: [http://www.cg-squared.com/...](http://www.cg-squared.com/) from [click](#)
21. U2 plane emitting visible smoke at take-off: [http://sky.arc.nasa.gov/...](http://sky.arc.nasa.gov/)
22. Valkyrie contrails (aerodynamical?) from the moment of the mid-air disaster (?): [http://www.labiker.org/...](http://www.labiker.org/) - from: [click](#)
23. X15: [http://www.dfrc.nasa.gov/...](http://www.dfrc.nasa.gov/)
24. Chinook helicopter said to produce contrails: [http://www.boeing.com/...](http://www.boeing.com/)
25. "Helicopter with contrail departing Lake Bonney camp [Antarctis] in late August 1995, ambient air temperature -50 d C" (exact link pointer lost): <http://www.homepage.montana.edu/~pdf>

OTHER GROUNDBASED PHOTOS ... up

1. Contrail over Moscow (copyright Eric Mathiasen): [http://www.mathiasen.com/...](http://www.mathiasen.com/)
2. Photo in the National Archives and Records Administration: "Jet Contrail Over the Mountains of Searchlight, Desert Air. Here Is Free of Smog": [http://www.nara.gov/...](http://www.nara.gov/)
3. Contrail photo in cloud atlas: [http://www.scienceclass.com/...](http://www.scienceclass.com/)
4. A UK site, with good photos (and some talk on US conspiracy theories): [http://www.jedi98.demon.co.uk/...](http://www.jedi98.demon.co.uk/)
5. Various vacation album photos: [http://www.cis.upenn.edu/...](http://www.cis.upenn.edu/)
6. Contrail photos by Menno van der Haven, The Netherlands: [http://www.rally.nl/...](http://www.rally.nl/)
7. Nice sunset photo with contrails: [http://www.altonweb.com/...](http://www.altonweb.com/)
8. Sunset photo with contrail (large) [http://members.iweb.net.au/...](http://members.iweb.net.au/) - and small version on: [http://members.iweb.net.au/...](http://members.iweb.net.au/)
9. Wind-swept contrail in sunset picture: [http://www.palmyra.demon.co.uk/...](http://www.palmyra.demon.co.uk/)
10. Chance imaging of contrails in twilight scene: [http://www.hep.colorado.edu/...](http://www.hep.colorado.edu/)
11. Sunset photograph: "Contrails add a really nice touch to an already beautiful scene...": [http://www.ccmr.cornell.edu/...](http://www.ccmr.cornell.edu/)
12. A contrail over Perth: [http://www.dundee.ac.uk/...](http://www.dundee.ac.uk/)
13. Zugspitze (geophysical) Observatory - contrail photo: [http://wwwsat03.met.fu-berlin.de/...](http://wwwsat03.met.fu-berlin.de/)
14. Chance alignment of Space Shuttle on launch pad and contrails shown on CNN: [http://www.cnn.com/...](http://www.cnn.com/)
15. Chance picture of contrails in photo of Japanese combat fighter A6M-5 Zero: [http://www.iaehv.nl/...](http://www.iaehv.nl/) quoted on [http://www.iaehv.nl/...](http://www.iaehv.nl/)
16. Chance appearance of contrail in image of Dassault Falcon Jet: [ftp://205.147.152.30/...](ftp://205.147.152.30/) quoted on [http://www.falconjet.com/...](http://www.falconjet.com/)
17. Chance imaging of contrail in rocket launch [http://www.awgnet.com/...](http://www.awgnet.com/) picture [click](#)
18. Chance imaging of contrails in photo of two AWACS aircraft (one in flight): [http://www.awacs.af.mil/...](http://www.awacs.af.mil/)
19. Circular contrail over Germany (?); notice also a very wide, transparent contrail in the photo's upper right corner: [http://www.did4u.de/...](http://www.did4u.de/)
20. Contrails at scenic German sunset: [http://www.in-trier.de/...](http://www.in-trier.de/)
21. A Taiwanese contrail: [http://nculib4.ncu.edu.tw/...](http://nculib4.ncu.edu.tw/)
22. Contrails in archaeology (well, have a look): [http://www.homestead.com/...](http://www.homestead.com/) (REDUNDANT)
23. Contrails over Silicon Valley: [http://www.livefromsiliconvalley.com/...](http://www.livefromsiliconvalley.com/) quoted from [click](#) and [click](#) quoted from [click](#) and [click](#) from [click](#)
24. Web-site photos: [http://jcleary.hypermart.net/...](http://jcleary.hypermart.net/)
25. Groundbased contrail photos from February 11, 1999: [http://sightings.com/...](http://sightings.com/)
26. Evening pictures with contrail: [http://bildung.freepage.de/...](http://bildung.freepage.de/) ... and [http://www.donnerwetter.de/...](http://www.donnerwetter.de/) ... and (Rostock, Germany): [http://212.89.192.36/...](http://212.89.192.36/) ... and [http://members.tripod.com/...](http://members.tripod.com/)
27. Contrails in super-light airplane photo: [http://webusers.anet-stl.com/...](http://webusers.anet-stl.com/)
28. Chance imaging of contrails behind B1: [http://www.b1b.wpafb.af.mil/...](http://www.b1b.wpafb.af.mil/) - and - [click](#)
29. "The Flying Hospital", with chance view of contrails in photo: [http://www.cruisinaltitude.com/...](http://www.cruisinaltitude.com/)
30. Contrails over Alaska, by NOAA: [http://www.avo.alaska.edu/...](http://www.avo.alaska.edu/)
31. Contrail photos from Montana, USA, May-June, 1999 (recommended): [http://www.spiritnexus.com/...](http://www.spiritnexus.com/)
32. Contrails in picture of Rotary Rocket, Mojave Desert: [http://www.kluft.com/...](http://www.kluft.com/) - and - [click](#)
33. Superb photo: [http://www.mississippi.net/...](http://www.mississippi.net/)
34. "Cranes returning against a sunset sky and the contrails of jetliners coming in and out of Chicago make a scenic backdrop": [http://www.wbu.com/...](http://www.wbu.com/)
35. Five or 6 contrails in amateur weather photo: [http://www2.shore.net/...](http://www2.shore.net/)
36. Contrails at Lanker Lake, Germany (photo) [http://www.schunter.etc.tu-bs.de/...](http://www.schunter.etc.tu-bs.de/)
37. Shadow of contrail cast on lower clouds: [http://casi.simplenet.com/...](http://casi.simplenet.com/)
38. Flight International: "Aircraft Pollution" (picture title): [http://www.FlightInternational.com/...](http://www.FlightInternational.com/) - and - contrail of four-engine aircraft: [click](#)
39. Phoenix, Az, May 1999: [http://www.lindahowe.com/...](http://www.lindahowe.com/)
40. Contrails in beach-buggy photo: [http://www.off-road.com/...](http://www.off-road.com/) from [http://www.off-road.com/...](http://www.off-road.com/)
41. Contrails seen in a helicopter/skate-board stunt (Jyllandsposten, October 23, 1999): [http://www.jp.dk/...](http://www.jp.dk/)
42. Vacation album photos with contrails, from Riga, Latvia: [http://www.flnet.nl/...](http://www.flnet.nl/) - and Vilnius, Lithuania: [click](#)
43. Contrail photos from Virginia: [http://members.xoom.com/...](http://members.xoom.com/) - and from Anchorage, Alaska: [click](#)
44. Marvellous contrail photo from Grand Canyon: <http://www.astro.ku.dk/~holger/IDA/S/PHOTOS/GrandCanyon.jpg> with permission from [click](#)
45. Chance imaging of contrail behind Warhawk plane (on ground): [http://glue.umd.edu/...](http://glue.umd.edu/) and B-18 plane (also on ground): [click](#)

46. Chance imaging of contrail over Pomona, New Jersey: <http://www.team-health.com/...>
47. Contrail pictures, groundbased: Minnesota: <http://www.netowne.com/...>
48. Spectacular photo of contrail and sun dog: <http://www.1000plus.com/...>
49. Superb sunset photo with contrails: <http://photorad.com/...>
50. Contrails in photo of Hudson River: <http://www.speakeasy.org/...>
51. Australian sky camera (very low resolution), showing 'vapor trails': <http://lachlan.bluehaze.com.au/...> and [click](#) and [click](#) and [click](#) and [click](#)
52. A scenic photograph from Utah, with a jet contrail "cloned out": <http://www.vfs.com/...>
53. Contrail, over ocean, a groundbased photo: <http://www.astrophys-assist.com/...>
54. Contrail photo, groundbased: <http://www.inclinesquare.org/...> [click](#)
55. Series of contrail photos: <http://hometown.aol.com/...>
56. Contrails in digital photography: <http://hometown.aol.com/...> 1
57. Ugly contrails: <http://hometown.aol.com/...>
58. Many contrail photos: <http://www.geocities.com/...>
59. Two superb photos: <http://www.watchingyou.com/...>
60. Superb photos: <http://members.xoom.com/...>
61. Contrail photographed near Birmingham airport, Alabama: <http://www.cris.com/...>
62. Digital camera photos of contrails: <http://www.geocities.com/...>
63. Contrails over Turret Arch: <http://public.logica.com/...>
64. Amateur photos showing contrails included on: <http://www.topcities.com/...> - and - [click](#) - and - [click](#) - and - [click](#)
65. Chance imaging of contrails in photo of "Sun Dogs" <http://www.skylook.net/...>
66. Photos of contrails over Los Angeles, April 9, 2000 <http://www.no-fi.com/...>
67. "An extremely rare instance of crossing contrails" (well, it is not *that* rare, hp): <http://www.brinckerhoff.org/...> see also [click](#) and [click](#)
68. Contrails over Carquinez Strait, Port Costa, California, photographed by Clayton Bailey [with kind permission included in slide show]: <http://www.claytonbailey.com/...> and [click](#) and [click](#)
69. Contrail photo: <http://members.aol.com/...>
70. Chance imaging of contrails behind Canadian fighter: <http://www.moosejaw.dnd.ca/...> - from [click](#)
71. Chance imaging of contrails in B2 flight photo: <http://www.dyess.af.mil/...> - and - [click](#)
72. Photo of contrail over sunset sky: <http://neptune.spaceports.com/...>
73. Chance photograph of a contrail over an NREL employee house, near Grand Canyon: <http://www.nrel.gov/...> from [click](#)
74. Chance imaging of contrail over Mt.Cevedale, and Mt.Langley, in "World Mountain Encyclopedia": <http://www.peakware.com/...> - and [click](#)
75. Idyllic horse picture with contrails <http://www.meteo.physik.uni-muenchen.de/...> and winter scene from Bavaria: [click](#) and lake scene from Bavaria: [click](#) from [click](#)
76. Photo of contrail over Haines Hwy., British Columbia, Canada: <http://worldwidewireless.com/...>
77. Chance imaging of contrail behind rusty telescope dome: <http://astro.uchicago.edu/...>
78. Rocket engine at Houston, with chance imaging of contrails: <http://members2.clubphoto.com/...> and [click](#)
79. Contrail, chance imaging of, in photo of the Alps: <http://www.cs.berkeley.edu/...> from [click](#)
80. Chance imaging of contrails in rock climbing picture, Alps: <http://www.cosleyhouston.com/...> from [click](#)
81. Chance imaging of contrails in vacation photo album: <http://pw1.netcom.com/...>
82. B1 bomber with chance imaging of contrails behind: <http://www.b1b.wpafb.af.mil/...> from [click](#)
83. Chance imaging of contrail in CNN's report on California power outages: <http://www.cnn.com/...> from [click](#)
84. Contrails over Big Ben, chance imaging: [click](#)
85. Chance imaging of contrails over Mt. St. Helens: [click](#)
86. Chance imaging of contrails in desertification research paper, Owens Lake, California: <http://geochange.er.usgs.gov/...> from [click](#)
87. Chance imaging of contrail over Oeresundsbro: <http://www.copenhagencard.f2s.com/...>
88. Chance imaging of diffuse contrails over Kimball's Ice Cream, Carlisle, Massachusetts <http://www.photo.net/...> from [click](#) - and other chance imaging contrail pics from the same site: (Alaska) [click](#) from [click](#) - and shoreline with Elephant Seal Colony.: [click](#) from [click](#)
89. Chance imaging of contrail over Montana ski slope: <http://wallace-id.com/...> from [click](#)
90. Matterhorn (small photo) <http://www.hep.fzu.cz/...> and (larger) [click](#)
91. The Golden Gate Bridge: <http://home11.inet.tele.dk/...>
92. Eiffel Tower: <http://www.contrailconnection.com/...>
93. Chance imaging of contrails over Mt.Shasta (copyright protected): <http://www.shastahome.com/...>
94. Chance imaging of contrails on moon lit sky (Crater Lake): <http://albums.photopoint.com/...> from [click](#)
95. Chance imaging of contrails in picture of "Cane Cholla Cactus with Fruit in Guadalupe Mountains National Park": <http://www.cs.virginia.edu/...>
96. Chance imaging of contrails in vacation album photo from Italy: <http://sca.uwaterloo.ca/...> - and Ontario: [click](#) and [click](#)
97. Chance imaging of contrails over Pyramidal Peak, La Vanoise Park: Contrails <http://raingod.com/...> - from [click](#)
98. Chance imaging of contrails behind a C-121A Constellation aircraft (on ground): <http://www.skytamer.com/...>
99. Chance imaging of contrail over Mt.St.Helens: <http://www.nssl.noaa.gov/...>
100. Chance imaging of contrails from passing jets in picture of Centurion electric flying wing, photographed March 1997: <http://www.dfrc.nasa.gov/...>
101. Chance imaging of contrail in landscape photograph, Bryce National Park: <http://209.20.234.180/...> - and Punta Helbronner, Funiwie Monte Blanco, Italy: [click](#)
102. Chance imaging of contrail in artistic photo from Paris: <http://www.geocities.com/...>
103. Chance imaging of contrails over city square: <http://www.wrexhamcybercity.co.uk/...> from [click](#)
104. Chance imaging of contrails in photo of Willem Penn, Philadelphia: <http://ajaxelectric.com/...>
105. Chance imaging of contrails over gantry crane: <http://www.ederer.com/...>
106. Chance imaging of a contrail over the "Oeresundsbron", linking Sweden and Denmark: <http://www.copenhagencard.f2s.com/...>
107. Chance imaging of contrails over a Matador guided missile, at the National Atomic Museum, Albuquerque: <http://www.atomicmuseum.com/...> from [click](#)
108. Contrails over railway (Canadian Pacific) picture: <http://www.lrhs.com/...>
109. Contrails in railway picture: <http://www.railfan.net/...>
110. Chance imaging of contrail over Parliament, London (commercial site): <http://www.picture-gallery.com>
111. Contrail (not very clear) in artistic photo from Yosemite National Park: <http://www.pcmagenetwork.com/...>
112. Stunning contrail picture: <http://www-pm.larc.nasa.gov/...>

FROM PLANE TO PLANE ...up

1. "We followed beside this (contrail) for an hour or two": <http://sdg.ncsa.uiuc.edu/...>
2. Desert Research Institute: "Contrail above cirrus": <http://www.dri.edu/...>
3. Photo of contrail from plane to plane: <http://hyperion.gsfc.nasa.gov/...>
4. Contrails from airplane to airplane: <http://www.papamike.com/...>
5. B52 at 37,000 feet somewhere north of Alaska: <http://www.users.qwest.net/...> from [click](#)

AND FROM SHIP TO PLANE ...up

1. From the South China Sea Monsoon Experiment: contrail through the port-hole: <ftp://trmm.gsfc.nasa.gov/...>
2. Sailing photo: <http://playground.sun.com/...>

SEARCH FOR OLD CONTRAIL PHOTOS ...up

1. Search for old contrail photos: [http://www.voy.com/...](http://www.voy.com/)

'CONSPIRATION' SITES ... up

Jump to sub-section:

[Introduction](#)

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[Pills, Eyeglasses, Airfilters, etc. against Contrails](#)

[Conspiration Photos, Reports \(a mixed bag\)](#)

['Chemtrail' Message Boards](#)

INTRODUCTION ... up

Early 1999, numerous web sites were created in the United States, claiming that the government was spraying the population with chemicals (ethylene dibromide), and even anthrax and anthrax vaccine. The internet-storm seems to have gotten a kick-start with Art Bell's 'Dreamland' radio programme (see below analysis by 'Der Spiegel'). It was written that cob-webs were falling from the sky, and that they had been chemically analyzed. People were said to fall sick, en masse, and one site claims that people have died. Many (other) sites associate contrails with UFOs and other paranormal observations. I take this as a mere effect of numerous military flights, in preparation for the Kosovo intervention. It is a pity that the contrail issue is dealt with in this manner. Hence, opinions expressed on these pages are generally not mine! Some sites are nevertheless included, since show excellent imagery, often with site and date. Further descriptions of conspuration theories can be found on the 'usenet' and deja-sites (181 hits), but mostly, these are rather naïve. So, before the reader indulges in the conspuration theories, a few warnings:

THERE IS NO SPRAYING ... up

1. Anti-conspiration information from the Propulsion Directorate of the US Air Force (no date): "Contrails are safe, contrary to misinformation on the internet and other sources. The creation of contrails may give the illusion an aircraft is spraying something, however, this is just an illusion. Contrails are created from the normal emissions of jet engines at higher altitudes which condense water vapor into a visible cloud. The emissions from jet engines are basically the same as from car or diesel engines. These emissions do not contain ethylene dibromide (EDB), since EDB is not a component of JP-8, or jet fuel. The contrails are water vapor. They do not pose a hazard": [http://www.pr.af.mil/...](http://www.pr.af.mil/)
2. Patrick Minnis, Dryden, responding to conspuration theories: [http://earthfiles.com/...](http://earthfiles.com/)
3. Mark Pilkington explaining irrationality of conspitation theories: [http://www.forteanimes.com/...](http://www.forteanimes.com/)
4. Der Spiegel (February 8, 1999) has a story, in which Art Bell's radio programme is described a 'cult': "Da berichtete ein verstörter Zahnarztpatient, wie er nach seiner letzten Behandlung plötzlich des Nachts Stimmen hörte bis er darauf gekommen sei, dass ihm sein Dentist während der Narkose einen Chip eingepflanzt haben müsse, über den ihn nun die CIA ablausche. ... Anrufer wollen Chemikalien in Kondensstreifen entdeckt haben und vermuten, die Armee teste heimlich neue Kampfstoffe über den Vorstädten Amerikas. Sie haben zugesehen, wie Außerirdische eine Kuh missbrauchten, einen Elch in ihr Raumschiff beamten oder eine ganze Rinderherde abschlachteten: "Art, warum tun sie das?" ... Das Programm ist Ausdruck einer in Amerika wachsenden Begeisterung für Verschwörungstheorien, Weltallmythen und apokalyptische Zukunftsvisionen. Bis in die Morgenstunden dauert die Veranstaltung, die mittlerweile über 460 Sender im ganzen Land ausstrahlen. "Dreamland" und "Coast to Coast", so heißen Bells Sendungen, sind nicht nur die skurrilsten..." [http://www.spiegel.de/...](http://www.spiegel.de/)
5. For comparison, see Time Magazine (August 18, 1999): [http://www.pathfinder.com/...](http://www.pathfinder.com/)
6. An anti-conspiration, pro UFO site (???): [http://pufori.org/...](http://pufori.org/)
7. Anti-conspiration: [http://www.fivedoves.com/...](http://www.fivedoves.com/)
8. Debunking a new urban legend: chemtrails: [http://www.tbtf.com/...](http://www.tbtf.com/)
9. The early history of the conspuration scare explained by Jay Reynolds: [http://www.fortunecity.com/...](http://www.fortunecity.com/)
10. Chemtrails debunked by Weatherwise Magazine's meteorologist Thomas Schlatter: [http://www.weatherwise.org/...](http://www.weatherwise.org/)
11. "U.S. Air Force denies it's spraying toxic substance": [http://www.siteseer.ca/...](http://www.siteseer.ca/)

PILLS, EYEGLASSES, AIRFILTERS, ETC. AGAINST CONTRAILS ... up

1. Eat vitamin pills against contrails: [http://www.islandnet.com/...](http://www.islandnet.com/) (Note: from the same site, where the scare originated!)
2. Protect your eyes against dangerous radiation from contrails, for only 5\$: [http://www.jps.net/...](http://www.jps.net/)
3. Eat 9 charcoal pills each day, and buy air filters against contrail spraying!: [http://www.geocities.com/...](http://www.geocities.com/)
4. Contrails selling T-shirts in Phoenix, Az: [http://www.umediam.com/...](http://www.umediam.com/)
5. Eucalyptus Oil against contrails, 8.95 \$ for 9 ml!: [http://www.wellbeinginst.com/...](http://www.wellbeinginst.com/)
6. Gas masks, etc. against contrails: [http://www.kenwelch.com/...](http://www.kenwelch.com/)
7. A book on "Chemtrails over America" sold for 29.95\$ per copy: [http://www.islandnet.com/...](http://www.islandnet.com/)
8. Audio cassettes with contrail conspiracy sold for 9.95\$ a piece: [http://www.eaglehost.com/...](http://www.eaglehost.com/)
9. A contrail talk with admission fee 5 \$: [http://persweb.direct.ca/...](http://persweb.direct.ca/)
10. On silver spheres in contrails (wish it were true...): [http://www.earthfiles.com/...](http://www.earthfiles.com/)

CONSPIRATION PHOTOS, REPORTS (A MIXED BAG) ... up

Note: some sites may indeed be anti-conspiration!

