Special thanks to NASA, NOAA, and all the other people who tolerated my questions during this project.

Printed on recycled paper

**Do you know a real cloud when you see it?**

Since the turn of the millenium, millions of people worldwide have noticed strange clouds created by jet aircraft that "do not look or act like normal clouds." By 2007, Google Search appeared to provide over a million Web pages written by people watching jet "chemical trails" (still scientifically referred to as *condensation trails*).

Actually, the phenomenon of jet contrails spawning clouds is not new; it's just getting much more noticeable as we continue to increase air traffic with larger, faster, higher-flying aircraft.

A large majority of Americans are apparently still unaware that artificial clouds exist, but in many areas, including California, jet clouds are more common than natural ones. If you don't believe that, you're not alone. That's what this report is about: maybe we haven't been paying enough attention.

Most people who are aware of "chemtrails" already know that artificially-created clouds comprise much of the visible cloud cover we see regularly. Some days jet trails are invisible; some days, they fill the sky almost completely. This report illustrates:

**1.** How jet contrails can persist for days and form clouds that affect local and global weather;

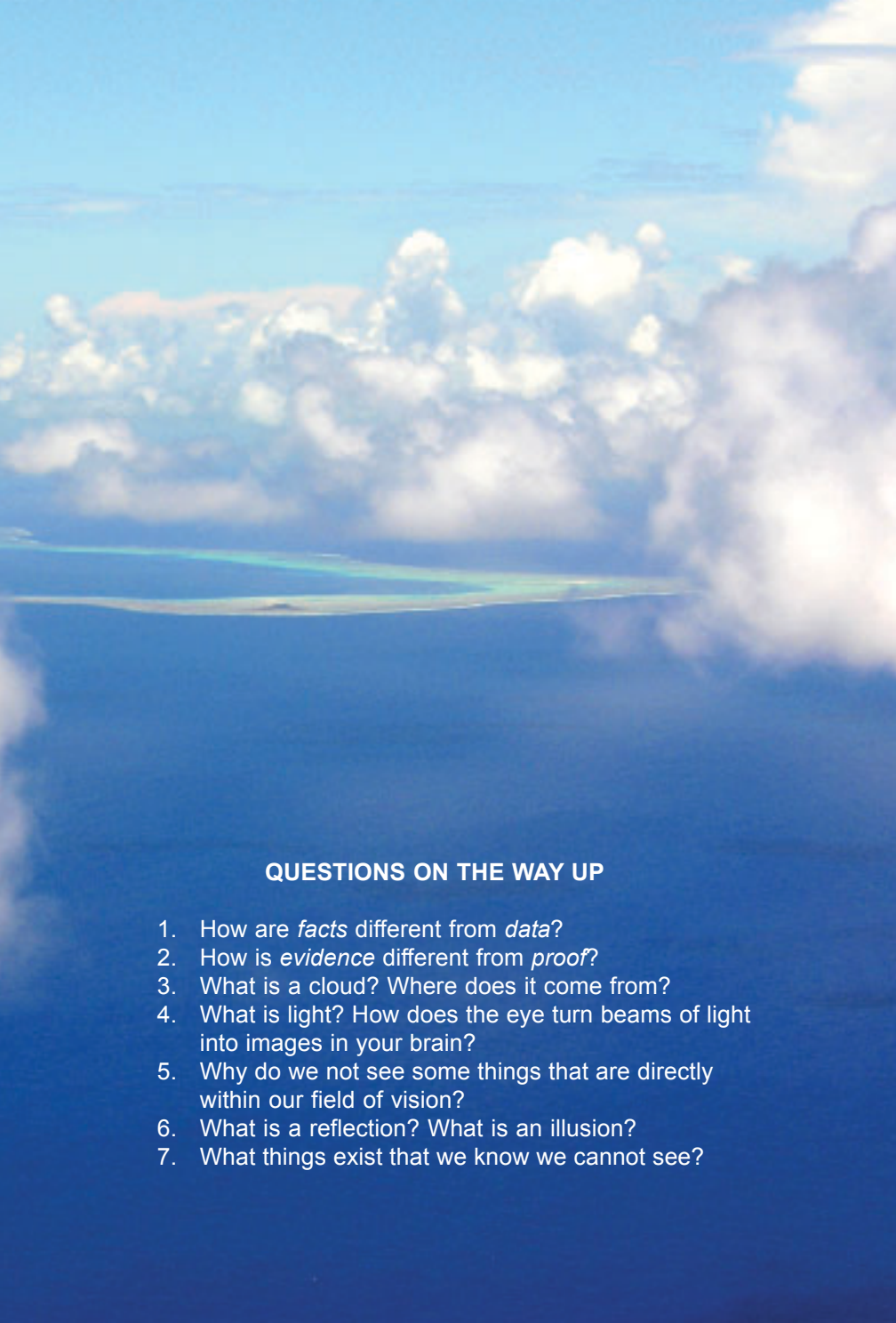
**2.** How jet aircraft and their supporting machines introduce more toxic waste into the air than any other industry;

**3.** How jet aircraft in the stratosphere affect global weather and temperatures, and must be considered in any climate modeling study; and

**4.** Why the United States, as the largest consumer of petroleum fuel products, has an obligation to provide more leadership and resources toward cleaner fuel, non-combustive energy and environmental cleanup.

This is not a complete report, just an overview of my findings, which I'm presenting as simply and accurately as possible. I took all the photos (except where noted). I only call them "artificial clouds" if I personally *watched* them as they were formed by jets...like these. All photos are unretouched.

*Natural clouds formed above Micronesia at 8,000 feet (2005)*



## QUESTIONS ON THE WAY UP

1. How are *facts* different from *data*?
2. How is *evidence* different from *proof*?
3. What is a cloud? Where does it come from?
4. What is light? How does the eye turn beams of light into images in your brain?
5. Why do we not see some things that are directly within our field of vision?
6. What is a reflection? What is an illusion?
7. What things exist that we know we cannot see?

Contrails, Chemtrails and Artificial Clouds



*The satellite photos in this report are courtesy of NASA/JPL.*

# Contents



## RELATED SCIENCE REMINDERS

- The atmosphere, a thin halo of gases and various particulate matter surrounding Earth, is held in place by gravity. Its natural components are nitrogen (78.09%), oxygen (20.95%), argon (0.93%), and carbon dioxide (0.03%) with traces of water, helium, methane, krypton, hydrogen, neon, xenon and ozone. About four hundred humans have been outside of our atmosphere.

- The troposphere, where natural cloud formation generally occurs, is down here, up to 7-17 kilometers from the surface of the earth (lower at the poles); the stratosphere reaches out beyond that to about 50km.

- The *neutral atmosphere* is everything below about 100 kilometers. The *ionosphere* is above that, where the Northern and Southern Lights happen; it contains particles charged with electricity from absorbed UV light. The magnetosphere, the upper part of the ionosphere, shields us from electrically-charged particles bound by Earth's gravity.

- Water comprises up to about 4% of the atmosphere. The total mass of water up in the atmosphere at any given time would cover the globe completely with about an inch of water. Because $H_2O$ has a positive charge on one side and a negative charge on the other, water particles attract each other, making it "wet" when it is liquid or gas, but as ice it acts differently.

- Light travels at over a billion kilometers per hour in a straight line until it hits matter—gas, solid or particles—and then reflects in a specific way. What our eyes see depends on its wavelength, the properties of what it shines on, the point of observation, and what's in between.

**PART ONE:**
A RE-INTRODUCTION TO CONTRAILS

## ILLUSIONS IN FRONT OF US

Once we are familiar with a word, its meaning usually becomes associated with a particular context. We charge words with those specific connotations, so when we try to use them outside of that familiar context, they no longer convey the same meaning. As generations pass, meanings of words become blurred.

In more than one way, *contrails*, which are now more often called *chemtrails*, are a phenomenon unlike anything we have ever seen before, one born of technology and human drive and expansion...and imagination. When we first used the word "contrail," we didn't picture the sky becoming completely filled with artificial clouds. (This photo shows a new contrail being formed among previous trails that are starting to look like natural clouds.)

Contrails have changed.

Whatever your conclusions may be about jet contrails and artificial clouds after reading this, they are in any case a reminder that there are things in our experience as humans that are at once hard to perceive, hard to understand and hard to explain...there are mysteries.

The chemtrails/contrails controversy and the lack of credible information available to the public also illuminates the truth that sometimes a single perspective can't notice everything.

This report is for people who are now asking:

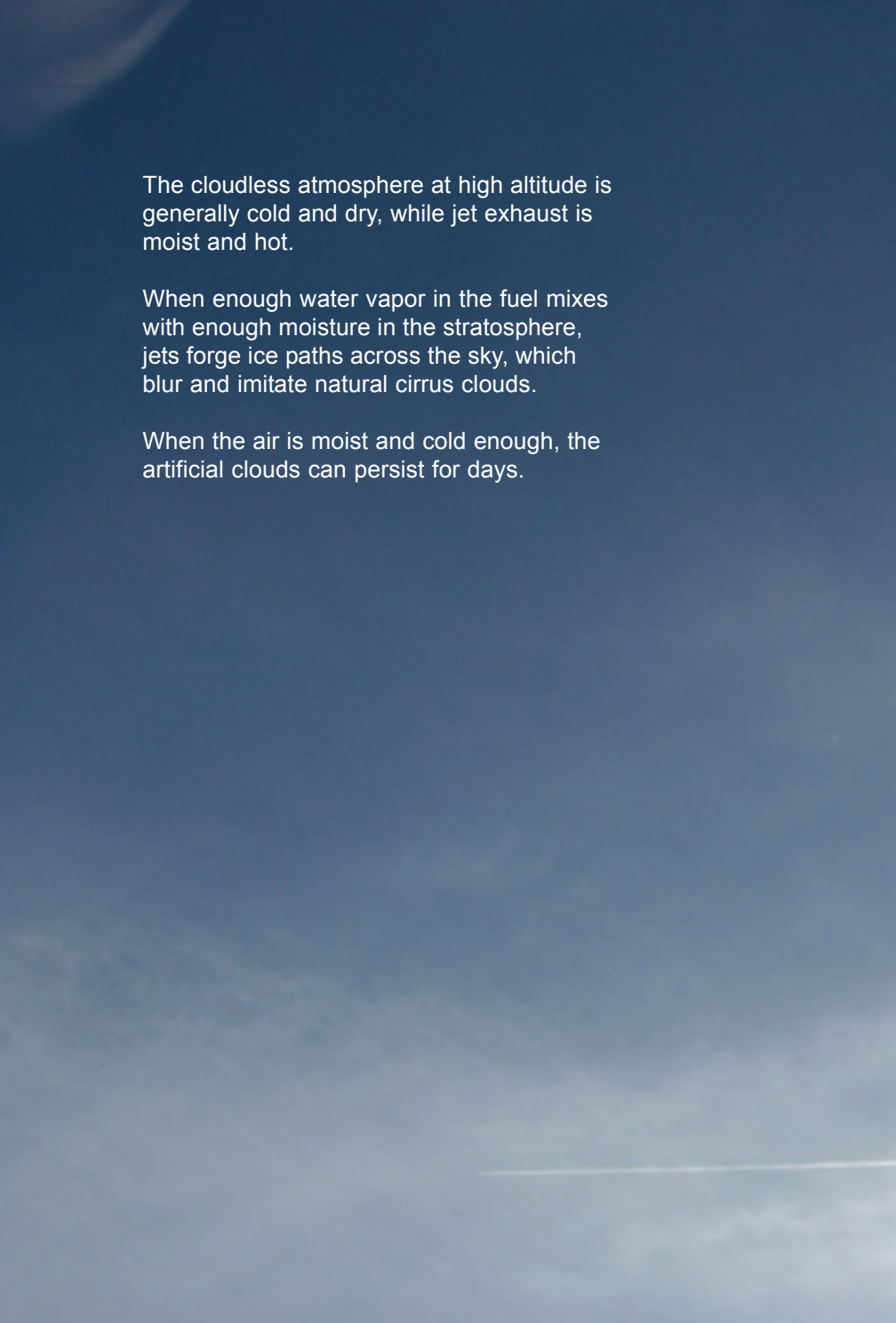
> What *are* chemtrails and chemclouds, exactly?
> Why are they there, and how can they make clouds?
> Why are they so variable and hard to explain?
> Are they dangerous? How should we respond?

In a greater context, the presence of chemtrails *is* natural. It's just us humans, interacting with our environment. And this is our story.

The clouds in this photo (central California) were created by aircraft over a period of about five hours. They are made of stratospheric ice dust. Toward the bottom, you can see how the clouds thicken as they move to the horizon.

In a TV special called *Best Evidence: Chemical Contrails*, aired on February 22, 2007 on the Discovery Channel, meteorologist Terry Kraus notes that California has been seeding clouds for almost 50 years. Cloud-seeding projects take place in over a dozen countries. “We’re trying to use modern technology to extract water,” Kraus said.

Deliberate efforts to produce rain may explain why some areas are densly covered with contrails on a regular basis. But what does jet fuel and its chemical additives do to the air we breathe?



The cloudless atmosphere at high altitude is generally cold and dry, while jet exhaust is moist and hot.

When enough water vapor in the fuel mixes with enough moisture in the stratosphere, jets forge ice paths across the sky, which blur and imitate natural cirrus clouds.

When the air is moist and cold enough, the artificial clouds can persist for days.

**Web of misdirection**

The Internet is elemental to the phenomenon we are discussing, not because chemtrails are created by it or because they don't really exist, but because the "chemtrails" controversy could not have evolved this way before the Internet arrived. The stir about chemtrails didn't really begin until information diffused across the world and people shared their photos and their fears.