1. Conspiration page with link to pictures from many US states and some locations elsewhere: <http://www.contrailconnection.com>
2. Art Bell's conspuration photos: [http://www.artbell.com/...](http://www.artbell.com/) including the sky above Las Vegas, Nevada: [click](#)
3. Conspiration picture: [http://www.islandnet.com/...](http://www.islandnet.com/) - and 'Chemtrails' (the beginning of the chemtrail scare?): [click](#)
4. William Thomas, January 8, 1999 (or was this the beginning of the scare?): "Contrails: Poison From the Sky": [http://www.anomalous-images.com/...](http://www.anomalous-images.com/)
5. Conspiration (claiming Anthrax spraying) discussing the February 11, 1999 13 UT NOAA image: [http://members.aol.com/...](http://members.aol.com/)
6. Photos from Feb 14, 1999 (i.e. shortly after NOAA picture): [http://www.geocities.com/...](http://www.geocities.com/) - and - more photos from the previous site: [click](#)
7. Photos from February 16, 1999: [http://www.heavensake.com/...](http://www.heavensake.com/)
8. Photos from Oregon, February 1999: [http://www.sightings.com/...](http://www.sightings.com/) - and - photos from Arkansas: [click](#)
9. "Mystery Substance Falls from the Sky Strands, Angel Hair, Globbs, & Gelatinous Blobs Black Helicopters and Bio-weapons?": [http://www.mt.net/...](http://www.mt.net/)
10. A conspuration site with some good photos: [http://strangehaze.freesevers.com/...](http://strangehaze.freesevers.com/) - and - [click](#) - and - [click](#) - and - [click](#)
11. A conspuration site with several good photos: <http://www.chemtrailcentral.com/>
12. Conspiration site with photos: [http://www.violawa.com/...](http://www.violawa.com/)
13. "Contrail Image Center" (but only few pictures by the end of 2000): [http://members.aol.com/...](http://members.aol.com/)
14. Conspiration photos [http://www.whitleysworld.com/...](http://www.whitleysworld.com/) from [click](#)
15. "What are they doing up there" (with excellent photo): [http://hometown.aol.com/...](http://hometown.aol.com/)
16. Postulated rabies vaccine drop tests: [http://www.strangetexas.com/...](http://www.strangetexas.com/)
17. "I have over 700 pictures of Contrails, that in my opinion are not normal. Why the mass-media won't touch this story is beyond me": [http://hometown.aol.com/...](http://hometown.aol.com/)
18. "My wife and I have been watching these jet airplanes turning the blue summer sky into a merkey gray mess" (with photos): [http://hometown.aol.com/...](http://hometown.aol.com/)
19. "September 18, 1999: While viewing the sunset, an estimated 50 plus streaks appeared over Central Arkansas once more" (with photos from Memphis): [http://hometown.aol.com/...](http://hometown.aol.com/)
20. 'Chemtrails' over Bunch (Oklahoma): [http://baproducts.com/...](http://baproducts.com/)
21. Dallas, March 9, 1999 [http://sharpwebpage.com/...](http://sharpwebpage.com/)

'CHEMTRAIL' MESSAGE BOARDS ... [up](#)

1. [http://www.webring.org/...](http://www.webring.org/)
2. [http://directweb.net/...](http://directweb.net/)
3. [http://forumcities.com/...](http://forumcities.com/)
4. [http://www.insidetheweb.com/...](http://www.insidetheweb.com/)
5. <http://clubs.yahoo.com/clubs/chemtrailtrackingusa>
6. [http://www.hostedscripts.com/...](http://www.hostedscripts.com/)
7. [http://townchat.com/...](http://townchat.com/)
8. [http://www.gulfwarvets.com/...](http://www.gulfwarvets.com/)
9. [http://pub8.ezboard.com/...](http://pub8.ezboard.com/)
10. [http://chemtrail.8m.com/...](http://chemtrail.8m.com/)
11. [http://www.szygyjob.com/...](http://www.szygyjob.com/)
12. [http://clubs.yahoo.com/...](http://clubs.yahoo.com/)
13. <http://www.contrails.cjb.net/>
14. [http://www.southernutah.com/...](http://www.southernutah.com/)
15. [http://www.mullum.com.au/...](http://www.mullum.com.au/)
16. [http://www.coolboard.com/...](http://www.coolboard.com/) and [click](#) (with many excellent photos):
17. [http://discserver.snap.com/...](http://discserver.snap.com/)
18. [http://www.sunspot.net/...](http://www.sunspot.net/)
19. [http://www.FreeRepublic.com/...](http://www.FreeRepublic.com/)

ANIMATIONS AND LIVE CAMERAS, SPACE AND GROUND ... [up](#)SPACE-BORNE ... [up](#)

1. Contrail Movie (segmented): [http://www.dri.edu/...](http://www.dri.edu/)
2. Java animation of Wisconsin: [http://cimss.ssec.wisc.edu/...](http://cimss.ssec.wisc.edu/)
3. GOES-10 showing contrail formation in Mississippi (5MB QT movie) on the morning of 27 March 1998: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
4. Movie of rotating contrails caught in a jet, March 29, 1995: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
5. Contrails burn cirrus movie, May 10, 1997: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
6. MPEG movie of rotating contrails caught in a jet over Ontario, Canada: [http://camille-f.gsfc.nasa.gov/...](http://camille-f.gsfc.nasa.gov/)
7. Space Movie Archive; one film (not seen) "Jet contrails over Louisiana, Florida" listed on: [http://graffiti.u-bordeaux.fr/...](http://graffiti.u-bordeaux.fr/)
8. GOES-10 movie (not seen) referred to on: [http://orbit35i.nesdis.noaa.gov/...](http://orbit35i.nesdis.noaa.gov/)

GROUND-BASED ... [up](#)

1. University of Nevada: Time lapse of contrail photos: [http://unr.edu/...](http://unr.edu/)
2. A wide-field, night time animation, 36 frames, showing a contrail in frame no.9, according to the web-site. However, I would contend that also the last frames shows a huge contrail: [http://www.thegrid.net/...](http://www.thegrid.net/) [from](#) and [click](#)
3. Web-cameras dedicated to contrail monitoring: So many so-called weather-cams are on the net, but few of them work, and they rarely show the sky. Some good examples are: [http://www.zkom.de/...](http://www.zkom.de/) - and (other frames also have contrails mentioned in captions): [http://www.wtoctv.com/...](http://www.wtoctv.com/) - and live contrails (Checked on May 18, 2000; seems not to have the live camera any more) from San Francisco: [http://www.citybirds.com/...](http://www.citybirds.com/)
4. HIGHLY RECOMMENDED: Sky camera at Mt.Wilson observatory (known to show contrails now and then): [http://www.astro.ucla.edu/...](http://www.astro.ucla.edu/)

NOT REALLY CONTRAILS ... [top of document](#)

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- [Anthropogenic Ionisation Trails](#)
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- [Insecticide Spraying](#)
- [Rockets](#)
- [Ships](#)
- [Vulcanos](#)

AERODYNAMIC CONTRAILS ... [up](#)

1. Breaking the sound barrier: [http://www.artbell.com/...](http://www.artbell.com/) - and (from behind): [click](#) - with details from: [click](#)
2. Aerodynamic, wing-tip contrails, described in: [http://x26.deja.com/...](http://x26.deja.com/)
3. "Breaking the sound barrier", a most remarkable picture: [http://www.chinfo.navy.mil/...](http://www.chinfo.navy.mil/) - and see also - [http://www.check-6.com/...](http://www.check-6.com/)
4. F-18 aerodynamic contrails: [http://www.geocities.com/...](http://www.geocities.com/)
5. Aerodynamic contrails, F-111 [http://1000pictures.com/...](http://1000pictures.com/)
6. B-1A Lance aerodynamic contrails: [http://groundzero.itgo.com/...](http://groundzero.itgo.com/)
7. B1 aerodynamic contrails: [http://www.b1b.wpafb.af.mil/...](http://www.b1b.wpafb.af.mil/) - and - [click](#)
8. British Aircraft Corporation: "The engines were not the relatively clean engines of present-day jets. Each engine produced thick black smoke, which, with the TSR.2's distinctive wingtip contrails, meant that it was not hard to spot a TSR.2 in the air!" (but could BA mistake wing-tip contrails for normal condensation-contrails?): [http://209.47.158.65/...](http://209.47.158.65/)
9. Antonov 225: [http://aeroweb.lucia.it/...](http://aeroweb.lucia.it/)
10. Rotor-tip vortices: <http://www.chinfo.navy.mil/>
11. Propeller tip contrails: [http://www.airliners.net/...](http://www.airliners.net/)
12. Battleship airplane propeller contrails: [http://www.nara.gov/...](http://www.nara.gov/)
13. Panavia Tornado aerodynamic contrails: [http://www.FlightInternational.com/...](http://www.FlightInternational.com/)
14. Walter Shierra, at the return from this 1962 6-orbit Sigma 7 space flight made contrails, before splash-down: [http://www.airfoilweb.com/...](http://www.airfoilweb.com/)
15. Valkyrie contrails (aerodynamical?) from the moment of the mid-air disaster (?): [http://www.labiker.org/...](http://www.labiker.org/) - from: [click](#)
16. Even the Space Shuttle leaves contrails when landing: [http://www.ksc.nasa.gov/...](http://www.ksc.nasa.gov/)
17. Contrail at Space Shuttle landing: [http://www.zianet.com/...](http://www.zianet.com/) from [click](#)
18. Space Shuttle reentry: [http://www.ghg.net/...](http://www.ghg.net/)
19. Space Shuttle re-entry photo (see also the above Apollo_Soyuz image): [http://www.drdale.com/...](http://www.drdale.com/)
20. Aerodynamic contrails at Shuttle landing (check for redundancy): [http://spacelink.nasa.gov/...](http://spacelink.nasa.gov/)

21. Aerodynamic contrails from Jaguar fighter: [http://ourworld.compuserve.com/...](http://ourworld.compuserve.com/)
22. Wing tip contrails: [http://www.shreve.net/...](http://www.shreve.net/)
23. Wing tip contrails: [http://www.cust.idl.net.au/...](http://www.cust.idl.net.au/)
24. SuperGuppy, with propeller-tip contrails: [http://www.thegrid.net/...](http://www.thegrid.net/)
25. AERODYNAMIC CONTRAILS: F-15 [http://www.photohome.com/...](http://www.photohome.com/)
26. AERODYNAMIC CONTRAILS: Propeller corkscrew contrails: [http://www.otter-caribou.org/...](http://www.otter-caribou.org/)
27. AERODYNAMIC: Mirage F1 aerodynamic contrails: [http://www.scramble.nl/...](http://www.scramble.nl/)
28. Aerodynamic contrails (nice photo) from two A7-Es: [http://www.voughtaircraft.com/...](http://www.voughtaircraft.com/)
29. Gliders releasing water, which looks like contrails (text only): [http://members.aol.com/...](http://members.aol.com/)
30. Concorde aerodynamic 'contrails' at take off: [http://www.british-airways.com/...](http://www.british-airways.com/)

AIRSHOWS ... up

1. Smoke 'contrails' during air-shows: [http://ourworld.compuserve.com/...](http://ourworld.compuserve.com/) ... and (Wings of Gold): [http://css.ecsis.net/...](http://css.ecsis.net/) ... and: [http://members.theglobe.com/...](http://members.theglobe.com/) -and (1999 Point Mugu Air Show): [http://128.111.124.11/...](http://128.111.124.11/)
2. Blue Angels formation: [http://reality.sgi.com/...](http://reality.sgi.com/)
3. Blue Angels over Golden Gate Bridge: [http://www.usatoday.com/...](http://www.usatoday.com/)
4. Sky Writer 'contrails' made by injection of 'biodegradable cooking oil': [http://www.examiner.net/...](http://www.examiner.net/)
5. Sky writing photos: [http://www.azstarnet.com/...](http://www.azstarnet.com/)
6. Skywriting: In the movie Woody Allen "Celebrity", the word HELP is sky-written over New York: [http://www.archiv.zeit.de/...](http://www.archiv.zeit.de/)
7. Skywriting "Contrails 69" the official logo for W.C. Hinkley High School graduating class of 1969": [http://home.earthlink.net/...](http://home.earthlink.net/)
8. Air-show ontails: [http://www.flight2000.com/...](http://www.flight2000.com/)
9. Not contrails, but smoke: Eurofighter [http://www.rolls-royce.com/...](http://www.rolls-royce.com/)
10. Even model airplanes do it: [http://lcr.org/...](http://lcr.org/) - and a special fuel-mixture produces long-lasting contrails from model aviation: [http://www.rcaviation.com/...](http://www.rcaviation.com/)

ANTHROPOGENIC IONISATION TRAILS ... up

1. Space Shuttle search site: "Why is there a glowing, white contrail that stretches from horizon to horizon as the orbiter crosses overhead before landing? The orbiter's speed heats the surrounding atmosphere to several thousands of degrees Fahrenheit. This temperature is great enough to strip some electrons from atoms in the air, creating an ionized plasma. The free electrons generate visible light as they escape from and recombine with atoms. This luminous 'ion sheet' or 'plasma trail' is fundamentally different from a conventional jet airplane contrail, which would be invisible on a moonless night": [http://spaceflight.nasa.gov/...](http://spaceflight.nasa.gov/)

BIRDS AND PEOPLE ... up

1. Even birds have been seen to produce contrails: [http://www1.drive.net/...](http://www1.drive.net/)
2. Birds can make contrails and even *anti-contrails*: [http://magazine.audubon.org/...](http://magazine.audubon.org/)
3. People making "vapor trails", in Alaska: [http://yukonweb.com/...](http://yukonweb.com/)

DISTRAILS (INVERSE CONTRAILS) ... up

1. A stunning satellite picture of holes in clouds in southern Virginia is theorized to be related to jet aircraft passing through the cloud layer: (with satellite image): [http://fermi.jhuapl.edu/...](http://fermi.jhuapl.edu/)
2. On 'dissipation trails', the opposite of 'contrails': [http://x35.deja.com/...](http://x35.deja.com/)
3. Inverse-contrails: [http://pals.agron.iastate.edu/...](http://pals.agron.iastate.edu/) by Dr. R.E. Carlson [click](#)
4. Inverse-contrail: [http://www.neosoft.com/...](http://www.neosoft.com/)
5. Inverse contrails: [http://www.geocities.com/...](http://www.geocities.com/) and [click](#)
6. Inverse contrails in stunning aircraft photo: [http://www.diam.unige.it/...](http://www.diam.unige.it/) g from [click](#)
7. A distrail seen over a Chevy's (restaurant?): [http://bsartist.com/...](http://bsartist.com/)

FIREBALLS ... up

1. Misused word 'contrail' to describe meteor persistent trail (there is no water to condense!): [http://www.nas.edu/...](http://www.nas.edu/)
2. The El Paso fireball from October 1997 left a 30-minute 'contrail': [http://www.phoenixat.com/...](http://www.phoenixat.com/)

INSECTICIDE SPRAYING ... up

1. C-130 insecticide spraying by Air Force: "After surveying the area for obstacles, like towers and buildings, overlooked by air charts, the plane begins hedgehopping over the island at an altitude of 150 feet. Buzzing the base at a ground speed of 230 mph, the crew releases a fine mist of pesticide that streams back from the wings like twin contrails": [http://www.af.mil/80/...](http://www.af.mil/80/)

ROCKETS ... up

1. Disclaimer regarding missile trails (with photo): "Vandenberg AFB has launched more than 1,700 missiles and space boosters since December 1958 and only a small number of these launches have created twilight phenomenon. Some observers have assumed - incorrectly that the missile creating the aerial spectacle must have malfunctioned. This belief stems from the appearance of the missile's contrail when it becomes twisted into giant white pretzel shapes by the high altitude air currents": [http://www.vafb.af.mil/...](http://www.vafb.af.mil/)
2. WWII - V2 rocket 'contrail': [http://www.kmx.com/...](http://www.kmx.com/)
3. Rocket 'contrail' photos: [http://web.utk.edu/...](http://web.utk.edu/) - and - [http://antwrp.gsfc.nasa.gov/...](http://antwrp.gsfc.nasa.gov/) - and - [http://www.schnapp.org/...](http://www.schnapp.org/) - and - [click](#) - and - [http://www.znet.com/...](http://www.znet.com/) - and - [http://www.afms.com/...](http://www.afms.com/) - and - [http://www.drsky.com/...](http://www.drsky.com/) - and - [http://www.noao.edu/...](http://www.noao.edu/) - and - [click](#) - and - [http://www.bouldercity.com/...](http://www.bouldercity.com/) with details from: [click](#) - and - [http://www.thepass.net/...](http://www.thepass.net/) - and - [http://www.moonglow.net/...](http://www.moonglow.net/) - and - [http://www.bouldercity.com/...](http://www.bouldercity.com/) - with details from: [click](#) - and Contrails of Minuteman missile, October 1999: [http://www.wygazette.com/...](http://www.wygazette.com/) [http://www.wygazette.com/...](http://www.wygazette.com/) - and same missile in [http://www.sitrib.com/...](http://www.sitrib.com/) - and [http://www.drsky.com/...](http://www.drsky.com/) - and [http://www.west.net/...](http://www.west.net/) - and [http://www.primenet.com/...](http://www.primenet.com/)
4. Rocket contrails, several pictures: [http://drsky.com/...](http://drsky.com/)
5. Rocket exhaust plumes: Delta II Rocket Launch, Vandenberg AFB, CA: [http://www.dosgatos.com/...](http://www.dosgatos.com/)
6. Rocket 'contrail' at Table Mountain Observatory: [http://www.qsl.net/...](http://www.qsl.net/)
7. 'Contrails' from a 1997 Minuteman II missile launch: [http://www.znet.com/...](http://www.znet.com/)
8. X-15 'contrail' after launch : [http://www.dfr.nasa.gov/...](http://www.dfr.nasa.gov/)

9. Exhausts from rocket-assisted take-off of Boeing XB-47 Stratojet: [http://www.wpafb.af.mil/...](http://www.wpafb.af.mil/)
10. Missile launch, with movie (from Mt. Wilson observatory): [http://www.astrophys-assist.com/...](http://www.astrophys-assist.com/)
11. Missile contrail: [http://jimtanner.virtualspace.net/...](http://jimtanner.virtualspace.net/)
12. Rocket contrails: THAAD FLIGHT 11 (with remarkable photo of rocket launch): [http://147.71.210.21/...](http://147.71.210.21/) - and - [click](#)
13. Rocket contrail: [http://www.azuswebworks.com/...](http://www.azuswebworks.com/)
14. Rocket contrails (from October 2, 1999): [http://www.skyscapes.com/...](http://www.skyscapes.com/) - and: [click](#)
15. A rocket launch contrail: [http://www.digitalphotocontest.com/...](http://www.digitalphotocontest.com/)
16. A rocket launch from White Sands: [http://www.starizona.com/...](http://www.starizona.com/)

SHIPS [...up](#)

1. Introduction to physics of ship contrail generation: [http://www.met.nps.navy.mil/...](http://www.met.nps.navy.mil/)
2. Ship contrails, with Sulphur content, may delay Global Warming: [http://www.newscientist.com/...](http://www.newscientist.com/)
3. Contrails from ship exhaust: [http://www.drdale.com/...](http://www.drdale.com/) - and - [click](#)
4. Features claimed to be 'chemtrails' over Pacific North West look more like ship-trails: [http://anomalous-images.com/...](http://anomalous-images.com/) and: [click](#)
5. Ship trails in NOAA images: [http://iwonderproductions.com/...](http://iwonderproductions.com/)
6. More ship-trails called contrails (Chemtrails): [http://www.sightings.com/...](http://www.sightings.com/)
7. Ship trails visible over the East China Sea, (image from August 4, 1998; see lower right corner): <http://seawifs.gsfc.nasa.gov/>
8. Good picture of ship trails: [http://www.das.uwo.edu/...](http://www.das.uwo.edu/)
9. How to distinguish ship trails from contrails: [http://www.physics.swin.edu.au/...](http://www.physics.swin.edu.au/)

VULCANOS [...up](#)

1. Spectacular steam ring from Etna vulcano: [http://news.bbc.co.uk/...](http://news.bbc.co.uk/)

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AUDIO FILES, TRANSCRIPTS [...up](#)

1. National Public Radio (NPR), Morning Edition, June 10, 1998: RealAudio: Airplanes and the Environment "NPR's David Baron reports that contrails ... pose a potential hazard to the environment" (5:14): [http://www.globalchange.org/...](http://www.globalchange.org/)
2. West Deutscher Rundfunk (WDR), on DLR research into the influence of Sulphur in jet fuel on the formation of contrails: [http://www.wdr.de/...](http://www.wdr.de/)
3. May 6, and January 15, 1999 radio interviews on contrails and conspiracy matters (be warned!): [http://www.broadcast.com/...](http://www.broadcast.com/)
4. "Copenhagen Calling", transmitted on World Radio Network (WRN) in September 1999 brought an interview with the keeper of this page. Transcription should appear on the September 19, 1999 entry of: [http://www.banns.com/...](http://www.banns.com/)
5. Audio: Mutual Radio (Oct. 29, 1997): Aerospace and Ocean Engineering Professor James Marchman discussed the physics of jet contrails on "Why is It?", a daily radio program produced by AAAS: [http://scholar.lib.vt.edu/...](http://scholar.lib.vt.edu/)
6. Also Real Audio: "Making Clouds by Flying in Airplanes": [http://www.mountwashington.org/...](http://www.mountwashington.org/) and "The Controversy Over Chemtrails": [click](#)

NEWSPAPERS, JOURNALS, AND TV STATION WEB SITES [...up](#)

Canada

1. CBC, August 29, 1999: Shirley Moore reports for CBC Radio "Ontario town worried about U.S. military flights" (apparently a spin-off of 'chemtrail' conspiracyism; contrails not mentioned): [http://newsworld.cbc.ca/...](http://newsworld.cbc.ca/)

Denmark

1. Berlingske Tidende, September 14, 1999: "Himmelsk Grafitti truer Miljøet" and "Jetfly giver mere grøvej", both by M.Katz.
2. Politiken, September 28, 1999: "Flystriber skader miljøet", by Niels Nørgård.
3. Søndagsavisen, October 3, 1999, "Mørke flyskyer på himlen", by Helge Faurby.
4. Press Release from NOAA (Friends of the Earth, Denmark), December 1999: "Your air travel from Copenhagen to London may release 144 kg of water in the form of contrails": [http://sunsite.auc.dk/...](http://sunsite.auc.dk/)
5. Politiken, March 15, 2000: Axel Walloe Hansen: "... Nye problemstillinger kan frygtes at udvikle sig, f.eks. flere og flere 'contrails', det vil sige kondensationsspor efter fly i stor højde".

Germany

1. Frankfurter Allgemeine Zeitung, from May 29, 1999, shall have an article 'From contrails to fuel taxation'.
2. Hieroglyphen am Himmel: Sterne und Weltraum 12, p.1077 (1999)
3. Die Welt: [http://www.welt.de/...](http://www.welt.de/) - and [click](#)

Israel

1. Jerusalem Post (on Kyoto meeting; December 7, 1997): "Within 24 hours of the thousands of participants dispersing to fill the global atmosphere with more jet exhaust from their planes, the ...": [http://www.jpost.com/...](http://www.jpost.com/)

Switzerland

1. Tages-Anzeiger, August 20, 1998: Flughafen-Jubiläum: Nicht nur Anlass für Jubel: "Für noch mehr Flugreisen eigentlich kein Bedarf!": [http://www.tages-anzeiger.ch/...](http://www.tages-anzeiger.ch/)

United Kingdom

1. New Scientist, March 29, 1997, said to have an article about contrails, check (link lost?): [http://www.doc.mmu.ac.uk/...](http://www.doc.mmu.ac.uk/)
2. New Scientist (does not work): [http://www.newscientist.com/...](http://www.newscientist.com/)

are straight when it is not" (redundant link): [http://awgnet.com/...](http://awgnet.com/)

3. Smithsonian Air and Space (1996): Contrails revealing turbulence: "Shears and whirlwinds also occur at higher altitudes, and Bedard, after years of listening to the infrasonic growls of weather, has begun reading what these winds write in the high troposphere--in contrails. He sees turbulence in corkscrewed contrails, and in contrails shaped like whips" (June/July 1996): [http://www.airspacemag.com/...](http://www.airspacemag.com/)
4. Contrails good for aviation safety?: [http://marina.fortunecity.com/...](http://marina.fortunecity.com/)
5. Contrails good for aviation safety: [http://www.flightsimnetwork.com/...](http://www.flightsimnetwork.com/)
6. Contrails useful in weather forecasts: [http://www.fb.com/news/...](http://www.fb.com/news/)
7. Embry Riddle Aeronautical University (in the pilot's choice of the most economical flight altitude, the generation of contrails is a mere consequence, and for "most passengers, the most important consideration is what movie will be shown"): [http://comm.db.erau.edu:80/...](http://comm.db.erau.edu:80/)
8. Berliner Morgenpost, September 16, 1997: Contrails mentioned in the discussion of the US/German mid-air collision off the South-West African coast: [http://archiv.berliner-morgenpost.de/...](http://archiv.berliner-morgenpost.de/)
9. Near collision in 1996: "The level change was authorised by air traffic control, and as the aircraft left flight level 350, the crew noticed the "contrails" of another aircraft above and levelled off. A traffic alert and collision avoidance system traffic advisory message was received at the same time, indicating that the vertical separation of the aircraft on passing was 1800 feet": [http://www.taic.org.nz/...](http://www.taic.org.nz/)
10. FAA on the use of contrails as a navigation aid during North-Atlantic ocean crossings: "Even with a sophisticated navigation system such as GPS, it is still essential to maintain good navigation practices. Do not just blindly follow the numbers; awareness of the azimuth of the sun, cross-checking with other NAVAIDs and disposition of contrails from high level traffic are all obvious but many errors have occurred which could have been prevented had the pilot shown more awareness": [http://www.faa.gov/...](http://www.faa.gov/)
11. Spotting contrails can help reestablish contact with aircraft if the radio has failed: [http://www.aviationnow.com/...](http://www.aviationnow.com/)

BUSINESS [...up](#)

1. "Insurance Journal News" on jet contrails (!): "Contrails Could Affect Future Weather": [http://still.yahoo.com/...](http://still.yahoo.com/)
2. Contrails are not good for business: "Contrail Airlines Inc." rejected as company name because: ""We started with Contrails," says McArtor. "We figured every other airline would be advertising for you, because contrails, or condensation trails, are those vapor trails that come out of the back of a plane. In Dallas people said, 'What's the deal with Conrail?' That's a railroad that doesn't have a great reputation in the area. Others thought contrails were pollution"": [http://www.pathfinder.com/...](http://www.pathfinder.com/)
3. Emit contrails and earn milage: [http://m.doubleclick.net/...](http://m.doubleclick.net/)
4. Contrails required in realistic flight simulators: [http://www.avsim.com/...](http://www.avsim.com/) - and - [click](#)
5. Aerodyne Research Inc.: Jet engine research, related to contrails and other emissions: [http://www.aerodyne.com/...](http://www.aerodyne.com/)
6. Aero International, 1996, issue 2, page 72-73: Contrails discussed in relation to jet engine design (?): [http://cip.physik.uni-wuerzburg.de/...](http://cip.physik.uni-wuerzburg.de/) (the article cannot be found on the publications own home page: <http://www.aerointernational.de/>)
7. Digital Photography: "After all the dust is gone we might remove other items that spoil the photo such as jet contrails or wires": [http://internetbrothers.com/t/...](http://internetbrothers.com/t/)
8. Contrails contaminating commercially offered satellite picture: [http://www.erim-int.com/...](http://www.erim-int.com/)
9. Commercial analysis by company "Analytical Services & Materials": "Constructed climatologies of surface-detected contrails over the US": [http://www.asm-usa.com/...](http://www.asm-usa.com/)
10. Contrails in commercials: Austrian Airlines (the logo): [http://www.austrianair.com/...](http://www.austrianair.com/)
11. Contrails in commercials: Air Zodiac: [http://www.airzodiac.com/...](http://www.airzodiac.com/)
12. Contrails in commercials: Continental Airlines (the 1968 logo): [http://www.continental.com/...](http://www.continental.com/) from [click](#)
13. Contrails in commercials: -- also Swissair used contrails in their commercials, maybe around 1980.
14. Contrails in real estate advertising (do they enhance property value?): [http://www.softcom.net/...](http://www.softcom.net/)
15. Commercial: Chance imaging of contrails in 'Miller Beer Stunt' (horse pulling hang-glider) [http://www.stuntwings.com/...](http://www.stuntwings.com/) from [click](#)
16. Heavy contrails seen in commercial (Volvo V70 van) on European CNN, wednesday April 12, 2000.
17. Contrails in music video: The music video playing on the European MTV channel on March 2, 2000, announcing MacGray's records STILL and ON HOW LIFE IS, shows several contrails.
18. Simulated contrail on Rolls Royce company page: [http://www.rolls-royce.com/...](http://www.rolls-royce.com/)
19. Make 225 \$ giving contrail information for kids: [http://www.mediaincorporated.com/...](http://www.mediaincorporated.com/)
20. Jobs in contrail research: [http://www.wiley-vch.de/...](http://www.wiley-vch.de/)
21. Shell Aviation: "Condensation trails from aircraft also contribute to the Greenhouse effect, as well as being very visible and increasing cloud cover in areas of high flight activity. Some models predict their effect to be 10% of that due to CO2, whilst more recent predictions put their effect as comparable to that of CO2": [http://www.shell.com/...](http://www.shell.com/)

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SUPERSONIC TRANSPORT AND HIGH ALTITUDE AIRCRAFT [...up](#)

1. SST: Liberty Tree Alliance quoting Earth Island Journal for this opinion: "EIJ has two primary worries: One, the effects of contrails have been at best ignored and at worst covered up. Two, airplane manufacturers are well underway in the development of higher-flying, supersonic passenger planes. One industry estimate has these jets heading for the stratosphere within the next ten years. Even without these jumbo SSTs, NASA says that within the next twenty years aircraft fuel consumption will more than double, nitrogen oxide emissions will nearly double, and carbon dioxide emissions will increase by half", and Liberty Tree Alliance concludes: "It's almost enough to make you want to stay home": [http://www.libtree.org/...](http://www.libtree.org/)
2. American pollution better than non-US pollution: "If SSTs are going to pollute our atmosphere, it's better to have it polluted by U.S. SSTs than by the same number of foreign-produced SSTs": [http://www.magma.ca/...](http://www.magma.ca/)
3. HSCT: "Contrail formation is not expected to occur at the altitudes at which HSCTs will fly [ca. 20 km], although indirect radiative impacts may result if HSCT emissions enhance the formation of PSCs": [http://www.nap.edu/...](http://www.nap.edu/) - and: "Formation of persistent contrails from HSCTs is expected to be infrequent": [http://hyperion.gsfc.nasa.gov/...](http://hyperion.gsfc.nasa.gov/)
4. HALO - the proposed "High Altitude Long Operation" aircraft. This is intended to provide telecommunication links for big metropolitan areas, cruising at altitude 15 - 20 km. It will leave contrails with diameter 80 to 120 kilometers: [http://www.geocities.com/...](http://www.geocities.com/)
5. Supersonic transport emissions: [http://www.aero.jussieu.fr/...](http://www.aero.jussieu.fr/)
6. One the influence of future aircraft on the environment: [http://www.edf.org/...](http://www.edf.org/)

ALTERNATIVE PROPULSION SYSTEMS [...up](#)

1. HYDROGEN TECHNOLOGY
 - a. Hydrogen planes (they create thicker, shortlived contrails): [http://www.decollage.org/...](http://www.decollage.org/)
 - b. Hydrogen plane technology: Daimler-Benz research into hydrogen planes, with less contrails: [http://www.landtag-sh.gruene.de/...](http://www.landtag-sh.gruene.de/)
 - c. Daimler Chrysler Aerospace on the 'absolutely harmless contrails': "Simulationsrechnungen zur Kondensstreifenbildung legen allerdings die Vermutung nahe, daß Kondensstreifen hinter einem Wasserstofftriebwerk optisch dünn und wenig strahlungswirksam, also absolut harmlos sein werden": [http://www.dasa.com/dasa/...](http://www.dasa.com/dasa/)
 - d. On the merits of hydrogen aviation: Eurosolar: Klimawirkungen von Wasserstoff- und Kerosinflugzeugen: "... Außerdem gibt es Hinweise dafür, daß der vermehrte Wasserdampf-Ausstoß nicht zu einer erhöhten Kondensstreifenbildung führen muß. Messungen von Kondensstreifen habe nämlich ergeben, daß der Wassergehalt in ihnen sich nicht wesentlich vom natürlichen unterscheidet. Daher besteht der Verdacht, daß insbesondere Rußpartikel und unverbrannte Kohlenwasserstoffe als Kondensationskerne wirken. Diese Produkte treten bei Wasserstoff als Treibstoff jedoch nicht auf": [http://www.eurosolar.org/...](http://www.eurosolar.org/)

- e. On the need for experiments with pure water contrails from Hydrogen planes: "Dr. Heinz Klug, of Daimler-Benz Aerospace, discussed the lack of knowledge of the environmental effect of water contrails, noting that, at above 12 km altitude, emission lifetimes could exceed 100 years, but that the concern would not be with water vapor but with ice crystals. Carbon and sulphur nuclei, present in the exhaust of conventional jets, are generally thought necessary as nucleation sites for ice crystals. One concludes that high-altitude flights of a hydrogen-fueled vehicle are required as an experiment in pure water contrails":
<http://www.ftcorp.com/...>
- 2. ATOMIC POWERED AIRCRAFT
 - a. Atomic powered aircraft: <http://www.csd.uwo.ca:80/...>
- 3. MICROWAVE AND SOLAR POWERED AIRCRAFT
 - a. Microwave powered aircraft, test link to patent on: <http://messages.clubs.yahoo.com/...>

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- [Computer generated Contrails](#)
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ANECDOTAL ... [up](#)

1. Contrails for kids: "During a recent stroller ride, Maggie looked down while the stroller wheels were going through some water. 'Contrails!', she shouted":
<http://kiwi.atmos.colostate.edu/...>
2. An early starter: "When she turned two, she learned to ride a bicycle with training wheels, counted to 20, wrote several letters and numbers, and talked about the contrails she saw in the sky": <http://www.momsonline.com/...>
3. Grandma's opinion: "My grandmother who died in 1987 and was 90 said that the jets changed our weather": <http://www.nature.net/...>
4. Contrails from South Pole: "did you know that planes at the South Pole can spew out contrails while still on the ground, thereby creating such a fog that they can't take off?": <http://www.amazon.com/...> - and - see also <http://www.asa.org/...> - and <http://byo.com/byo/...>
5. Contrails on ground at South Pole: <http://www.cybertours.com/...>
6. A GHOST with contrail: <http://photos2.ghostweb.com/...>
7. Concorde contrail (the only observation of this type found so far!): "Der Steward bringt eben zur Tea Time neben heißen Getränken köstliche Törtchen und Sandwiches, da bildet sich am blauen Himmel ein Kondensstreifen. Hoch oben huscht ein Flugzeug vorbei und verschwindet wieder. Erst etliche Sekunden später hallt ein dumpfer Doppelknall über das Schiff - Insider können sich denken, daß es sich um die »Fußspuren« der Concorde handelt, den Überschallknall. Der erst vor drei Stunden in New York gestartete Jet wird gleich in London-Heathrow landen. Die Schiffspassagiere dürfen sich noch einmal entspannt zurücklehnen. Sie werden erst am nächsten Morgen England erreichen und haben noch einen letzten Abend auf See vor sich" <http://www.fvw.de/...>
8. Even ecologically minded people shun discussion on the negative aspects of Concorde flights: "Herr Lewandowski und seine Kinder schauen "immer an den Himmel, wenn da was fliegt", sie sind Liebhaber, "Plane spotter", und die Concorde ist ohne Frage "ein Meisterstück". Nun, vielleicht nicht ökologisch, aber das sieht er ihr nach, auch wenn er sonst ein Grüner ist, den Müll trennt und schon Obacht auf die Umwelt gibt. "Bei der hakt's bei mir aus", sagt er mit dem Lächeln eines schwer Verliebten": <http://www.cce.fht-esslingen.de/...>
9. "Because I'm no scientist, I want some ordinary Jane or Joe to come out of the woodwork and talk to me about flying -- not some astrophysicist with three Ph.D.s trailing a contrail of technical jargon": <http://www.aopa.org/...>
10. Hillary Clinton honoured by contrails over Kosovo: "Prompt zur Visite überfliegen US-Kampffjets das Lager, die eben von ihrer Bombardierungs-Mission in Serbien zurückkehrten. Sie malten dicke Kondensstreifen in den strahlend blauen Himmel über Stenkovec. Mit etwas Phantasie ließ sich aus den Linien die Buchstabenkombination H-I-L herauslesen": <http://www.kosova-info-line.de/...>
11. About Chuck Yeager: "Leaving a white contrail like a chalk mark across a cloudless sky, Yeager radioed from the cockpit, 'I'm smoking along at about 1.35.' He meant 1.35 times the speed of sound, or roughly 900-950 mph": <http://detnews.com/...>
12. CERN, Geneva, using airplane contrail analogy to explain elementary particle detection technique: <http://www.cern.ch/...>
13. The shape of a 1963-contrail seen from Arizona has been likened to the face of Christ: <http://www.postman.net/...>
14. Contrails in horoscopes: <http://www.vianet.on.ca/...> - and: "Be watchful of jet trails in the sky -- local air quality could be deliberately degraded by aerial spraying-- If you have a weak immune system it is advisable to err on the side of caution and stay indoors. You can help plan something, with a person who is confused or emotionally upset. Pay attention to your local newspaper. Part of skepticism is based on a denial. While hear-say and opinions may be safely ignored, it is unwise to be in denial about constantly observable facts. Don't be an ostrich -- judge rightly": <http://www.psychicdebbie.com/...>
15. Contrails in Dreams: <http://www.greatdreams.com/...>

THEY GOT IT WRONG ... [up](#)

1. Air Transport Action Group: "The influence of the aviation industry on the environment is much smaller than some people claim: aircraft use less space to move more people and often produce less pollution per passenger than cars, trucks and other forms of surface transport": <http://www.atag.org/...>
2. British Airways, two statements from the head of environmental issues: "The industry is incredibly fuel efficient" ... "investigation into the effects of contrails, containing carbon dioxide and water vapour, had only begun in earnest in the past year" <http://www.planetark.org/...>
3. Upbeat sentiments: "We must have looked great from the ground, with our trailing contrails": <http://www.redbay.com/...>
4. " ...the smell of aviation fuel and hydraulic fluid on the ramp with the fog lifting or the chasing of a sunset on a westward flight or watching contrails on a winter day still gives me a very good feeling": <http://www.awgnet.com/...>
5. A tourist at Grand Canyon: "I am gazing at a low spot in the canyon rim, a jagged chip in the edge of the bowl where the moon will first appear. The sky beyond is brightening to a blue only a few shades darker than daylight, but I can tell that it will be awhile before the moon breaks into view. Just as I steel myself for a long wait, a jet flies by high overhead, its contrail pulling a thread of moonlight out from behind the rock, stretching it clear across the sky. The dogs go wild with delight, and so do I": <http://www.savtrav.com/...>
6. Marvel at contrails: "I still marvel at the site of a 'jumbo-jet' lumbering, laboriously across the sky. In the wake of which is a contrail, looking as if some great being had employed a huge piece of chalk; scribing it's encoded message across the clear blue heavens, in an effort to tell us mere mortals down below something about the mysteries of life, the universe and everything": <http://www.cranfield.ac.uk/...>
7. Andrew Phelps on photographer Mark Klett's exhibition at Galerie Fotohof, May 1997: "But where his predecessors often tried to hide the encroachment of civilization on the environment in an attempt to reclaim some sort of Eden, going to great lengths to exclude roads, fences, dams, and jet-contrails, Klett sees these as important elements which often become the focal point of his images": <http://fotohof.or.at/...>
8. Victorian Dreams: "So think of us here in our quiet little corner of Kansas where the glow of the western sky is painted like only god can do it, crisscrossed by the soft, golden vapor trails of wandering airplanes": <http://www.moundcityks.com/...>
9. "Over the Barnes Ice Cap there was snow and ice forever and this is really a rather small ice cap -- an oval about 80 nautical miles wide by 35 nautical wide. We managed to pass our position to Baffin Radio a couple of times via airlines. One of them made a beautiful contrail high in the clear azure sky":
<http://web.usna.navy.mil/...>
10. "I am a pilot and I can tell you that there has never been a plane built that can create a contrail that lasts for more than 45 seconds": <http://www.don-bradley.com/...>
11. Contrails erroneously classified 'smoke' by NASA: <http://earthrise.earthkam.ucsd.edu/...>
12. Contrails embellish landscape painting (sic): <http://www.tucsonweekly.com/...> - and - <http://www.american-reporter.com/...>
13. Vietnam war photographer: "Le Minh Truong, 70, who took up photography after he was wounded fighting the French in the 1950's, then discovered beauty everywhere

- he looked, in the flare of napalm or the contrails of American warplanes, in the rubble of Hanoi or the silhouettes of jungle fighters": <http://www10.nytimes.com:80/...>
14. Contrails over the North Pole (text only): "I made my first jump with Patrick from a Russian jumbo jet over the North Pole. I only had 150 jumps, nearly all head-down. This was the early days of freeflying but he still seemed almost excited to jump with me and Spotty Bowles. I'd never jumped with anyone on a skysurf before. As we stepped off the tailgate of the IL76 I rocked over to be head-down and could see Patrick, bright red from head to foot, surfing towards me between the four huge vapour trails, streaming from the massive aircraft. I had stepped into a dream": <http://www.skydivemag.com/...>
 15. "Trees and jet trails" [but it would appear to be a rocket launch!]: <http://www.ai.sri.com/...>
 16. GOT IT WRONG: Erroneous information on contrails on weather information site: "Contrails are left behind by jet airliners. When certain conditions arise, the airliners wing tips create a vortex which shortly after leaves a contrail. The airliner must be traveling with 180° of the direction of the wind for contrails to occur": <http://www.thelightningstorm.com/...>
 17. Aurorae taken for contrails (it should be the other way round!): <http://www.lookoutnow.com/...>
 18. "The combination of the birds, an airplane's contrail, and an Arizona sunset brings a dramatic view to the Tres Rios wetland area" (Promotion material for the Tres Rios Constructed Wetlands area, Arizona): <http://www.tresrios.net/...> from [click](#)

MOVIE GOOFS ...up

Introduction:

* Warning to film instructors: they "must avoid "jet vapor trails in Civil War Westerns": <http://faculty.icc.cc.il.us/...>

* Instructions to film photographers working at the Medieval Research Centre, Nykøbing, Denmark, include avoidance of contrails (and other modern artifacts) in the footage (information from an anonymous employee, June 2000). See <http://www.middelaldercentret.dk/...>

1. In "Moby Dick" (1956), jet contrails are visible in the background when Starbuck plans to shoot Ahab, - <http://andy.rz.uni-karlsruhe.de/...>
2. "Spartacus" (1960): "Of course, there are also the film's amusing, but distracting anachronisms. In film history, Spartacus is perhaps as well known for its airplane contrails, as its four Academy Awards": <http://students.vassar.edu/...> - see poster: <http://images.amazon.com/...>
3. Contrails are seen in "The Flim Flam Man", 1967, when Morgan finds Scott's abandoned jeep in a ditch: <http://www.greenspun.com/...>
4. The "Little House on the Prairie": several episodes of the tv-series from 1974 show contrails (have a look yourself, it will not take more than a few weeks).
5. In "Gettysburg" (1993) jet contrails are visible in the sky when Chamberlain talks to the prisoners: <http://andy.rz.uni-karlsruhe.de/...>
6. "The Cowboy": <http://haven.ios.com/...> and "The cowboy looks up and sees the contrail of a jet plane": <http://www.kics.bc.ca/...>
7. "Horse Soldiers" (Civil War movie, recorded ??, portraying 1863): "Very obvious in the sky above them is a jet contrail.": <http://www.nitpickers.com/...>
8. Contrails in "Zorro" (episode No. 25): <http://www.members.home.net/...> - and - [click](#) - from - [click](#)
9. "Wild_Wild_West" movie (1999) showing jet concontrail: <http://www.films.movie-mistakes.com/...> and "Gladiator" movie showing jet concontrail: [click](#)
10. Moovie goofs: Gladiator: contrails one of 124 historical impossibilities: <http://www.tiscali.de/ente/...>
11. Moovie Goof in film "Top Gun" (not sure) <http://www.slipups.com/...>

HAVING FUN WITH CONTRAILS ...up

1. Contrail jokes: "Warum hinterlassen Düsenjäger Kondensstreifen ? Damit Engel auch mal auf den Strich gehen können!": ([link lost](#))
2. Jokes: "Über den Kondensstreifen eines Flugzeugs meinte ein Kind zu seinem Vater: 'Der Himmerl hat einen Reißverschluss'" ([link lost](#))
3. "Bean Soup, if used as rocket fuel, has one disadvantage: it leaves a green contrail": <http://www.conservativebookstore.com/...>
4. Watching contrails from the Space Shuttle can make astronauts laugh: "From orbital height, you can see ship wakes as well as contrails from airplanes as they streak through the sky, Thornton [i.e. Kathryn Thornton, Space Shuttle Mission Specialist] recounts, a remembrance that ties into one humorous event. "I think over India, it looked like an airliner just made a U-turn. That was about the time when that coffee commercial was running on TV. The one where they run out of Columbian roast coffee and they turned around and went back. We all laughed out that up there," she says": <http://www.thespaceport.com/...>
5. Contrail shadow used by a pilot to cheat a visitor to the cockpit that he was seeing the shadow of a solar eclipse: <http://www.pprune.org/...>
6. The best spelling error in contrail history, by the aviation industry-friendly organization ATAG: "Water vapour emitted by aircraft is believed to contribute to climate change through the formation of condensation trails (contrails) and citrus clouds": <http://www.atag.org/...>

CONTRAILS IN RELIGION, CULT AND ART ...up

1. Native Americans expressing concern regarding the visual impact of rocket contrails <http://ast.faa.gov/...>
2. Cherokees and contrails: <http://www.countryroadchronicles.com/...>
3. German Evangelic Environment Forum suggesting contrail formation to be included in a forthcoming revision of Kyoto agreement. <http://www.ekir.de/...>
4. German Baptist site, with mention of contrails: <http://www.baptisten.de/...>
5. Contrails in the German Church (text only): <http://www.anger-crottendorf.de/...>
6. Contrails in religion: <http://www.flash.net/...> from [click](#)
7. Contrails at a Baptist web site: <http://www.acts2.com/...>
8. Contrails and Church: "Klimaänderung durch Flugverkehr" (A discussion of the IPCC report): <http://www.ekir.de/...>
9. Contrails may obscure Muslim definition of new moon: <http://www.alignmentonline.com/...>
10. Church News on "New Dietary Code - Volcanoes, Tsunamis & Chemtrails ": <http://www.nccc.org/...>
11. Religion and contrails (chemtrails): Radio Liberty, California: <http://www.radioliberty.com/...>
12. A contrail observed during church construction work: "The metal roof against God's Beautiful blue sky and a vapor trail from a jet at approximately 30,000 feet. ": <http://www.opengatechurch.org/...> from [click](#)
13. Contrails in art (oil painting): <http://members.eunet.at/...> and [click](#)
14. "Contrail and Moon": <http://www.caldbeck.com/...>
15. Contrails in art: "Moon with Contrail", a painting discussed at the web-site of the US Embassy in Chile: <http://www.usembassy.cl/...>
16. Contrails in Art: An oil painting by well-known German artist Gerhard Richter, distributed as a postcard (series 19, no 7 of 10, Gebr. Koenig Postkartenverlag, Koeln). The painting carries the title 'Korsika 1969' and shows two realistically looking contrails in a twilight setting.
17. Artistic rendering of contrails in an airbattle August 17th, 1943 : <http://www.oceanicarts.com/...>
18. Contrails a must in space art: <http://www.txdirect.net/...>
19. Contrails in art: <http://www.marswest.org/...> - and - <http://www.museenkoeln.de/...>
20. Even Claude Monet seems to have used contrails (sic!): <http://www.glyphs.com/...> - with painting on: <http://www.glyphs.com/...>
21. Contrails in cartoons: <http://www.hometown.aol.com/...>
22. Contrails in war art: <http://web-birds.com/...> - and - <http://www.starduststudios.com/...> - and - [click](#) - and - [click](#) - and - <http://www.caf-france.com/...>
23. Nature photographer Larry Sizemore: "Sometimes human impact (jet trails) can lend an interesting element to an image. The converging pink lines draw the viewer to the shadowed cypress trees": <http://www.larrysizemore.com/...>
24. "Im Projektraum des Museums stellt Marijke van Warmerdam in einer großen Projektion ihren Film "Skytypers" (1997) vor, der Flugzeugformationen am blauen Himmel zeigt, die mit ihren Kondensstreifen lineare Zeichnungen in den Himmel schreiben": <http://germangalleries.com/...>
25. "Der Titel dieser Bildserie "Die Spur des Menschen" ist ein Hinweis auf die indirekte Anwesenheit des Menschen in der Landschaft und im Stilleben. Es ist die vom Menschen gestaltete Landschaft; Äcker, Felder Wiesen und Baumgruppen, es sind Signale, Verkehrswege, Wegweiser, Wohnsiedlungen, aber auch Kondensstreifen am Himmel, die heute das Bild der Umwelt mitgestalten": <http://members.eunet.at/...>
26. "With his landscape paintings, Robert D. Cocke of Phoenix taps contrasting nuances to achieve an almost cartoon-like surreality. His rolling hills, marching clouds and gradated skies are encroached upon by jet contrails, city skylines and other hallmarks of human "progress": <http://desert.net/...>
27. Contrails in artistic photography: <http://www.image.pe.ca/...>
28. Contrails in Art: "Contrails at Sunset", oil painting by George Brown, price 400 \$ if framed: <http://www.brownlionhouseart.com/...>
29. Handcolored contrail photo: <http://handcolor.com/...>
30. Painting: "Die Farben von Tirol": <http://www.kand.at/...>
31. Contrails in art: "Landschaft bei Gelting": <http://home.t-online.de/...> from [click](#)
32. A drawing of contrails made by an infant: <http://csep2.phy.ornl.gov/...> - from: [click](#)

33. John Denver memorial service: "I truly believe he was with and all around us that day... The glorious weather. The long strings of pelicans dancing sinuously over the sparkling ocean. The doves they released during the service. The jet contrails sweeping across the sky": <http://www.impossible-dream.net/...>
34. Frank Sinatra funeral: "In den blauen Himmel von Beverly Hills zeichnete ein 'sky writer' langsam einen großen weißen Kondensstreifen in Form eines Herzens": <http://archiv.berliner-morgenpost.de/...>
35. Swissair 111 tragedy: "Between the second and third shots of the gun salute that followed, the vapour trail of a jet flying out across the Atlantic was visible in the evening sky. The trail dissipated to the heart-breaking sound of the Lone Piper Lament!": <http://lighthouse.ns.ca/...>
36. Taiwanese cult and strange 007-shaped contrails: <http://factnet.org/...>
37. Taiwanese cult: <http://www.virtuallatexan.com/...> -and- <http://www.farshore.force9.co.uk/...>

=== CONTRAIL DETECTION TECHNIQUES

1. IR photo of suspected contrail [suspected by hp]: <http://www.astro.wisc.edu/...>
2. IR photo of contrail <http://www.a1.nl/...>

=== CONTRAILS IN MOVIES

1. Contrails made into movies: "Jet Vapor Trails in the Dawn", a US-financed, Japanese "Top Gun"-like feature film released in December 1957 and seen by 15 million people: <http://www.jpri.org/...>
2. Contrails an artistic element in the 1986 film "M" Manhattan: <http://filmhaus.polyfilm.at/...>
3. A film by Karl Kels, from 1982: "Condensation Trail", lasting 3 minutes, 24 seconds: <http://mfj-online.org/...>
4. Heavy contrails in movie poster, for the 1955 film: "Strategic Air Command: <http://images.amazon.com/...> from [click](#)

=== CONTRAILS IN ART

1. Oil painting with contrails offered for 7500 GBP: <http://www.curwen.demon.co.uk/...>
2. Contrails in art: "She [Debra Bermingham] includes telephone poles and vapor trails from passing planes -- evidence of civilization's presence in the landscape": <http://www.artincontext.org/...>
3. Oil painting "Vapor Trails" offered for 1900 \$: <http://www.davidsongalleries.com/...>
4. Several oil paintings of contrails for sale for 2,250 US \$ a piece: e.g. <http://www.52sunsets.com/...> and [click from click](#)
5. An oil painting "Contrails I": <http://www.flight2003art.com/...>
6. Art, oil on canvas, 22.5 x 244 cm <http://lux.qc.ca/...>

=== CONTRAILS IN ART PHOTOGRAPHY

1. Artistic photo with contrails: <http://community6.webshots.com/...>
2. Artistic photo of contrail, black and white: Virginia, 1990: <http://www.sirius.com/...>
3. Artistic photograph of contrail (ca. 1980) (the R.B. Russell Federal Building & U.S. Courthouse; Atlanta, GA): <http://w3.gsa.gov/...>
4. Contrails in artistic B/W photo: <http://www.mcgiard.freeuk.com/...>
5. Artistic photo of contrails on Halifax sky: <http://users.andara.com/...>
6. Contrails in artistic landscape photography: <http://www.meworkshops.com/...>
7. Artistic photos, showing contrail: Sandy Cole: " "Con" trails from high altitude aircraft appear to create a rift in the sky, as the sun sets": <http://www.bsg.org/...> quoted from [click](#)
8. Contrails in artistic photo from North York Moors: <http://www.first-contact.demon.co.uk/...>
9. "Moon in Vapour Trails", artistic photo: [click](#)
10. Artistic photography is difficult: "The key to most photography is usually excluding something; contrails, litter, powerlines, tourists, etc.": <http://www.photo.net/...> and "I think some people overestimate the difficulty of digital editing. It's literally a 1-10 minute job to remove contrails from an image, or to take out power lines.": [click ...](#) but that can cost you your job (see next entry):
11. Editing power lines from a photograph can cause suspension without pay for a newspaper photographer (the keeper of this page wonders if the same rule applies to jet contrails): <http://www.sjmc.umn.edu/...>
12. Oregon, artistic photo of farming landscape: <http://students.washington.edu/...> - and street scenery with contrails: [click](#)
13. German photo (artistic?) of contrail on evening sky: <http://home.t-online.de/...>

CONTRAILS IN BADGES, EMBLEMS, LOGOS, PATCHES [...up](#)

1. Badge: <http://www.brooks.af.mil/...>
2. Badge: <http://www.laafb.af.mil/...>
3. Badge: <http://www.maxwell.af.mil/...>
4. Badge: <http://www.40th-bomb-wing.com/...> from [click](#)
5. Badge with blue contrails: <http://www.usafa.af.mil/...>
6. Badge: <http://www.usafa.af.mil/...>
7. Badge: <http://www.usafa.af.mil/...>
8. Badge: <http://www.usafa.af.mil/...>
9. Badge: <http://www.usafa.af.mil/...>
10. Badge: <http://www.andersen.af.mil/...>
11. Badge: <http://www.perscom.army.mil/...>
12. Emblem, mention only: <http://www.whiteman.af.mil/...>
13. Logo: <http://www.deltaweb.co.uk/...>
14. Emblem: <http://www.spacecom.af.mil/...>
15. Emblem: <http://www.hilltopstimes.com/...> from [click](#)
16. Emblem with three contrails (347th operations support sq) <http://www.moody.af.mil/...>
17. Patch with 5 contrails: <http://www.kirtland.af.mil/...>
18. Patch with contrails: <http://www.pafb.af.mil/...>
19. Norwegian logo: <http://home.no.net/...>
20. NATO Badge: <http://www.nato.int/...>

COMPUTER GENERATED CONTRAIL PICS [...up](#)

1. Computer generated contrail pics: <http://www.incompetech.com/...> - and - <http://www.raingod.com/...>

INITIATIVES [...up](#)

1. Former President Clinton encouraged to fly less on Air Force I, so as to cause less contrails and global warming: [http://206.147.58.5/...](http://206.147.58.5/)
2. BBC, May 1, 2000: "take fewer holiday flights, for the sake of the Earth' climate" (mostly on CO2 emissions; contrails not mentioned): [http://news.bbc.co.uk/...](http://news.bbc.co.uk/)
3. AUSTRIA: Question to the Austrian Parliament: "Ist Ihnen bekannt, daß laut einer einschlägigen Studie die Wolkenbildung durch die Kondensstreifen erheblich gefördert wird und in welcher Form wird dieser Umstand bei der Festlegung der Flugrouten berücksichtigt bzw. wer kommt für allfällige Schäden auf?": [http://www.parlinkom.gv.at/...](http://www.parlinkom.gv.at/) - and official reply: "Allfällige Wolkenbildung durch Kondensstreifen wird bei Festlegung von Flugrouten nicht berücksichtigt": [click](#)

SMOKE AND UNKNOWN [... up](#)

1. A mysterious contrail observed near the Falkland Islands (text only): [http://www.the-islander.org.ac/...](http://www.the-islander.org.ac/)
2. Smoke or anthropogenic clouds of unknown origin in a commercially presented satellite (NOAA or SeaWiFS) image of southern Europe: [http://www.time-step.com/...](http://www.time-step.com/)
3. Center for Air Pollution Impact and Trend Analysis: A 1000 mile smoke plume of unidentified nature, with geometric confinement similar to contrails: [http://capita.wustl.edu/...](http://capita.wustl.edu/)
4. Mexico Burning, NASA astronaut photos: [http://eol.jsc.nasa.gov/...](http://eol.jsc.nasa.gov/)
5. Smoke plume over China: [http://www.nrlmry.navy.mil/...](http://www.nrlmry.navy.mil/) from a site featuring many interesting data, including global aerosol maps: [click](#)
6. Smoke (tire-fire in NOAA image): [http://fermi.jhuapl.edu/...](http://fermi.jhuapl.edu/)
7. Gas cannon smoke ring [http://www.donaldedavis.com/...](http://www.donaldedavis.com/) from [click](#)

UFO ISSUES [... up](#)

1. Hong Kong Observatory reports that UFO was a contrail: "In the past, most aircraft in Hong Kong were seen at low altitudes either taking off or landing. Therefore, contrails have not often been recorded in Hong Kong," the spokesman added (January 6, 1999): [http://www.info.gov.hk/...](http://www.info.gov.hk/)
2. Pilots spot UFO over Kazakhstan: The UFO left contrails! (must be a joke): [http://www.vikingslides.com/...](http://www.vikingslides.com/)
3. A 1952 UFO leaving contrail (sic!): [http://jagor.srce.hr/...](http://jagor.srce.hr/)

NOTORIOUSLY MISSING [... up](#)

1. Long base-line stereo photos of contrails taken from ground (contrails being the largest Earth-bound structures, which can be photographed; well one found, but of low clarity: [http://www.ahoymatey.com/...](http://www.ahoymatey.com/)
2. Research using correlated space and ground observations. There is much to learn on how contrails decay.
3. Descriptions on how contrails are measured in standard cloud-cover statistics.
4. Photos of contrails after supersonic aircraft.
5. Photos of pre-WWII contrails.
6. References to tv-programmes on contrails.

CONTRAILS FOR KIDS [... top of document](#)

1. "What is the white we see coming off an airplane in the sky?": [http://www.windows.umich.edu/...](http://www.windows.umich.edu/)
2. Contrail consciousness promoted on educational site: [http://www.weather.com/...](http://www.weather.com/)
3. "Why Do Some Planes Leave Contrails In The Sky But Not Others?": [http://members.tripod.com/...](http://members.tripod.com/)
4. Contrails for kids: [http://earthsky.com/...](http://earthsky.com/)
5. Contrails for kids: Contrails over Lisbon, Portugal: "Vapor trails, like those crossing this image, are formed by the combustion of airplane fuel when a plane passes through a part of the atmosphere with relatively high humidity. The contrails themselves are actually plumes of ice crystals that can persist in the atmosphere for several hours. Most of these contrails are probably intercontinental flights coming and going from Madrid, Spain": [http://a52.g.akamaitech.net...](http://a52.g.akamaitech.net/) from [http://www.spacekids.com/...](http://www.spacekids.com/)
6. Elementary description of contrails: [http://www.howstuffworks.com/...](http://www.howstuffworks.com/)
7. NASA's S'COOL site: [http://asd-www.larc.nasa.gov/...](http://asd-www.larc.nasa.gov/)
8. Elementary meteorology class on contrails (with photo): [http://www.scienceclass.com/...](http://www.scienceclass.com/)
9. Kids' interest in contrails can be a problem for teachers (sic!): [http://eu.microsoft.com/...](http://eu.microsoft.com/)
10. For German kids: Leibniz- Gymnasium Östringen Klasse 11d Biologie-Chemie- Erdkunde : [http://www.uni-karlsruhe.de/...](http://www.uni-karlsruhe.de/)
11. Contrails for German kids: Fliegen und Atmosphärenschaden "Heute hier, morgen dort - plötzlich ist die Atmosphäre fort...": [http://jugendumwelt.de/...](http://jugendumwelt.de/)
12. Contrails for German kids: [http://www.laudaair.com/...](http://www.laudaair.com/)
13. Contrails for French kids: [http://asd-www.larc.nasa.gov/...](http://asd-www.larc.nasa.gov/)
14. Teletubbies and contrails???: "Langsam dämmert der finstere Horizont in giftigem Gelb; durch dunkle Schwaden von Industrieabgasen, Kondensstreifen düster grollender Flugzeuge und Wissensnebeln kämpft sich die Babysonne empor, das Gesicht von Neurodermitis zerschunden, die Augen blutunterlaufen. Die schwarzen Silhouetten niedrig fliegender Hubschrauber knattern tosend vorbei. Weiberstimme: Hinter den Hügeln und keinem bekannt - Hier liegt das Teletubby-Land": [http://home.germany.net/...](http://home.germany.net/)
15. Contrails for kids: [http://earthsky.com/...](http://earthsky.com/)
16. Contrails for kids (morbid): [http://www.geocities.com/...](http://www.geocities.com/)
17. Contrails in cartoons: "An anime-style girl is preparing to fly her JetSuit. Some of her friends have left contrails in the sky with their JetSuits": [http://www.sonic.net/...](http://www.sonic.net/)
18. A 25-month infant is quoted as being a student of contrails (or is the story ghost-written by a parent?): [http://www.its.caltech.edu/...](http://www.its.caltech.edu/)
19. Vulcano eruptions may look like contrails in satellite imagery: [http://www.euromet.met.ed.ac.uk/...](http://www.euromet.met.ed.ac.uk/)
20. [http://www.atmos.washington.edu/...](http://www.atmos.washington.edu/)
21. Contrails for Italian kids: [http://www.vivoscuola.it/...](http://www.vivoscuola.it/)
22. Contrails Galore - Cloud Watch Europe 2000: [http://atschool.eduweb.co.uk/...](http://atschool.eduweb.co.uk/) - and - [click](#) - and - [click](#)
- 23.
24. Sky Awareness Week, April 22 - 28, 2001: Encouraging students and others interested to observe (among natural phenomena and other man-made items) airplanes and atmospheric pollution: [http://www.weatherworks.com/...](http://www.weatherworks.com/)

THE WEB [... top of document](#)

Jump to subsection:

- [Lost URLs](#)
- [Contrails in Site Searches](#)
- [Crosslinks](#)

Lost URLs: [... up](#)

- a. MSNBC: Do contrails affect climate?: [http://www.msnbc.com/...](http://www.msnbc.com/)
- b. "Training a Neural Network to Detect Jet Contrails in Satellite Images": [http://141.33.144.9/...](http://141.33.144.9/)
- c. Sian Lloyd: weather information in contrails: [http://www.fortunecity.com/...](http://www.fortunecity.com/)
- d. Check this one: [http://it.ncsa.uiuc.edu/...](http://it.ncsa.uiuc.edu/)

Contrails in site searches: [... up](#)

- a. FAA - National Transportation Library (21 hits, on October 9, 1999): [click](#)
- b. National Science Foundation, web pages only (1 hit on October 15, 1999): [click](#)
- c. Environmental Protection Agency, EPA (4 hits on October 15, 1999): [click](#)
- d. National Archives and Records Administration (53 hits on October 25, 1999): [click](#)
- e. National Resources Defence Council (NRDC): (20 hits on October 22, 1999, mostly bogus): [click](#)
- f. US Air Force (7 links, 172 sites on October 16, 1999): [click](#)
- g. Embry-Riddle - claims 9 hits, but they do not list: [click](#)
- h. National Renewable Energy Center (no info on contrails in solar collector efficiency measurements): [click](#)
- i. Atmospheric Research and Applications Division, NOAA gave 8 hits on May 11, 2000 [click](#)
- j. World Meteorological Organization (0 hits on October 16, 1999): [click](#)
- k. United Nations: Framework Convention on Climate Change, (2 hits on November 6, 1999): [click](#)
- l. Greenpeace (0 hits on October 20, 1999): [click](#)
- m. European Environmental Agency (0 hits by November 29, 1999): [click](#)
- n. OECD (0 hits by April 18, 2001): [click](#)
- 15. Union of Concerned Scientists (no hits on April 15, 2001): [http://www.ucsusa.org/...](http://www.ucsusa.org/)
- p. Christian Science Monitor (11 hits by December 19, 1999) [click](#)
- q. Orange County Register (12 hits on December 13, 1999): [click](#)
- r. Los Angeles Times (no hits on December 13, 1999): [click](#)
- s. Environmental Defense Fund (2 hits on January 5, 2000): [click](#)
- t. Global Hydrology and Climate Center, Search for 'contrails' in [click](#) gave 9 hits, on April 13, 2000
- u. Global Change Magazine (3 hits by October 6, 1999): [click](#)
- v. Americal Meteorological Society (24 hits for contrail, October 15, 1999): [click](#)
- w. Americal Institute of Physics (3 hits for contrail, June 8, 2000): [click](#)
- x. Smithsonian Air & Space Magazine finds 2 hits on contrails, on October 9, 1999: [click](#)
- y. ICAO, 0 hits, on April 14, 2000: [click](#)
- z. Der Spiegel, 2 hits, on October 9, 1999: [click](#)
- aa. Boeing (1 hit by October 16, 1999): [click](#)
- ab. Die Welt, 7 hits by January 19, 2000: [click](#)
- ac. NASA gives 975 hits out of 917692 documents, on October 9, 1999: [click](#)
- ad. ESA gives 0 hits on November 10, 1999: [click](#)
- ae. CSIRO Atmospheric Research: 0 hits on 2000 April 6: [click](#)
- af. Bureau of Meteorology, Australia: 0 hits on 2000 April 6: [click](#)
- ag. Department of Energy's Environmental Management: 0 hits on May 12, 2000: (However, the search machine finds NOTHING whatsoever) [click](#)
- ah. AFCEE - Air Force Center for Environmental Excellence (no hits on July 4, 2000): [click](#)
- ai. IATA (re no search facility): [click](#)
- aj. International Solar Energy Society: 0 hits by May 20, 2000 [click](#)
- ak. Library of Congress (1 hit by May 28, 2000): [click](#)
- al. The Environmental Working Group: 0 hits by May 28, 2000: [click](#)
- am. 'airliners.net', site search: 11 hits (pictures) on June 11, 2000: [click](#)
- an. Flight.com, one (irrelevant) hit, on May 20, 2000 [click](#)
- ao. Energy Efficiency and Renewable Energy Network, EREN, 3 hits on May 19, 2000 [click](#)
- ap. Solstice (REPP-CREST), no hits on contrails on May 18, 2000 [click](#)
- aq. Center for the Study of Carbon Dioxide and Global Change 9 hits on June 11, 2000: [click](#) WARNING!!
- ar. Search pdf-documents: 13 hits on August 8 2000: [click](#)
- as. Eurocontrol (no hits on July 15, 2000): [click](#)
- at. Danish search machine: [click](#)
- au. Environmental Policy Project: 0 hits by July 15, 2000 [click](#)
- av. Deutcher Wetterdienst: no hits on July 15, 2000 [click](#)
- 49. Excite search engine [http://search.excite.com/...](http://search.excite.com/)
- 50. Fireball search for 'Kondensstreifen' gives 513 results on January 6, 2001 [click](#)

Crosslinks [...up](#)

The following web-sites link the present 'notes', or entry points to the associated slide show:

- a. US Air Force: http://www.af.mil/environment/contrails_chemtrail.shtml
- b. Hermann Mannstein: <http://www.pa.op.dlr.de/homepages/HermannMannstein/contrails/contrail.html>
- c. West London Friends of the Earth: <http://www.wfoet5.demon.co.uk/airtran2.htm> (listed under USA)
- d. Dundee Satellite Tracking Station: <http://www.sat.dundee.ac.uk/interesting.html>
- e. Radio Denmark: <http://dr.dk/videnom/>
- f. Patrimoine Côte Bleue: http://patrimoinecotebleue.com/ciel_climat_pcb.html
- g. Andreas Hänel, Universität Osnabrück: <http://www.physik.uni-osnabrueck.de/astro/darksky/aktuel.htm>
- h. "Ask Yahoo": [http://howto.yahoo.com/...](http://howto.yahoo.com/)
- i. [http://CosmicRose.tripod.com/...](http://CosmicRose.tripod.com/)
- j. [http://worldzone.net/...](http://worldzone.net/)
- k. [http://members.tripod.com/...](http://members.tripod.com/)
- l. From Reerso: [http://www.reerso.dk/...](http://www.reerso.dk/)
- m. [http://theaviationhub.com/...](http://theaviationhub.com/) and (pdf document) [click](#)
- n. <http://forumcities.com/cgi-bin/forum/contrail/messagessubject.cgi?topic=19102121>
- o. <http://www.spacestar.net/users/adikkers/spaceart/contrail.htm>
- p. <http://gene.wins.uva.nl/~heedens/links.html>
- q. <http://www.greatdreams.com/chems.htm>
- r. <http://www.seaportbeach.nl/990811-e.htm>
- s. <http://www.pollution.dk/jet-caused-clouds.htm>
- t. <http://www.kijk.nl/99/condens.htm>
- u. <http://home.t-online.de/home/bock.freiburg/chris.htm>
- v. <http://www.fortunecity.com/greenfield/swallowtail/619/index.html> (which has copied many of my links, without credit!)
- w. <http://tabletalk.salon.com/webx?13@101.36RdcfB3FY9^1@.ee9f32b>
- x. <http://www.nonwo.com/newlinks/>
- y. [http://members.aol.com/...](http://members.aol.com/)
- z. <http://members.xoom.com/XMCM/centrexnews/chemtrails/index.html>
- aa. <http://www.angelfire.com/mn/kanuck/>
- ab. <http://www.rumormillnews.com/cgi-bin/config.pl?read=725>
- ac. <http://members.aol.com/gca7sky/viewing.htm>
- ad. http://www.rjwhite.com/RJ_Survival.htm
- ae. <http://www.lacarte.org/health/chemtrails/>
- af. <http://www.geocities.com/CapeCanaveral/Hangar/5549/trail.html>
- ag. [http://teksphere.com/...](http://teksphere.com/)
- ah. <http://www.searchtogo.net/popular/contrails.htm>
- ai. <http://ufcna.com/sommaireanglais.html>
- aj. <http://www.citybirds.com/contrails/contrailinks.html>

- ak. <http://www.plausiblefutures.com/text/special.html>
- al. <http://bbs.msnbc.com/bbs/msnbc-space/posts/ws/58626.asp>
- am. <http://pub8.ezboard.com/...> -and click -and click -and click
- an. <http://www.kokotele.com/chemtrail.htm>
- ao. <http://www.geocities.com/ukchopper/>
- ap. <http://www.carnicom.com/contrails.htm>
- aq. <http://roger.garinmichaud.free.fr/toilscie.html>
- ar. <http://www.geocities.com/Area51/Quark/7272/index.html>
- as. <http://www.watnf.atnf.csiro.au/...>
- at. <http://www.coolboard.com/...>
- au. <http://www.islandnet.com/~wilco/links.htm>
- av. <http://www.weather-photography.com/links.html>
- aw. <http://www.chemtrailcentral.com/ubb/Forum1/HTML/000046.html> and click and click
- ax. <http://www.kitcomm.com/...> - and - click
- ay. <http://www.angelfire.com/movies/blackjaguar/EcologyLink.html>
- az. <http://www.chooseclimate.org/links.html>
- ba. <http://www.geocities.com/...>
- bb. http://www.spruance.com/Photo_Links.htm
- bc. <http://www.nmsr.org/...>
- bd. <http://www.egroups.com/...>
- be. <http://home.worldonline.dk/~brianjon/Godelinks.htm>
- bf. <http://www.bact.wisc.edu/lindquistjohn/mphotos.html>
- bg. <http://www.rense.com/general3/massive.htm>
- 60. <http://www.egroups.com/message/grandcanyon/5861>
- 61. 'Chemtrailtrackingusa': <http://messages.clubs.yahoo.com/...>
- 62. 'Chemtrails over Canada': <http://ca.messages.clubs.yahoo.com/...>
- 63. <http://members.aol.com/chopstcks/gca7sky/lnkxchg.htm>
- 64. <http://nitricacid.dyndns.org/bookmark.htm>
- 65. <http://www3.bc.sympatico.ca/Willthomas/links.htm>
- 66. <http://www.andreak.de/...>
- 67. <http://www.timebomb2000.com/...>
- 68. <http://www.junjun.com/...>
- 69. <http://shadesofmeaning.com/...>
- 70. Milo's contrail site: <http://www.geocities.com/...>
- 71. (and a later one discussing the keeper): <http://messages.clubs.yahoo.com/...>
- 72. <http://www.chemtrailcentral.com/...>
- 73. NASA'S "EARTH SCIENCE PICTURE OF TODAY" (for September 3, 2001): <http://epod.usra.edu/>
- 74. Linux Journal editor: <http://doc.weblogs.com/2001/09/13>
- 75. <http://members.aol.com/...>
- 76. <http://64.124.217.71/...>
- 77. <http://soeg.ofir.dk/...>
- 78. <http://home01.wxs.nl/...>
- 79. <http://shadesofmeaning.com/...>
- 80. <http://www.chemtrailcentral.com/...>
- 81. <http://tierra.rediris.es/...>
- 82. <http://pub31.ezboard.com/...>
- 83. <http://www.xs4all.nl/...>
- 84. <http://groups.yahoo.com/...>
- 85. <http://www.100megsfree4.com/...>
- 86. <http://www.ecosustainable.com.au/links.htm>
- 87. <http://www.geocities.com/milo702000/links/links.htm>
- 88. <http://www.wlfoet5.demon.co.uk/airtran2.htm>
- 89. <http://members.aol.com/tillsquest/private/strangeitude.html>
- 90. <http://disc.server.com/discussion.cgi?id=149495&article=19375>
- 91. <http://power.arc.losrios.cc.ca.us/...>
- 92. <http://members.netscapeonline.co.uk/...>
- 93. <http://userpages.umbc.edu/...>
- 94. <http://www.takuuk.gl/...>
- 95. <http://members.aol.com/...>
- 96. <http://ca.groups.yahoo.com/...>
- 97. <http://epod.usra.edu/...>
- 98. <http://www.ufoalert.com/...>
- 99. <http://communities.anomalies.net/...>
- 100. <http://vivisimo.com/...>
- 101. <http://www.kitcomm.com/...>
- 102. <http://www.metatech.org/...>
- 103. <http://www.newsmax.com/...>
- 104. <http://www.sadcom.com/...>
- 105. <http://www.indymedia.org/...>
- 106. <http://lachlan.bluehaze.com.au/...>
- 107. <http://ca.groups.yahoo.com/...>
- 108. <http://www.meteored.com/...>
- 109. SUEDEDEUTSCHE ZEITUNG: <http://www.sueddeutsche.de/...>
- 110. <http://ticker.netzeitung.de/...>
- 111. <http://www.chemtrailcentral.com/...>
- 112. <http://members.aol.com/...>
- 113. <http://millennium-ark.net/...>
- 114. <http://www.chemtrailcentral.com/...>
- 115. > <http://www.earthmountainview.com/...>
- 116. <http://groups.msn.com/...>
- 117. <http://ragingbull.lycos.com/...>
- 118. <http://forums.cloud-busters.com/...>
- 119. http://www.takuuk.gl/takuuk/LANGT_UDE1.shtml
- 120. <http://lachlan.bluehaze.com.au/other-links.html>
- 121. <http://wind.he.net/...>

RECENT ADDITIONS [...top of document](#)

Jump to subsection:

--Partially sorted Items

--Not sorted yet

--Last Batch (January 30, 2003)

PARTIALLY SORTED ITEMS [... up](#)

=== CONTRAILS IN WEATHER REPORTS:

1. Possibly the first mention of contrails in a regular weather report: July 16 3:30 pm: "Clear skies continue through the afternoon and evening with the exception of Contrails which are clouds left behind by jets flying across the sky. The wind pushes these clouds into different shapes but today that's where all of our clouds are coming from in the Willamette Valley", Bruce Sussman(meteorologist): <http://www.kgw.com> quoted on 'chemtrailtrackingusa', message no. 28175.
2. March 2000: "Contrails fill the sky at Royston" (pictures loading poorly) <http://www.iceni.org.uk/>

=== CONTRAILS IN WEATHER ATLAS PICS

1. Contrail photo in weather amateur page: <http://www.kilty.com/...>
2. Contrails included inadvertently on a weatherman's cloud gallery: <http://geocities.com/...>
3. Many contrail photos between cloud gallery pics: <http://albums.photopoint.com/...>
4. Contrails in Dutch cloud atlas: <http://www.homepages.hetnet.nl/...>
5. Contrail photos in Finnish weather atlas: <http://www.sunpoint.net/...> and [click](#) from [click](#)
6. Weather photo of the week: "Contrail in Crystal Lake, Illinois (by Linda Chiles)": <http://photo.weather.com/...>
7. Weather pix: "View of sunrise over University Park with Contrail": <http://www.hn.psu.edu/...>
8. Contrails photographed by Australian weather amateurs: <http://www.stormchasers.au.com/...>
9. Contrail photos in weather atlas: [click](#)
10. Cloud atlas (amateur) with many contrail-affected pictures: <http://www.geocities.com/...> in particular: [click](#) and [click](#) and [click](#)
11. Illinois Cloud Catalogue, with contrail in sun-halo photo: <http://bondo.wsc.mass.edu/...>
12. Contrail photo from 'cloud atlas', University of Illinois: <http://www.astro.uiuc.edu/...>
13. CLOUD ATLAS: <http://itg1.meteor.wisc.edu/...> from [click](#)
14. Contrails in weather atlas: <http://www.wetter-und-klima.de/...>
15. Photo of contrails in cloud atlas: <http://clem.msced.edu/...>
16. Contrails in weather atlas pictures: "A former contrail results in the seeding of an altocumulus deck over Norman Oklahoma during Fall of 1996": <http://www.weatherpix.com/...>

=== SCIENTIFIC WORKS AVAILABLE AS WEB DOCUMENTS

1. CLOUDMAP : "Cirrus and Contrail cloud-top maps from satellites for Weather Forecasting and Climate Change Analysis": <http://www.ge.ucl.ac.uk/...>
2. Contrails interfering with algal bloom measurements from NOAA AVHRR measurements over the Botnic Bay, Baltic Sea: <http://satobsys.co.uk/...>
3. Minnis et al.: Global distribution of contrail radiative forcing Geophys. Res. Letters, 1999, vol. 26 , No. 13 , p. 1853 <http://www.agu.org/...>
4. SCIENCE: Influence of propulsion efficiency on contrail formation, by Schumann U <http://wos.isiglobalnet.com/...>
5. Observations and model estimates suggest that contrail growth is only weakly, if at all, affected by preexisting cirrus clouds. Schroder et al: JOURNAL OF THE ATMOSPHERIC SCIENCES 57: (4) 464-480 FEB 15 2000 <http://wos.isiglobalnet.com/...>

=== NO CONTRAILS: A POSITIVE VALUE

1. Living in Arizona is almost good: "Our skies are almost always blue, except for the con-trails made by the high flying planes": <http://www.ctaz.com/...>
2. On the beauty of the Chilean Atacamenean night: "Finally, we emerged from the canyon and then climbed a sand dune to a hilltop commanding a view of the Valley of the Moon. We were perched in a noiseless sky uncrossed by contrails and unpunctuated by planes": <http://www.journeys-intl.com/...>
3. "The sky is glorious in North Dakota. The flat land allows wide vistas and three-dimensional views of the sky. During the day the sky is often cloud free, and sometimes is a deep blue. In the winter, sun dogs make bright second and third suns, and other luminous arcs circle the sun. Frequently the only cloud in the sky is the long contrail of a high flying jet airplane": <http://www.natureshift.org/...>
4. "... With almost 100 photos - it shows New Jersey beaches, forests, meadows, streams and rivers. It is a vision of New Jersey set back in time. No people, no buildings, no telephone wires, no airplane contrails in the sky. Photography as art": <http://www.somersetvalley.com/...>
5. "No contrails at Dinosaur, N.M. contrary to Grand Canyon" (??): <http://www.hanksville.org/...>

=== CHANCE IMAGING OF CONTRAILS IN SPORTING EVENT PICTURES

1. Motor cycling: Flying motorcycle and contrail photograph: <http://www.photosport.com/...>
2. Sport: A contrail captured during a sporting event: <http://www.kjf.de/...>
3. Contrail in skiing pictures from Italy: <http://www.tvk.rwth-aachen.de/...>
4. Contrails in Skydiving, Hanggliding, Paragliding photos: <http://www.qbc.clic.net/...> - and (spectacular): <http://www.skydiveavez.com/...> - and <http://www.aerohio.com/...> - and <http://www.phdskydiving.co.uk/...> - and <http://www.skydivesantabarbara.com/...> - and <http://www.skydivemontereybay.com/...> - and <http://www.skydivemag.com/...> - and <http://www.skydivemag.com/...> - and <http://live.altavista.com/...> - with the same pictures also displayed at <http://www.parapente.nl/...> - and <http://www.southernskies.net/...> from [click](#) - and <http://www.hangglide.com/...> - and <http://www.fkc.o.se/...> - and <http://www.skydiveskane.m.se/...> - and <http://www.sky-adventures.com/...> - and <http://www.skyeyeskydiving.com/...> and [click](#)
5. Contrails in Japanese hang-gliding picture; chance imaging: <http://www.pluto.dti.ne.jp/...>
6. Contrails in paragliding pic: <http://paraglide.com/...>
7. Contrails in paragliding picture: <http://www.sky-adventures.com/...>
8. Glider plane photos with contrail: <http://www.glidenet-global.de/...>
9. Hot air ballooning: Chance imaging of contrail in hot air balloon photos: <http://www.bris.ac.uk/...> and [click](#) - and <http://www.k2balloons.co.uk/...> - and [click](#)

=== MILITARY

1. Aircraft Condensation Trails (Contrails) Information: <http://xre604.brooks.af.mil/...>
2. A military text describing a "beautiful contrail": <http://www.afmc.wpafb.af.mil/...>
3. Real-time image processing unit for strategic contrail detection: <http://www.swcp.com/...>
4. B52 emitting smoke at take-off: <http://www.sky-flash.com/...>
5. Military pesticide spraying likened to contrails: <http://www.af.mil/...>
6. Military contrail research related to Nobel Prize winning research (Mario Molina, 1995, chemistry): <http://afosr.sciencewise.com/...>
7. MILITARY: Contrails mentioned as one topic for basic physical research on "Chemistry Impacts on Military Space": <http://www.chis.navy.mil/...>
8. MILITARY: Operational prediction of contrails: <http://www.met.nps.navy.mil/...>
9. On RF86 flights to Siberia, in the 1950ies: "But the flights were so sensitive we flew in absolute radio silence at very high altitudes. But we had to turn around if the airplane started showing contrails [a telltale white exhaust stream left behind in supercold air]." <http://u2.lvcn.com/...>
10. State Department: Site search for "contrails" gives five replies, including the Vientiane one.: <http://www.state.gov/>
11. (Redundant) B52 contrail <http://community.webshots.com/...>
12. Oil painting (B52) <http://www.flightjournal.com/...>
13. B52 banking, with heavy smoke: <http://dc2.uni-bielefeld.de/...>

=== GLOBAL WARMING

1. CBS News on how to reverse global warming: [http://cbsnews.com/...](http://cbsnews.com/)
2. On the atmospheric effects of petroleum misuse, including a rapidly spreading sheet of contrail-cirrus, by Tim Thompson: [http://vest.gu.se:70/...](http://vest.gu.se:70/)
3. Contrails a greater factor in global warming than aviation emission of CO2: [http://umwelt.lufthansa.com/...](http://umwelt.lufthansa.com/)
4. On Global Warming (an educated text from 1988): [http://www.ciesin.org/...](http://www.ciesin.org/)
5. A German citizen concerned that contrails may influence climate: [http://www.hh-live.de/...](http://www.hh-live.de/)
6. Center for International Climate and Environmental Research, Oslo (no mention of contrails): <http://www.cicero.uio.no/>
7. Global Change Magazine electronic edition [http://globalchange.org/...](http://globalchange.org/)
8. Global warming and aviation (no mention contrails): [http://reason.com/...](http://reason.com/)
9. GLOBAL WARMING PRIME WEB REFERENCE: [http://thermal.gg.utah.edu/...](http://thermal.gg.utah.edu/)
10. Global Warming and Weather Engineering (quoting New Scientist): [http://www.cosmiverse.com/...](http://www.cosmiverse.com/)

=== GLOBAL WARMING HYSTERIA

1. "Reagan Centre against Global Warming hysteria": [http://www.reagan.com/...](http://www.reagan.com/)
2. "Studies show there is no Global Warming": [http://www.reagan.com/HotTopics.main/...](http://www.reagan.com/HotTopics.main/)
3. American Policy Center: "There is No Global Warming. Period": [http://www.americanpolicy.org/...](http://www.americanpolicy.org/)
4. "Almost from the beginning of the organized environmental movement in the nation and worldwide, the print and broadcast press has been enlisted to further the cause of saving the Earth. To this day, one can turn on nightly television news such as NBC to hear a reporter like Robert Hager breathlessly tell us that airplane contrails are altering Earth's climate by -- gasp! -- creating clouds. When global warming came along as a story, after the earlier failure in the 1970's of the "coming Ice Age" theory, it was tailor-made for journalists who love any kind of doomsday scenario": [http://www.anxietycenter.com/...](http://www.anxietycenter.com/)
5. Conspiracy text: National Anxiety Center, on contrails [http://anxietycenter.com/...](http://anxietycenter.com/)

=== CONTRAILS FREQUENCY

1. Contrail frequency: [http://www.cave.larc.nasa.gov/...](http://www.cave.larc.nasa.gov/)

=== FUNNY CONTRAILS

1. Larger section of the North Sea AWACS picture; [http://www.hep.princeton.edu/...](http://www.hep.princeton.edu/) and NOAA HRPT scans of Florida and the Gulf coast: [click](#) from [click](#)

=== CONTRAIL RECORDS

1. MOST HEAVY CONTRAIL COVER IN A SINGLE SATELLITE IMAGE: SeaWifs detection of massive contrail coverage over Newfoundland, Labrador on May 7, 1999: [http://visibleearth.nasa.gov/...](http://visibleearth.nasa.gov/) from [click](#)
2. THE EARLIEST KNOWN COLOR PHOTO OF A CONTRAIL: "Vapor trail of a high flying aircraft, or could it be just another UFO. (Fisher 1951-52) " (Warning: the direct link to the picture may fail!): [http://members.nbc.com/...](http://members.nbc.com/) from [click](#)
3. AN EARLY CONTRAIL PHOTO FROM THE COCKPIT: Possibly the earliest photograph taken by a commercial airplane pilot, showing contrails generated by other aircraft (in this case military fighters between Bergen, Norway, and Amsterdam, The Netherlands): [http://www.danbbs.dk/...](http://www.danbbs.dk/) from [click](#)
4. MOST WELL KNOWN CRIMINAL INTERESTED IN CONTRAILS: Lee Harvey Oswald is said to have had an "inordinate interest in the contrails of high flying aircraft": [http://members.aol.com/...](http://members.aol.com/)

=== MEASUREMENTS

- On pyranometer measurements: [http://emsolar.ee.tu-berlin.de/...](http://emsolar.ee.tu-berlin.de/)

=== CLOUD PHYSICS

1. Cloud physics: "Aircraft-produced particles may also trigger cirrus indirectly, that is, without contrails or after the disappearance of short-lived contrails": [http://medias.obs-mip.fr:8000/...](http://medias.obs-mip.fr:8000/)

=== ELEMENTARY CONTRAIL PHYSICS

1. Jane's World Aircraft Recognition Handbook, 1985, on contrails (elementary): [http://www.aircadet.net/...](http://www.aircadet.net/)
2. UK Meteorological Office, on Contrails: "These are thin trails of condensation, formed by the water vapour rushing out from the engines of jet aircraft flying at high altitudes. They are not true clouds, but can remain in the sky for a long time, and grow into cirrus clouds" [with photo]: [http://www.met-office.gov.uk/...](http://www.met-office.gov.uk/)
3. Elementary contrail information from NOAA: [http://www.wrh.noaa.gov/...](http://www.wrh.noaa.gov/)
4. Elementary British contrails description, with ugly photo: [http://www.scoutingresources.org.uk/...](http://www.scoutingresources.org.uk/)
5. Elementary description of the contrail phenomenon, in Danish: [http://www.1khk.dk/...](http://www.1khk.dk/)
6. Discovery Channel elementary explanation of contrail (pronunciation «KAHN trayl»): [http://school.discovery.com/...](http://school.discovery.com/)
7. Scientific American: [http://www.sciam.com/...](http://www.sciam.com/)

=== CLOUD SEEDING

1. Cloud seeding, environmental effects, Texas (contrails not mentioned): [http://www.tnrcc.state.tx.us/...](http://www.tnrcc.state.tx.us/)

=== CONTRAIL RESEARCH PROGRAMMES

1. AEROCHEM project, Norway: [http://www.uio.no/...](http://www.uio.no/) de1.html
2. EU project CORSAIRE: "Coordination of Research for the Study of Aircraft Impact on the Environment": [http://www.ozone-sec.ch.cam.ac.uk/...](http://www.ozone-sec.ch.cam.ac.uk/)
3. On-going research projects: ACCENT: EOS 80, p.437 (1999)
4. German contrail research programme, PAZI: [http://www.pa.op.dlr.de/...](http://www.pa.op.dlr.de/)
5. SUCCESS photograph of contrail photographed from cockpit: [http://cloud1.arc.nasa.gov/...](http://cloud1.arc.nasa.gov/)

=== CONTRAIL CHANCE IMAGING

1. Chance imaging of contrails over US farm show: [http://www.webpages.ainet.com/...](http://www.webpages.ainet.com/)

=== LAMENTING THE VIEW OF CONTRAILS

1. Vacation in England: "The sky, clear blue last time I looked, has now darkened and is criss-crossed with jet contrails that glow pink in the setting sun. It has become an abstract painting": [http://www.virginianpilot.com/...](http://www.virginianpilot.com/)
2. Lamenting contrails: "While we were at Grand Canyon were hundreds of jets which flew over leaving conspicuous vapour trails in the skies above. We did not have much of the intrusion of the light sightseeing aircraft in the canyon referred to below although we did hear and see helicopters": [http://www.sinclair.org.au/...](http://www.sinclair.org.au/)

3. At Bear Lake: "I had attempted this photo several times and always failed due to wind, lack of clouds, or jet contrails": <http://www.paragon-press.com/...>
4. "The Weather Man Called For Clear Blue Skies, This Is What We Got!": <http://www.frontiernet.net/...>
5. Memories of a trip to Corfu: "The day was another flawlessly good sunny day with great visibility. The water was a beautiful deep blue and faded far off into the horizons. The wake of the ship even looked like it stretched way off into the horizon. In the distance you could tell we were in a shipping lane as we passed many other ships and even some oil rigs at one point. You could even see land in the distance as the visibility was so good today. Overhead, at one point, we must have passed near a convergence point of a number of international flights as the sky was crisscrossed with contrails. Some of the contrails lasted a long time - while others dissipated into wisps that hung around. There were no other clouds other than these man made ones": <http://www.dragonridge.com/...>
6. Salzburger Nachrichten, April 27, 2001 (text only): "Irgendwann werden wir es endlich geschafft haben, dass es keinen blauen Himmel mehr gibt aufgrund der künstlichen Wolkenbildung durch die Kondensstreifen des starken Flugverkehrs. Sämtliche Vorhersagen über die negativen, gefährlichen Auswirkungen der von Menschenhand geschaffenen Veränderungen in der Atmosphäre ignorieren wir. Anscheinend meint jeder einzelne von uns - das betrifft nicht mich, das ist noch weit entfernt, das kommt von den anderen, das wird schon nicht so schlimm werden, die Natur wird sich schon helfen oder man wird schon irgendetwas dagegen erfinden. Wir verhalten uns wie ein Raucher, der trotz schlechter Diagnose und Prognose weitermacht. Wir kennen die Vorhersagen bei der Krankheit "Umweltverschmutzung". Wenn wir alles ruiniert haben, wenn wir den Himmel verfinstert haben, wenn wir die Lunge unserer Natur geschädigt haben, dann hilft kein Klagen und kein Weinen, dann gibt es auch kein Zurück mehr. Späte Reue hilft dann weder der Natur noch uns": <http://www.salzburg.com/...>
7. "Business soars over Atlantic: Last summer, sitting on the front porch of a cottage on Cape Breton Island, I watched the traffic in the night sky, an uninterrupted stream of taigating aircraft lights moving in both directions -- eastbound to Europe, westbound to the major cities of North America. In the daytime, the contrails over Atlantic Canada can turn a sunny day cloudy": <http://www.canada.com/...>
8. From a bicycle trip: I crossed the border into Montana and immediately looked up to see if this really was "Big Sky Country", but I couldn't tell because there was too much of it (sorry!). Jets leave enormously long contrails, stretching nearly to both horizons.": <http://www.freshairadventures.com/>
9. South Tirol: "Das Jahr 2000 war das wärmste Jahr des Jahrhunderts, hat der Deutsche Wetterdienst ermittelt. Extreme Witterungsverhältnisse sind Zeichen einer globalen Klimaveränderung. Dabei werden dem Flugverkehr immerhin ca. 40 % der gesamten klimarelevanten Schadstoff-Emissionen zugeschrieben. Kurzstreckenflüge sind aus ökologischer, ökonomischer, aber auch gesundheitlicher Sicht grundsätzlich abzulehnen. Gäbe es eine auf Nachhaltigkeit ausgerichtete internationale Förderungspolitik, würde es sicher weniger Kondensstreifen am Himmel geben; dafür könnten jedoch mehr Subventionen für einen effizienteren und ökologisch vertretbaren Schienentransport locker gemacht werden. Dies gilt auch für Südtirol. Aus der Presse entnehmen wir, daß entgegen aller politischen Ankündigungen zusätzlich öffentliche Gelder in den Flugverkehr investiert werden": <http://www.provinz.bz.it/...>
10. Contrail irony (by a bird watcher): Thanks to everyone who flew into/out of San Francisco on cross-country flights today for making a good sunset. The web of criss-crossed contrails made a bank of high clouds that gave a great sunset show. Reno to Phoenix and L.A. flights probably helped too. <http://www.monolake.org/...>
11. "Man muss nur einmal am frühen Morgen 5 Minuten den Himmel betrachten und die Kondensstreifen zählen, diese auf 24 Stunden hochrechnen und einmal überlegen, was da alles nach oben und unten an Schadstoffen verteilt wird. Was da nach unten geht, ist wohl nicht ganz unbeteiligt an der steigenden Zahl der Krebserkrankungen und was nach oben geht ist bestimmt kein Mittel zur Erhaltung der Ozon-schicht": <http://home.t-online.de/...>
12. "Somebody ought to be thinking about Florida's burgeoning movie industry, and how difficult it will someday be, for period movies, to get a shot of a skyline without a cellular tower on it or jet contrails in the background": <http://www.sptimes.com/...>
13. Lamenting contrails: "I spent the weekend in a remote region up in very northern California. The purpose was to observe the flyway for jet commercial travel. It is astounding how many hours of the day the sky is laced with jet contrails, and huge morphing of these 'undersuns' into giant coverings of the sky. Direct sunlight fails to reach the earth and the flora, and a sickening yellow pale color is "sunshine". When these enormous and hundreds of miles long contrails cross the sun (floating from west to east), there is a darkening of the light, and a false weather front is enacted, including a rush of eerie wind. This goes on much of a day, day after day, with no let up, thousands upon thousands of flights by winged kerosine burners, emitting more than contrails...and much of the gunk is also have negative impacts on our ozone, etc. Hug a tree! We all have a right to the natural order as intended by God, including clean water, clean air, natural sunshine, and an intact eco-system that is free from the constant encroachment of what passes for an oxymoron...development and "planning": <http://www.google.com/...>

=== UFO SIGHTING EXPLAINED AS CONTRAIL

1. Contrail with shadow crossing Sun; several other degraded contrails: <http://www.1klik.dk/...> from [click](#)

=== MID EAST CONFLICT

Contrails over Israel at the funeral of Eliran Rosenberg: April 3, 2001 <http://www.politiken.dk/...>

=== US Military

1. Wright-Patterson Air Force Base, research into contrail duration: <http://weather.lab.wpafb.af.mil/...>
2. First strategic description of contrails: <http://naca.larc.nasa.gov/...>
3. Air Force denial: cited at the end of <http://www.nmsr.org/...>

=== VARIOUS

1. ECCO SHOES: <http://www.ecco.com/...> and upper part of figure: [click](#)
2. "As the sun set, it illuminated a number of contrails from airplanes high in the sky -- what a sight": <http://home.hawaii.rr.com/...> from [click](#)
3. Nebraska photo: <http://www.hprcc.unl.edu/...>
4. "It seemed as if every time the wind would slow down enough to fire off the shutter there was at least one prominent jet vapor trail in the image which in my opinion would be unacceptable in a photograph": <http://www.tranquilityimages.com/...>

=== CHEMTRAILS

1. "A Field Guide to Chemtrails": <http://www.ufos-aliens.co.uk/...>
2. Chemtrail photos, impressive: <http://webpagesruss.com/...>

=== ???

1. SR 71 (text only): Watching contrails can give job satisfaction to the pilots: ""During my time with the program, our 'visits' to the Korean DMZ and other northern Pacific areas, sending signals to the Sandinistas in Nicaragua, monitoring Beirut, saying 'hello' to Mr. Castro, snapping Qaddafi's Libya during the El Dorado Canyon strike, cruising north of the Arctic Circle, watching contrails of foreign jets faltering as they tried to intercept you, and many more interesting missions prompted an unparalleled level of job satisfaction to the crews," said Deal": LOST.

=== ENVIRONMENT DAMAGE

1. "Boycottfedex" (on aviations extraordinary damage to the environment, also mentioning contrails): <http://www.boycottfedex.com/...>
2. On the hydrogen chloride and Al2O3 emissions from the launch of the Space Shuttle: <http://www.fas.org/...>
3. Space Shuttle Booster reaction: <http://www.assumption.edu/...>
4. "Save our Skies", against airport expansion in Miami, quoting the IPCC report: <http://www.mcsos.org/...>

=== SCENIC PHOTOGRAPHY MARRED BY CONTRAILS

1. Wide angle photogtraphy is difficult in the presence of contrails (with superb photo): <http://www.marietta.edu/...>
2. Superb twilight photo: by M.Wells, UK: <http://www.wells.org.uk/...>
3. A contrail photographed over Japan, September 2000: <http://www.kasumi.sakura.ne.jp/...>

=== SCIENCE

1. EarthKAM Contrails over Portugal: [http://www.earthkam.ucsd.edu/...](http://www.earthkam.ucsd.edu/)
2. Aerodynamic contrails after supersonic bullets: [http://yarchive.net/...](http://yarchive.net/)
3. A jet contrail displays Clean Air Turbulence: [http://exn.ca/...](http://exn.ca/)
4. Environment Canada, proposing that "The more contrails, the less natural cirrus": [http://www.msc-smc.ec.gc.ca/...](http://www.msc-smc.ec.gc.ca/) with html version on [http://www.google.com/...](http://www.google.com/)
5. From the pyranometer site in Arizona: [http://www.optics.arizona.edu/...](http://www.optics.arizona.edu/)
6. Earliest satellite photo of contrails: "Contrails south of San Diego. Date 5-5-63, TIROS V Orbit 3343": [http://www.photolib.noaa.gov/...](http://www.photolib.noaa.gov/) with high-resolution version on [click from http://www.junjun.com/...](http://www.junjun.com/)
7. Recently updated homepage with vortex gif: [http://www.knmi.nl/...](http://www.knmi.nl/)
8. Summary for Schumann: [http://www.aip.de/...](http://www.aip.de/)
9. New paper: "Estimates of Cloud Radiative Forcing in Contrail Clusters Using GOES Imagery, Duda, D.P.; Minnis, P.; Nguyen, L., Journal of Geophysical Research - Atmospheres, March 16, 2001 (vol. 106, no. D5, p. 4927)" cited on: [http://earthobservatory.nasa.gov/81/...](http://earthobservatory.nasa.gov/81/)
10. NOAA neglecting contrails as a source of global change: [http://www.cmdl.noaa.gov/...](http://www.cmdl.noaa.gov/)
11. [http://www.wmo.ch/...](http://www.wmo.ch/)
12. "Jet Aircraft Contrails Reduce the Diurnal Amplitude of Earth's Surface Air Temperature", by Meerkotter, R., Schumann, U., Doelling, D.R., Minnis, P., Nakajima, T. and Tsushima, Y. 1999. Radiative forcing by contrails. *Annales Geophysicae* 17: 1080-1094: [http://www.co2science.org/...](http://www.co2science.org/)
13. The consequence of discussing only CO2 as a source of aviation pollution: [http://www.copernicus.org/...](http://www.copernicus.org/)
14. 'CO2SCIENCE' (watch out for their real purpose!), citing Meerkotter, R., Schumann, U., Doelling, D.R., Minnis, P., Nakajima, T. and Tsushima, Y. 1999. Radiative forcing by contrails. *Annales Geophysicae* 17: 1080-1094: [http://co2science.org/...](http://co2science.org/)
15. Vortex tube theory: [http://www.copernicus.org/...](http://www.copernicus.org/)
16. Contrails discussed in new (2001) book on "Cirrus" from Oxford: [http://www.oup-usa.org/...](http://www.oup-usa.org/)
17. A2C3 pdf document summary: [http://www.aero-net.org/...](http://www.aero-net.org/)
18. Americal Geophysical Union: Polar Stratospheric Clouds: "Peter et al. [1991] showed that exhaust from aircraft in the stratosphere can increase the partial pressures of nitric acid and water vapor, and thus allow the formation of ozone depleting PSC's at warmer temperatures than currently observed": [http://earth.agu.org/...](http://earth.agu.org/) and, on natural and human cirrus clouds: "Fu and Liou [1993] ... also show that in most cases the IR greenhouse effect outweighed the solar albedo effect, except when significant numbers of small ice crystals were present": [click](#)
19. Aircraft and aircraft contrail detected from space, using a Medium Wave Infra Red Telescope: [http://www.dera.gov.uk/...](http://www.dera.gov.uk/)
20. "Clouds, Contrails, and Climate," *Nature* 391, 837-838 (1998) cited on [http://vayu.che.caltech.edu/...](http://vayu.che.caltech.edu/) (redundant url).
21. Paper by Patrick Minnis: CHANGES IN CIRRUS CLOUDINESS AND THEIR RELATIONSHIP TO CONTRAILS [http://ams.confex.com/...](http://ams.confex.com/)
22. Contrails studied by "Association of American Geographers": [http://www.geog.ukans.edu/...](http://www.geog.ukans.edu/)
23. Neural networks to detect contrails in satellite images [http://www.aip.de/...](http://www.aip.de/)

=== VARIOUS

1. Rolls-Royce on contrails: [http://www.rolls-royce.com/...](http://www.rolls-royce.com/)
2. Contrails discussed on a (highly recommended) page on atmospheric phenomena: [http://www.schremmer.onlinehome.de/...](http://www.schremmer.onlinehome.de/)
3. Contrails discussed in German magazine for female pilots: [http://www.pilotinnen.de/...](http://www.pilotinnen.de/)
4. NOT REALLY CONTRAILS: On the similarity between contrails and vulcano eruptions in satellite imagery: > [http://www.euromet.met.ed.ac.uk/...](http://www.euromet.met.ed.ac.uk/)
5. ?? [http://www.dcmilitary.com/...](http://www.dcmilitary.com/)
6. Automated Weather Stations, and the difficulty of comparing instrumental and human estimates of cloudiness: [http://www.das.uwyo.edu/...](http://www.das.uwyo.edu/)
7. All Sky Web Camera, good for contrail viewing: [http://www.metoffice.gov.uk/...](http://www.metoffice.gov.uk/)
8. Latest IR satellite picture, Europe: [http://www.metoffice.gov.uk/...](http://www.metoffice.gov.uk/)
9. '2nd Chemtrail Protest': [http://users.ev1.net/...](http://users.ev1.net/)
10. Either or: [http://home3.inet.tele.dk/...](http://home3.inet.tele.dk/)

=== ASTRONOMY

1. Astronomy: Contrails contribute to light-pollution, by the reflection of city-lights, whereby they disturb astronomical observations: "Nachtflüge von Linien- und Charterflugzeugen sorgen für Emissionen in großen Höhen, die als Kondensstreifen durch Lichtreflektion zur Nachtaufhellung beitragen": [http://www.sternwarte.de/...](http://www.sternwarte.de/)
2. Astronomy: "Saturday, April 05, 1997: Despite some very thin high clouds and contrails comet Hale-Bopp was visible this evening ... in Savannah": [http://www.topistar.com/...](http://www.topistar.com/)
3. Astronomy: A unique photograph of a contrail obscuring the Sun: [http://www.ra-dec.de/...](http://www.ra-dec.de/)
4. Lunar eclipse 2001 January 9 (text only): "I was able to watch the whole thing from P1 to P4 in my back garden. Some high cirrus/ aircraft contrails were a nuisance early on but as the Moon climbed higher in the sky conditions improved tremendously": [http://www.netspeed.com.au/...](http://www.netspeed.com.au/)
5. "Can contrails be observed with the telescopes at Lick Observatory?" [http://www.ucolick.org/...](http://www.ucolick.org/)
6. 1999 Solar Eclipse seen from Hungary (text only): "Fast genau über uns verwehten sieben parallele Kondensstreifen von Flugzeugen, die im Mondschatten mitgeflogen waren": [http://home.t-online.de/...](http://home.t-online.de/)
7. Solar Radiation Research Laboratory, all sky camera: [http://204.132.141.30/...](http://204.132.141.30/)
8. Web-cam Canary Islands: [http://www.iac.es/...](http://www.iac.es/)
9. Solar Radiation charts: [http://www.iac.es/...](http://www.iac.es/)
10. Astronomy affected by contrails: "Another wird pollution concerns planes contrails... (NOAA satellite scan) recorded by May 29th, 2001": [http://www.astrosurf.com/...](http://www.astrosurf.com/)
11. Moon observations obstructed by contrails (doublet?) (effect is not evident from photo): [http://home.t-online.de/...](http://home.t-online.de/)
12. Vega crossed by contrail (but is it true?): [http://www.weisenbergers.de/...](http://www.weisenbergers.de/)

=== ASTRONAUT OBSERVATIONS

1. Astronaut Frank Culbertson warns of Earth impact: [http://news.bbc.co.uk/...](http://news.bbc.co.uk/)
2. ISS astronaut Susan Helms, in a ham radio interview with school children, on July 13, 2001, said that ...she enjoyed the view from the ISS and that she and her crewmates can see aircraft contrails in Earth's atmosphere. "There's nothing like looking out the window!" she said. ": [http://www.arrl.org/...](http://www.arrl.org/)
3. Space Shuttle Payload commander Kathryn Sullivan took time out to answer two questions from a list from schoolchildren in Alabama and Texas. 'One student wanted to know whether the northern lights differ from the southern lights. The answer: no. Another asked what evidence of man, besides the Great Wall of China, could be seen from space. The answer: lots. "We've seen jets flying along, contrails in busy parts of the sky, cities on the ground, plumes of smoke where people are clearing their fields to plant a new season's crop, airports, boats in the water," Sullivan said': *St.Petersburg Times*, March 29, 1992: [http://pqasb.pqarchiver.com/...](http://pqasb.pqarchiver.com/)
4. Space Shuttle, "Ask an Astronaut" site: Byron Lichtenberg replying to the question: "What is the most predominant land feature that can be viewed from space? There are many predominant land features that can be seen from space. The great lakes, Florida peninsula, the Straits of Gibraltar--from our altitude of about 300 km (200 miles) you can see about 1,500km (1,000 miles) in any direction. What is really amazing is how small things you can see. We could see runways, the contrails of aircraft, the roads of housing subdivisions, the wakes of ships etc. While you couldn't see an individual building, you could see the grey of cities. It really is an amazing view. I highly recommend it to everyone": [http://www.thespaceport.com/...](http://www.thespaceport.com/)

=== SPACE IMAGERY

1. Aircraft seen well on ISS photo: [http://eol.jsc.nasa.gov/...](http://eol.jsc.nasa.gov/)
2. Croatia on ISS photo: [http://eol.jsc.nasa.gov/...](http://eol.jsc.nasa.gov/)
3. STS 96: [http://eol.jsc.nasa.gov/...](http://eol.jsc.nasa.gov/)
4. STS 101 [http://eol.jsc.nasa.gov/...](http://eol.jsc.nasa.gov/)

=== POLITICAL LEVEL

1. UK: Department of the Environment, Transport and the Regions: The Future of Aviation The Government's Consultation Document on Air Transport Policy (on radiative forcing and contrails): [http://www.aviation.detr.gov.uk/...](http://www.aviation.detr.gov.uk/)
2. The British Parliament, House of Commons, debates aviation emissions (21 May 2000): [http://www.parliament.the-stationery-office.co.uk/...](http://www.parliament.the-stationery-office.co.uk/)
3. Contrails in Tirol, political concern: "Das Jahr 2000 war das wärmste Jahr des Jahrhunderts, hat der Deutsche Wetterdienst ermittelt. Extreme Witterungsverhältnisse sind Zeichen einer globalen Klimaveränderung. Dabei werden dem Flugverkehr immerhin ca. 40 % der gesamten klimarelevanten Schadstoff-Emissionen zugeschrieben. Kurzstreckenflüge sind aus ökologischer, ökonomischer, aber auch gesundheitlicher Sicht grundsätzlich abzulehnen. Gäbe es eine auf Nachhaltigkeit ausgerichtete internationale Förderungspolitik, würde es sicher weniger Kondensstreifen am Himmel geben; dafür könnten jedoch mehr Subventionen für einen effizienteren und ökologisch vertretbaren Schienentransport locker gemacht werden. Dies gilt auch für Südtirol": [http://www.landtag-bz.org/...](http://www.landtag-bz.org/)

=== US Universities and Organisations

1. EPA on Haze: "During much of the year, a veil of white or brown haze hangs over many of the country's most visited natural parks": [http://www.epa.gov/...](http://www.epa.gov/) specifically this pdf document: [click](#)
2. National Science Foundation supports this kind of activity: [http://www.earthsky.com/...](http://www.earthsky.com/)
3. NOAA contrail elementary information, with picture (poor): [http://nimbo.wrh.noaa.gov/...](http://nimbo.wrh.noaa.gov/)
4. Contrails contaminate cirrus measurements: [http://ftpwww.gsfc.nasa.gov/...](http://ftpwww.gsfc.nasa.gov/)
5. Updated site at Langley: [http://www-pm.larc.nasa.gov/...](http://www-pm.larc.nasa.gov/)
6. On trends in cirrus clouds, and the relation to contrails: [http://www.atmos.colostate.edu/...](http://www.atmos.colostate.edu/)
7. Redundant: CONTRAIL SHADOW on Seti at Home home-page: [http://milkyway.ssl.berkeley.edu/...](http://milkyway.ssl.berkeley.edu/)
8. MIT on contrails: [http://web.mit.edu/...](http://web.mit.edu/)
9. NASA's erroneous classification of shiptrails as contrails: [http://visibleearth.nasa.gov/...](http://visibleearth.nasa.gov/) and [click](#)
10. CLAMS project, with link to new SeaWiFS data: [http://www-angler.larc.nasa.gov/...](http://www-angler.larc.nasa.gov/)
11. [http://www-clams.larc.nasa.gov/...](http://www-clams.larc.nasa.gov/)
12. NOAA "Weather in Action" on contrails, with photo: [http://www.nws.noaa.gov/...](http://www.nws.noaa.gov/)

=== INTERNATIONAL Organisations

1. ICAO Journal (April 2001, on noise, mostly, but also a bit on contrails) [http://www.icao.int/...](http://www.icao.int/)

=== SPACE IMAGING

1. GOES, picture of contrails over Florida, February 23, 2001: [http://rsd.gsfc.nasa.gov/...](http://rsd.gsfc.nasa.gov/)
2. Most recent satellite NOAA image of NorthWestern Europe, from DLR: [ftp://ftp.dfd.dlr.de/...](ftp://ftp.dfd.dlr.de/)
3. NOAA satellite maps from "Wetterzentrale": [http://www.wetterzentrale.de/...](http://www.wetterzentrale.de/)
4. WEST OF IRELAND PHOTO: [http://earth.leeds.ac.uk/...](http://earth.leeds.ac.uk/)
5. Redundant: Recall this photo of contrails over Portugal: [http://store2.yimg.com/...](http://store2.yimg.com/)

=== WWII

1. WWII (photo): "The captioning on the back of the photo misidentified the a/c as a P-38. It also says the contrails were made by P-63 King Cobra's practicing dog fighting. [http://j-aircraft.com/...](http://j-aircraft.com/) from [click](#)

=== REAL ESTATE CONTRAILS

1. [http://www.danbolig.dk/...](http://www.danbolig.dk/) with full size picture on [click](#) and [http://www.nybolig.dk/...](http://www.nybolig.dk/) and [http://www.home.dk/...](http://www.home.dk/) and [click](#) and [http://www.edc.dk/...](http://www.edc.dk/)

=== KIDS

1. CONTRAILS FOR GERMAN KIDS: [http://www.milkywayclub.de/...](http://www.milkywayclub.de/)
2. Contrails for German kids: [http://www.hr-online.de/...](http://www.hr-online.de/)

=== SIMPLE VISUAL OBSERVATION

1. Verbal description of a contrail observed from an aircraft: "We're paralleling the contrail and it looks like DNA -- endless variety, endless repetition": [http://www.semanchuk.com/...](http://www.semanchuk.com/)
2. Chemtrail account in the Massapequan Observer, for August 22, 2000: [http://antonnews.com/...](http://antonnews.com/)
3. Wall Street Journal's correspondent on the Atlantic Ocean: "A steady array of contrails lined the sky as the European traffic made its way to and from New York and Boston": [http://www.expeditionsail.com/...](http://www.expeditionsail.com/)

=== AVIATION INDUSTRY AND CONTRAILS

1. Lufthansa: [http://umwelt.lufthansa.com/...](http://umwelt.lufthansa.com/) and [click](#)
2. Time Magazine on congested skies: [http://www.time.com/...](http://www.time.com/) with picture: [click](#)
3. ONERA: [http://www.onera.fr/...](http://www.onera.fr/)
4. EUROCONTROL with elementary contrail description: [http://www.eurocontrol.fr/...](http://www.eurocontrol.fr/)

=== SCIENCE

1. Research, USA: "Cirrus and persistent contrails over ARM CART site": [http://members.tripod.com/...](http://members.tripod.com/)
2. Nature, August 15, 2001, "best to fly airplanes morning and evening": [http://www.nature.com/...](http://www.nature.com/)
3. "Aviation, aerosols, contrails and cirrus clouds", Proceedings of a European Workshop, Eds. Ulrich Schumann and Georgios T. Amanatidis, European Commission, 2001, ISBN 92-894-0461-2.
4. IPCC Shanghai resolutions: [http://www.met-office.gov.uk/...](http://www.met-office.gov.uk/)
5. Jyllandsposten and Jens Hesselbjerg Christensen about contrails: [http://www.jp.dk/...](http://www.jp.dk/)

===== SEARCH MACHINES

1. Search machine compuserve: 2649 matches on contrails, on April 13, 2000: [http://csearch.compuserve.com/...](http://csearch.compuserve.com/)
2. Literature references to contrail research: [http://www.fmi.fi/...](http://www.fmi.fi/)
3. Search for vapor trails and find document on greenhouse gasses including water [http://dosfan.lib.uic.edu/...](http://dosfan.lib.uic.edu/)

===== CHANCE IMAG

1. Contrails in vacation photo from Santa Fe: [http://home.flash.net/...](http://home.flash.net/) - from [click](#)

===== ON AVIATION AND ENVIRONMENT

1. Busiest airports: [http://www.airports.org/...](http://www.airports.org/)
2. On aviation's environmental problems: [http://www.ufcna.com/...](http://www.ufcna.com/)
3. On the contribution of German aviation to CO2 pollution: "Traue keiner Statistik, die du nicht selbst gefälscht hast!": [http://www.uni-saarland.de/...](http://www.uni-saarland.de/)
4. Aviation statistics for Germany, including military flights: [http://www.dfs.de/...](http://www.dfs.de/)
5. "Nur Fliegen ist schöner?" - but Kondensstreifen is a problem!: [http://www.uni-saarland.de/...](http://www.uni-saarland.de/)
6. Orange County Register (10/26/99): "Jets & global warming: Both gas emissions and contrails add up to an effect on global climate likely equal to that of the entire state of California, Prather said": [http://www.tigerherbs.com/...](http://www.tigerherbs.com/)
7. Jet contrails are not useful in geoen지니어ing, at they tend to heat the planet, instead of cooling it: [http://www.britannica.com/...](http://www.britannica.com/)
8. Environmental Defense Fund: "Jet contrails, formed of frozen water vapor emissions, may also enhance formation of cirrus clouds, wispy clouds that trap heat and add to the greenhouse effect": [http://www.edf.org/pubs/...](http://www.edf.org/pubs/)

===== PILOT COMMENTS AND PHOTOS

1. Very few airline pilots mention contrails. Here is one case: [http://x41.deja.com/...](http://x41.deja.com/) - and a pilot's photo of a contrail: [http://www.pprune.org/...](http://www.pprune.org/) - and again a statement: "We then made S-turns over Monument Valley where giant monoliths cast shadows as long as our contrails": [http://www.barryschiff.com/...](http://www.barryschiff.com/)
2. Contrails over a runway, photographed through the cockpit windows: [http://128.173.16.28:10021/...](http://128.173.16.28:10021/)

===== UV MONITORING

1. UV Monitoring: [http://www.epa.gov/...](http://www.epa.gov/)
2. National UV Monitoring Network (check for light curves): [click](#)
3. UV Monitoring in National Parks: [click](#) and [click](#)

=== Ground based photos

1. Yosemite contrails, photo: [http://www.boscarelli.com/...](http://www.boscarelli.com/)
2. Photo of contrail over Yosemite National Park: [http://www.ewav.com/...](http://www.ewav.com/)
3. Montana contrails, good photos: [http://www.crosswinds.net/...](http://www.crosswinds.net/)
4. Contrail photo from Dominionpost, Canada [http://www.dominionpost.com/...](http://www.dominionpost.com/)
5. Rocket contrail photo: [http://www.friedmanarchives.com/...](http://www.friedmanarchives.com/)
6. Contrails (photo) over Oberbaumbruecke, Berlin: [http://rosa.physik.tu-berlin.de/...](http://rosa.physik.tu-berlin.de/)
7. MIG 29 tour to America, 1999: [http://www.fabulousfulcrums.de/...](http://www.fabulousfulcrums.de/)
8. Chemtrail site with a few photos: [http://humandala.50megs.com/...](http://humandala.50megs.com/)
9. UK contrail photo from amateur astronomy site: "May 7th 2001. So you want to live near an airport? As well as urban (and airport) light pollution, aircraft contrails are a real problem at times": [http://www.carmine.demon.co.uk/...](http://www.carmine.demon.co.uk/) from [click](#)
10. German contrail observation, with two photos: [http://www.studsem-bs.de/...](http://www.studsem-bs.de/)
11. Most impressive chemtrail photo: [http://blurr.myblackvault.com/...](http://blurr.myblackvault.com/) from [click](#)
12. Chemtrail site with an excellent photo (redundant) [http://hometown.aol.com/...](http://hometown.aol.com/)
13. Sunset, White Rock: [http://showcase.clubphoto.com/...](http://showcase.clubphoto.com/)
14. Amalienborg, Denmark: [http://showcase.clubphoto.com/...](http://showcase.clubphoto.com/)
15. Chance imaging of contrails over Paris [http://sanjose.clubphoto.com/...](http://sanjose.clubphoto.com/)
16. Egne Altavistabilleder: [http://www.altavista.com/...](http://www.altavista.com/)
17. Huge number of photos, not inspected, including two "chemtrails" [http://www.fperkins.com/...](http://www.fperkins.com/)
18. Picture of the day: "Wolken und Kondensstreifen" (January 8, 2001): [http://www.oberberg-aktuell.de/...](http://www.oberberg-aktuell.de/)
19. Nice sunset picture, with contrails: [http://www.fullcirclegraphics.com/...](http://www.fullcirclegraphics.com/)
20. Australian Weather Calendar Photo for February 2001, looks funny: [http://www.bom.gov.au/...](http://www.bom.gov.au/)
21. Contrails on front cover photo of "Weather", May 2001, Royal Meteorological Society. The presence of the contrails is not referred to in the legend.
22. Chemtrail (Patriot!) site with nice photos: [http://www.apfn.org/...](http://www.apfn.org/)
23. Contrails on the cover of American Patriot Magazine, June 2001.
24. Picture of contrails, from ground: [http://www.geocities.com/...](http://www.geocities.com/)
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NOT SORTED YET ...up

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17. Term "Cirrus Aviaticus" used, perhaps for the first time; contrail casting shadow on ground, contrail from specific aircraft McDonnell Douglas MD11: [http://www.chitambo.com/...](http://www.chitambo.com/) - and contrails casting shadow: [click](#)
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64. Contrail between clouds (nice picture!): [http://watership.net/...](http://watership.net/)
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103. CONTRAILS CASTING SHADOW <http://milkyway.ssl.berkeley.edu/...> from [click](#) - and <http://www.ametro.net/...>
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134. Images of contrails: <http://callinglakes.com/...> and [click](#) and [click](#) from [click](#)
135. CBS News Item: <http://cbsnews.com/...>
136. Slow loading: [click](#)
137. Trace gas studies from aircraft, relation to contrail research: [click](#)
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143. Science: "Do Commercial Aircraft Affect Clouds?": Conclusion: More research is needed. [click](#)
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145. Federation of American Scientists on B2 bomber contrail protection: <http://www.fas.org/...> and [click](#)
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166. On the capacity of the Earth to house human beings: <http://dieoff.com/...>
167. Hurricane Daniel and a photograph of a contrail: <http://www.datasync.com/...>
168. Contrails observed from an U-2 flight: "The Sierra Nevada, the mountainous spine of California, has lost its glory, a mere corrugation on the Earth. Lake Tahoe looks like a fishing hole, and rivers have become rivulets. Far below, "high flying" jetliners etch contrails over Reno, Nevada, but we are so high above these aircraft that they cannot be seen" - and - "The forward cockpit also is equipped with a small side-view mirror extending into the air stream. It is used to determine if the U-2 is generating a telltale contrail when over hostile territory": <http://www.aopa.org/...>
169. Admiring contrails: <http://www.amarillonet.com/...>
170. Stereo photo of contrail: <http://www.lrz-muenchen.de/...>
171. Contrails in German weather lexicon: <http://www.tagesschau.de/...>
172. German worries about contrails: <http://www.nabu.de/...>
173. Commercial contrail photo: <http://vfoto.lbw.bwue.de/...>
174. Goleta Air and Space Museum photo of contrail: <http://www.air-and-space.com/...>
175. 'The Advocate': "Dick Gebhart comments on weather guru Pat Shingleton's description of contrails seen across the sky in cold weather as condensation produced by high-flying jet aircraft": <http://www.theadvocate.com/...>
176. <http://www.m-w.com/...>
177. <http://www.thconline.com/...> from [click](#)
178. Mag-Lev: Jesse H. Ausubel: Hydrogen technology: "Airplanes consume ever more fuel. Although hydrogen attracts because of its light weight and combustion properties precious for high performance, compact, safe storage of liquid H2 still offers barriers for the engineers and scientists of the air and space carriers to overcome. The prizes will include the markets for the new Super Jumbos and the commercial hypersonics. To speed the ever more numerous climate negotiators cleanly to their next meeting": <http://phe.rockefeller.edu/...>
179. Aviation Conference 2003, six thousand participants, no mention of 'environment', 'contrails': <http://www.flight100.org/...>
180. FRENCH: On airport architecture: "The aeronautical revolution has completely altered traditional notions of speed, time and distance; it has changed the faces both of warfare and of holiday-making, and has been a major contributor to the globalisation of the economy. All over the planet, the skies are marked by vapour trails": <http://www.europe-air.culture.fr/...>
181. Contrails over unknown British location: <http://www.gavin.southafricans.co.uk/...>
182. Erotica: "Smoke belched out the back of her car like contrails from a B-52 at altitude as the worn automobile built up a head of steam": <http://www.totse.com/...>
183. Oak Ridge National Laboratory: Sub-visible clouds or contrails may interfere with plant growth measurements: <http://daac.ornl.gov/...>
184. J.Reynolds: <http://www.williamcooper.com/...>
185. Natural Resources Defence Council on military aircraft inventory <http://www.nrdc.org/...>
186. Ship trails recognised in commercial image analysis: <http://www.arette.com/...>
187. Contrails in advertising, Sak's at 5th Avenue: <http://www.jr@rense.com/...>
188. Amateur astronomical photography of early morning sky contaminated by contrails: <http://www.graham-wood.freeserve.co.uk/...>
189. Make your own contrails (in photoshop): <http://www.myjane.com/...>
190. "A Bus with Wings" - and poorly simulated contrails: <http://www.povray.org/...>
191. Lost message board on contrails: <http://www.genespage.com/...>
192. Air Line Pilot Nov/Dec 1999: <http://www.alpa.org/...> from [click](#)
193. Good NOAA picture (lost?): <http://www.dmi.dk/...>
194. Air Space Magazine: <http://www.airspacemag.com/...>
195. Contrail over Venice: <http://goeurope.about.com/...>
196. Chance recording of what must be contrails, over the Dundas Mountain, near Thule Air Base, Greenland: <http://hjem.get2net.dk/...>
197. Global Fuel Burn: <http://www.eurocontrol.fr/...>
198. Text on environmental effects of aviation: <http://chemnaionline.com/...>
199. Cornell University: Cloud atlas photo with many contrails: <http://www.css.cornell.edu/...>
200. "Notice how well the contrails in the sky record on Kodak infrared film.": <http://www.gorillasites.com/...>
201. On contrails' role in the formation of thin cirrus: "Anthropogene und natürliche Einflüsse auf Bildung und Eigenschaften von optisch dünnem Zirkus in den mittleren Breiten der Nord- und Südhemisphäre": <http://wetterstation.pa.op.dlr.de/...>
202. Dutch site with contrail pictures and text: "Wel waren er veel contrails van vliegtuigen te zien die overgingen in heuse cirrus. Een teken dat het op vlieghoogte vochtige lucht aanwezig was": <http://www.vwkweb.nl/...>
203. Space Shuttle "contrails" at launch, nice photo [seems lost a few weeks after inclusion]: <http://www.artwebworks.com/...>
204. Australian "chemtrails": <http://www.byronunderground.com/...>
205. Nice java-animations of 'chemtrails': <http://www.umediam.com/...>
206. Contrails, nose-cone art, P-17 <http://www.americanflyers.net/...>
207. Pentagon said to be illustrated by B-17 and B-24 drawing contrails: <http://www.jdy.net/...>
208. Coming meetings: <http://ams.confex.com/...>

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1. Own talk on contrails: <http://kl5alfa.ki.ku.dk/laser/seminar.html>
2. Elementary page on atmospheric chemistry: <http://www.hausarbeiten.de/...>
3. German site with rise in aviation, domestic, figure: <http://www.bund-berlin.de/...>
4. DMI with new AWACS picture: <http://www.dmi.dk/...>
5. Canadian "chemtrails": <http://www.geocities.com/...>
6. Milo (redundant) <http://www.geocities.com/...>
7. <http://www.flugverkehr.ch/...>
8. Contrail diary (March 1999) <http://people.montana.com/...>
9. "Sustainable Aviation" (what is that?): <http://www.t-e.nu/...>
10. On average process, and much more: <http://www.eurocontrol.be/...>
11. REDUNDANT clover leaf <http://www.newsminer.com/...>
12. FLIGHT EXPLORER <http://worldzone.net/science/...>
13. Track flights in real-time: <http://www.trip.com/...>
14. Hand over Sun: <http://www.imagestation.com/...>
15. A rare contrail in weather report: <http://www.ahlen.de/...>
16. Site searches: National Geographic (0, on august 18, 2001) <http://riptide.nationalgeographic.com:80/...>
17. B747 contrails: <http://www.chris.brady.ukgateway.net/...>
18. A very negative description is given of a pilot, interested in the formation of contrails behind his plane: "A pilot, senior in age to most of us at the time, with mucho DC-3 hours took nearly 50 hours to check out in his company's new big jet. Then, on his first flight with the boss, he plowed into a snowbank in Chicago. He installed a rearview mirror so he could see his contrails. He also smoked smelly cigars in the cockpit, a big no-no today": <http://www.aviationnow.com/...>
19. How Stealth Works: <http://hometown.aol.com/...>
20. Editing contrails away is easy: <http://www.uwp.edu/academic/...> with pictures [click](#) and [click](#)

===== CLOUDS

- 21. Clear sky identification: [http://playground.arm.gov/...](http://playground.arm.gov/)
- 22. KNMI on all sky imager for automatic registration of cloudiness: [http://www.knmi.nl/...](http://www.knmi.nl/)
- 23. Cloud history:
 1803: First description of cirrus clouds: [http://www.weatherwise.org/...](http://www.weatherwise.org/)
 1885: First description of noctilucent clouds: [http://aipsoe.aip.de/...](http://aipsoe.aip.de/) and (papers by W Schröder) [http://www.ggki.hu/...](http://www.ggki.hu/) - and: increased occurrence since 1960: [http://www.nsf.gov/...](http://www.nsf.gov/)
 1985: Ozone Hole discovery: [http://earth.agu.org/...](http://earth.agu.org/)
 1990: Increased duration of Polar Stratospheric Clouds: [http://ccf.arc.nasa.gov/...](http://ccf.arc.nasa.gov/) see also [http://www.awi-potsdam.de/...](http://www.awi-potsdam.de/)

===== EARN MONEY ON CONTRAILS

- 24. Sell 'chemtrail' videos for 25 and 50 bucks apiece: [http://www.google.com/... ..](http://www.google.com/)

===== POLITICS

- 25. Trafikpolitik, med omtale af kondensstriber: [http://www.leksikon.org/...](http://www.leksikon.org/)
- 26. Department of the Environment, on "The Future of Aviation", chapter Six "Environmental Effects": [click](#)

===== NASA

- 27. Official NASA photo of contrails near an airport: [http://windows.ivv.nasa.gov/...](http://windows.ivv.nasa.gov/)
- 28. NOAA photo of contrails: [http://www.nssl.noaa.gov/...](http://www.nssl.noaa.gov/)
- 29. High Speed Systems Office: "There is a potential that particulates, a byproduct of turbine engine combustion, can affect climate change by becoming condensation nuclei and forming contrails and clouds": [http://www.lerc.nasa.gov/...](http://www.lerc.nasa.gov/)

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- 30.
- 31. On US areas under "constant contrail cover", from a UK government site: [http://www.foresight.gov.uk/...](http://www.foresight.gov.uk/)
- 32. "Summer Contrails" (photo) on a Canadian amateur astronomer's page: [http://www.ras.sk.ca/...](http://www.ras.sk.ca/)
- 33. "AVweb readers submitted more than 50 images last week. Congratulations to this week's winner, Bill Buckingham from Tacoma, Wash., who sent us a spectacular shot of a C-17 generating contrails. Great stuff, Bill! Your AVweb prize is on the way": [http://www.avweb.com/...](http://www.avweb.com/)
- 34. Othermeanings: Knife: <http://www.shoplite.com/columb36.htm>
- 35. From a star-gazer party, on october 12, 2001 at Frosty-Dew Observatory: "Outside a constantly changing by very interested group of skywatchers (many of whom were visting FDO for the first time) saw a wide variety of meteors, satellites and planes [Planet Cessna and Planet Boeing as well as Comet Contrail were sighted all over the sky]:" [http://www.frostydvew.org/...](http://www.frostydvew.org/)
- 36. On the smoky contrail of B52s: [http://www.weeklystandard.com/...](http://www.weeklystandard.com/)
- 37. Funny contrail photo (by Jeff Reifman): [http://www.komotv.com/...](http://www.komotv.com/)
- 38. [http://pics.jp.dk/...](http://pics.jp.dk/)
- 39. Hubertus jagt: [http://www.berlingske.dk/...](http://www.berlingske.dk/)
- 40. Google image search: [http://images.google.com/...](http://images.google.com/)
- 41. Got it wrong: "Here in the Rockies, I can still take a picture without having to battle for composition with the many factors of mankind: airplane contrails, telephone wires, deforested cut blocks and litter. ": [http://www.wroblewski.com/...](http://www.wroblewski.com/)
- 42. Contrail image search: [http://multimedia.alltheweb.com/...](http://multimedia.alltheweb.com/)
- 43. Contrails over Nashville, Tennessee: [http://www.netowne.com/...](http://www.netowne.com/)
- 44. NTSB mistakenly refers to 'black contrails' in an accident report: [http://www.nts.gov/...](http://www.nts.gov/)
- 45. The Holy Bible and contrails: [http://www.christiananswers.net/...](http://www.christiananswers.net/)
- 46. The Horse Soldier, 1959 movie: "Jet contrail in Civil War movie: There is a scene somewhere near the middle of the movie in which The union cavelry is riding slowly along singing about how they would ride to hell and back for Ulysis Sympon Grant. Very obvious in the sky above them is a jet contrail. [http://www.nitpickers.com/...](http://www.nitpickers.com/)
- 47. Humorous contrail description from the Navy: [http://pao.cnmoc.navy.mil/...](http://pao.cnmoc.navy.mil/)
- 48. Greener Skies: [http://www.aef.org.uk/...](http://www.aef.org.uk/) and contrails: [http://www.aef.org.uk/...](http://www.aef.org.uk/)
- 49. A retire pilot proclaims: "I still miss making stick clouds, as the late Tom Whitworth claimed the Indians called contrails.": [http://www.google.com/...](http://www.google.com/)
- 50. Contrails over Mounrt Washington Observaotory: [http://www.mountwashington.org/...](http://www.mountwashington.org/)
- 51. Kristian Kunz, Germany, on gross emissions from aviation: [http://home.t-online.de/...](http://home.t-online.de/)
- 52. Redunadant rocket contrails photo: [http://azuswebworks.com/...](http://azuswebworks.com/)
- 53. Particle pollution worse than CO2: [http://www.information.dk/...](http://www.information.dk/)
- 54. US official governeemt doc search: [http://www.firstgov.gov/...](http://www.firstgov.gov/)
- 55. EPA has a contrail contact person: [http://www.daq.state.nc.us/...](http://www.daq.state.nc.us/)
- 56. On change in cloud reporting procedures in 1951: [http://dnr.state.il.us/...](http://dnr.state.il.us/)
- 57. Virginia Department of Aviation speaking positively about contrails in their aviation art competition: "2000 International Aviation Art Contest : My Dream to Fly: It was you who spent lazy summer days watching the cloud's form castles, sailboats, and dragons, and dreamed of soaring among them. It was you who sat on your porch and watched the contrails left in the sky by big jets and dreamed of one day sitting in the cockpit yourself, crisscrossing the sky at 30,000 feet. It was you who attached a parachute to your favorite teddy bear and dropped it out the window": [http://www.doav.state.va.us/...](http://www.doav.state.va.us/)
- 58. Camera: [http://www.metoffice.com/...](http://www.metoffice.com/)
- 59. US Air Force information on contrails (new!): [http://www.safmi.hq.af.mil/...](http://www.safmi.hq.af.mil/)

===== POST SEPT 11 =====

- 60. CBS News: No lazy white contrails in the late-summer sky, with the U.S. air space closed to commercial flights for the first time ever. [http://www.cbsnews.com/...](http://www.cbsnews.com/)
- 61. Absence of contrails over USA on September 13, 2001 by Linux Journal senior editor Doc Searls: "Con trail? We'll find out. There wasn't a cloud in the sky yesterday, for the second day in a row. Not even a wisp of cirrus. Why? No contrails. This isn't a small thing. We almost never talk about it, because we can hardly imagine doing without air travel (until two days ago); but jet aircraft flying at high altitudes cause lots of contrails, which often spread out to create large overcast areas. Many of the high altitude clouds you see may not resemble contrails, but that's because they've morphed from contrails into less obvious shapes. I've watched a few contrails here in Santa Barbara spread out to cover nearly the whole sky. And guess what that contributes to? Try global warming. Well, at least some folks think so. Wacko or not, the absence of commercial aviation in the U.S. is at least an invitation to all kinds of interesting science. When the current news trails off, don't be surprised to hear about some interesting discoveries made in the absence of airplanes": [http://doc.weblogs.com/...](http://doc.weblogs.com/)
- 62. Post September 11 clear sky, Patrick Minnis: <http://www.ens.lycos.com/ens/nov2001/2001L-11-02-09.html>
- 63. Absence of contrails after September 11: <http://fly.hiwaay.net:8000/~garson/bluesky0901.htm> and http://www.trsc.com/cw/cw_20010915.html
- 64. After September 11: [http://www.scalzi.com/...](http://www.scalzi.com/)
- 65.
 - Station Crew Notes
 - Absence of American
 - Air Traffic in Wake of
 - Terrorist Attacks
 - By Todd Halvorson
 - Cape Canaveral Bureau Chief

posted: 01:26 pm ET
14 September 2001

CAPE CANAVERAL, Fla. - The International Space Station's crew spied yet more evidence Friday of the aftermath of this week's terrorists attacks on America: the lack of air traffic over the continental United States.

Three days after suicide airplane hijackers toppled the World Trade Center in New York and slammed into the Pentagon in Washington, D.C., the station crew noted an obvious absence of airborne jetliners from their perch 240 miles (384 kilometers) above Earth.

"I'll tell you one thing that's really strange: Normally when we go over the U.S., the sky is like a spider web of contrails," U.S. astronaut and outpost commander Frank Culbertson told flight controllers at NASA's Mission Control Center in Houston.

"And now the sky is just about completely empty. There are no contrails in the sky," he added. "It's very, very weird."

"I hadn't thought of that perspective," fellow astronaut Cady Coleman replied.

Air traffic in the United States remained relatively sparse as less than half the nation's normally scheduled morning flights - or about 1,700 of 4,000 - actually took off from airports around the country.

Some major airports remained closed, including Boston's Logan Airport - the embarkation point of the two hijacked airliners that struck the twin 110-story World Trade Center towers Tuesday.

The New York area's major airports - John F. Kennedy International, LaGuardia and Newark International - reopened Thursday but then closed abruptly as the FBI detained 10 suspected terrorists for questioning. All were cleared and later released but the airports remained closed.

And Reagan National Airport, located just outside Washington, D.C., still was shut down because of its close proximity to the Pentagon, the White House and other key government buildings in the nation's capital.

"We do have air traffic resumed at many airports, although not the New York area or the Washington area yet," Coleman told the station crew, which includes Russian cosmonauts Vladimir Dezhurov and Mikhail Turin.

"They are resuming travel," Culbertson asked.

"At some airports they are, and at others they are not," Coleman replied. "I don't think Logan's resumed yet either."

Onboard the international station since August, Culbertson and his crew have taken a keen interest in the terrorist attacks and their aftermath. In the past few days, the trio has beamed back video images of the towering plume that billowed up from the World Trade Center as well as the disaster site lit up for emergency rescue efforts at night.

Other NASA and commercial remote sensing satellites have sent back images of the carnage in both New York and at the Pentagon, the latter of which is the nerve center and headquarters of the U.S. Department of Defense.

Flight controllers, meanwhile, have been keeping the crew updated on the rescue and recovery efforts at both disaster sites, where the number of dead or missing now stand at about 5,000 people.

And the station crew is continuing to take video with every pass over the U.S. eastern seaboard, although their efforts Friday were thwarted by the same rainy weather that hampered workers sorting through massive rubble piles in New York and Washington.

"Unfortunately, the east coast was pretty well covered with clouds, so we didn't get a whole lot - couldn't see a whole lot," Culbertson said. "They had quite a lot of rain last night, and it's continuing, which is making things difficult down there," Coleman replied.

The entire U.S. space agency, meanwhile, observed a moment of silent prayer at noon EDT (1600 GMT) as part of a national day of remembrance for the victims of the terrorist attacks and their surviving families.

In a ceremony broadcast at NASA headquarters and the agency's 10 field centers, NASA chief Dan Goldin said the agency wanted "to honor the spirit of our nation and the brave people caught in the midst of this senseless tragedy."

"Along with millions of Americans, we are gathered together to pray to our Creator for guidance, and to enlighten the nation's leadership and provide them the wisdom that will prepare them to lead us on a path to righteousness and justice," added Christopher Rodriguez of the NASA headquarters Equal Opportunity and Diversity Management Office. "We will, and I repeat, we will win this spiritual battle against this evil in our midst."

[http://www.space.com/...](http://www.space.com/)

66. B 52 contrails displayed by AP: [http://news.bbc.co.uk/...](http://news.bbc.co.uk/) from [http://news.bbc.co.uk/...](http://news.bbc.co.uk/)
67. Chemtrail picture collection: [http://photos.yahoo.com/...](http://photos.yahoo.com/) with exaple photo [click](#)
68. Contrails in Religion: [http://www.rgi.com/...](http://www.rgi.com/)
69. Chemtrail stuff: [http://www.indymedia.org/...](http://www.indymedia.org/)
70. Letter to member of the House of Representatives: [http://www.danenet.wicip.org/...](http://www.danenet.wicip.org/)
71. Japanese contrail researcher Kira: [http://taiki.ep.sci.hokudai.ac.jp/...](http://taiki.ep.sci.hokudai.ac.jp/)

LAST BATCH (JANUARY 30, 2003) [...up](#)

1. Dissipation trails: [http://www.spc.noaa.gov/cooling/...](http://www.spc.noaa.gov/cooling/)
2. Contrails in Warfare: Over Monschau/Eifel on april 17, 1944 (verbal only): [http://www.dhm.de/...](http://www.dhm.de/)
3. Germany: Freie Presse on Contrails: (With photo): [http://www.freiepresse.de/...](http://www.freiepresse.de/)
4. Germany: Bielefeld University on contrails and soot from banking B52: [http://dc2.uni-bielefeld.de/...](http://dc2.uni-bielefeld.de/)
5. German school site, with contrail photo: [http://nibis.ni.schule.de/...](http://nibis.ni.schule.de/)
6. Contrails in Paradise: "After adding in the warming effect of contrails (the clouds formed around jet exhaust) and other airplane impacts (such as the emission of sulfur oxides, which tend to reflect sunlight), he says, planes account for 6-7.5% of overall human-caused warming": [http://ehpnet1.niehs.nih.gov/...](http://ehpnet1.niehs.nih.gov/)
7. SeaWiFS image of contrails over the Baltic: [http://visibleearth.nasa.gov/...](http://visibleearth.nasa.gov/)
8. Emblem with contrails [http://www.losangeles.af.mil/...](http://www.losangeles.af.mil/) described on [click](#)
9. Emblem with patriotic contrails: [http://www.au.af.mil/...](http://www.au.af.mil/)
10. Department of Transport says: Contrails in company logos: "The spherical logo overlaid with jet contrails denotes speed, air, modern, high tech, efficiency.": [http://www.fta.dot.gov/...](http://www.fta.dot.gov/)
11. Contrails near MIT: [http://www.ics.uci.edu/...](http://www.ics.uci.edu/)
12. NASA AeroQuiz question on contrails responded to: "They're called condensation trails, or contrails, and they have been a normal effect of jet aviation since its earliest days. Contrails evaporate quickly if the ambient humidity is low, or persist and grow if the humidity is high. One of the byproducts of combustion is water vapor. If there is sufficient humidity in the exhaust plume, water condenses on small particulate matter to form liquid droplets. These droplets then freeze rapidly in the cold air at cruising altitude and form a contrail. The area of concern among atmospheric scientists is when ambient humidity is high and the contrails persist and grow in size by taking in existing water from the surrounding atmosphere. Contrails can increase the cloudiness of the atmosphere and can therefore have an effect on the Earth's temperature and climate. How much of an effect contrails have on the Earth's climate is a point debated by atmospheric scientists. - The Aeroquiz Editor ": [http://www-psao.grc.nasa.gov/...](http://www-psao.grc.nasa.gov/)
13. On the External Costs to Aviation: [http://www.cedelift.nl/...](http://www.cedelift.nl/)
14. British photos of contrails: [http://www.apra.org.uk/...](http://www.apra.org.uk/)
15. Contrails mentioned on danish state tv weather forecast, 2002 june 2, 18:50 MEST.

=====TRAVIS ET AL. PAPER ON SEPT 11 AIRCRAFT GROUNDINGS=====

16. Abstract: [http://ams.confex.com/...](http://ams.confex.com/) - (notice: 4 other contrail papers presented at the same conference) and full paper: [http://academics.uww.edu/...](http://academics.uww.edu/) News reports: [http://www.sciencenews.org/...](http://www.sciencenews.org/) and [http://www.wired.com/...](http://www.wired.com/) and [http://www.popularmechanics.com/...](http://www.popularmechanics.com/) and [http://www.jsonline.com/...](http://www.jsonline.com/) and [http://www.loe.org/...](http://www.loe.org/) - and, in Danish: [http://www.ing.dk/...](http://www.ing.dk/)

===== OTHER SEPT 11 AND POST SEPT 11 =====

17. September 11 Air Force One detected in satellite imagery: [http://www.zeit.de/...](http://www.zeit.de/)
18. Post September 11 absence of contrail discussed by Nikon: [http://home1.nikonnet.com/...](http://home1.nikonnet.com/)
19. Contrail absence after september 11: [http://www.spiegel.de/...](http://www.spiegel.de/)

=====VARIOUS=====

20. Danish Environmental Protection Agency on Danish Fuel use and environmental considerations of aviation: [http://www.mst.dk/...](http://www.mst.dk/)
21. Religion and post september 11 Chemtrails [http://www.demonbuster.com/...](http://www.demonbuster.com/)
22. RESEARCHERS: David Travis <http://facstaff.uww.edu/travisd/>
23. Calendar: Australian Bureau of Meteorology proudly presents contrail affected skies: [http://www.bom.gov.au/...](http://www.bom.gov.au/)
24. Hong Kong observatory displaying NOAA contrail photo: [http://www.weather.gov.hk/...](http://www.weather.gov.hk/)
25. Post Sept 11, re. Travis et al study: [http://www.meteor.iastate.edu/...](http://www.meteor.iastate.edu/)
26. Antarctic, groundbased contrails: [http://astro.uchicago.edu/...](http://astro.uchicago.edu/)
27. They got it wrong: "The fact that aircraft con trails may carve up the sky of the remotest regions, or that satellite surveillance can view vulnerable ecosystems in such regions, may also be seen as stripping the wildness from nature by making it "known" in some way. But the con trail is a passing phenomena which may denature nature as effectively as trailing a finger in a river, and what is the knowing achieved through satellite images -- what the satellite perceives may have as much impact on nature as the actions of an unseen voyeur.": [http://laetusinpraesens.org/...](http://laetusinpraesens.org/)
28. Contrails in the austrian alps: "Während der Himmel sein Farbenspiel mit den Wolken treibt, von zartrosa bis orange und dunkel-rot, sind die Kondensstreifen der Flugzeuge noch lange hell erleuchtet.": [http://www.oaav-events.at/...](http://www.oaav-events.at/)
29. Spitzbergen proclaimed free of contrails on Sept 21, 1999: "Nicht einmal Kondensstreifen am Himmel erinnerten an Zivilisation": [http://www.bergwacht-bayern.de/...](http://www.bergwacht-bayern.de/)
30. Moon, ring, and contrail: [http://www.polarimage.fi/...](http://www.polarimage.fi/)
31. Good contrail photo: [http://tpromo.com/...](http://tpromo.com/) from this contrail/chemtrail site: <http://tpromo.com/gk/contrail/>
32. Chemtrail site, California: <http://www.californiaskywatch.com/>
33. Contrail photos by amateur photographer: [http://www.the-meissners.org/...](http://www.the-meissners.org/)
34. AWACS contrails nine days after September 11: [http://www.his.com/...](http://www.his.com/)
35. Othermeanings: A company Jet Contrail: <http://www.jetcontrail.com/>
36. [http://users.iafrica.com/...](http://users.iafrica.com/)
37. From space, Britain could only be seen due to crossing jet-contrails over Heathrow, says british astronaut Piers Sellers: [http://news.bbc.co.uk/...](http://news.bbc.co.uk/)
38. The high cost of low-cost airlines: [http://news.bbc.co.uk/...](http://news.bbc.co.uk/)
39. Texas is "Contrail Country" [http://www.texasdistrictclerks.org/...](http://www.texasdistrictclerks.org/)
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