Information online about "contrails" is vast, but seemingly disconnected from the growing number of worrisome observations, and in complex English with a jargon lining. The science papers that are easy to find are overly complex and the conclusions nebulous. On the other hand, information about "chemtrails" found on the Web is a very unlibrary-like mish-mash of ground observations, speculative renderings and even snake oil for sale.

The Web is only beginning to provide us with a superspective; it is a long way from complete. We may think we can get any information anytime, but with the Internet only in its second decade of popular use, it is missing a lot of dots, and they are difficult to connect on this complex matter. This is not to say that accurate information doesn't exist within the Web, but much of it is not grounded in reality, and accurate reports are not readily accessible to the average person in a simple, plausible summary. Interestingly, the Web itself provides us with a glimpse of ourselves with its metaphor: whether our search term is "chemtrails" or "contrails," we can only find what we are looking for.

To really find out what's going on, you have to pay attention again to a whole bunch of things we hate thinking about. After about five minutes of surfing around government sites like the EPA, DOT and FAA, our brains will try to compel us to watch Comedy Central. Let's start with something easier: can you identify the naturally-formed clouds in this next picture? It has both natural, puffy tropospheric clouds and artificial clouds formed in the stratosphere above them.

Clouds formed by jets in the stratosphere are made of tiny ice particles scattering, usually higher than about 25,000 feet.

Natural clouds usually form in the troposphere, rarely above about 20,000 feet, and usually much lower.

Some cirrus clouds form naturally at high altitudes, but a growing percentage of overall cloud cover is from jet aircraft.

Fifty years ago, Earth's stratosphere did not have thick layers of jet clouds.

Most people who have not watched chemtrails turn into clouds would probably think those clouds are all naturally formed. Most people who *have* watched jet contrails turn into clouds would probably still agree.

Most people who have studied contrails carefully would probably say the high clouds are stratospheric and were left by jets, and the puffy clouds that are lower are naturally-formed ones.

But a NASA scientist or extremely well-informed meteorologist would probably say it's hard to be sure; the problem with identifying the original source of any clouds is that any water-based cloud in the sky needs a "seed" to get started. A *cloud condensation nucleus* (or "cloud-forming nucleus") is an aerosol—a particle bigger than a normal molecule but small enough to pass through a membrane, and small enough to be suspended by air. These nuclei begin the formation of clouds.

Before humans interfered (which is only *very* recently on a geological scale of five billion years or so), there was already enough particulate matter blowing around to create clouds: dust, salt, ice... a cloud nucleus can be made of almost anything. With our species stirring up such a ruckus down here on Earth, clouds are also incubated by a multitude of other things, and a lot more frequently. Apparently we can't help but make clouds. But aside from volcanoes, only jet aircraft and rockets, both of which produce extremely toxic gas emissions, actually provide anthropogenic (human-made) cloud-forming nuclei in the stratosphere.

And according to NASA, *clouds that we inadvertently make can prevent the formation of natural rain clouds*. Artificial clouds can also change on-the-ground weather, by shading large areas of land and water, and chilling the air below.

This is just one reason why *aerosol-cloud interaction* is an area study which is of great interest to NASA: the tremendous influence humans have had on the quantity of particles available that can create clouds. In fact, that influence causes even bigger problems. But back to the artificial clouds...

**No such thing as "plain sight"**
If you have ever caught a lobster, you know that most scuba divers will never see one. If you don't know what to look for, they'll see you first and back down into their holes.

It's the same with clouds formed by jets: unless you know what to look for, you will not notice them. Most people haven't. (According to NASA's Langley Research Center, the earliest reports of contrails came shortly after WWI, when detecting enemy aircraft was the big concern about jet trails...but contrails didn't persist noticeably and go on form clouds then the way they do now, with so many stratospheric flights today.)

I was first trained to observe the sky as a lookout on a U.S. Navy ship. I did not really pay attention to the jet trails; our military operations were generally far outside normal commercial flight paths and I was looking for ships and planes, not looking at clouds.

Later, as a navigator on the ship, I learned to observe and record weather patterns. I did not notice long-persisting jet trails that formed clouds until 1991, when I was at the beach in Santa Barbara and watched as a sunny blue day turned gray by noon, the sky completely covered by persisting, expanding jet clouds.

**Theories**
By about 2004, millions of Web pages had been created about "chemical trails" (1,880,000 on Google, 1,330,000 on Yahoo! Search, as of February 2007).

It is unprecedented that so many people write about a universal subject in speculation, and amazing how many theories there are (all of which are "the truth") with a lack of publicized responses from official or even credible sources.

At Answers.com you can read about theories involving deliberate poisoning to decimate the population, government sunscreen programs—even spiritual suppression. I have no wish to disprove them, and I doubt anyone can. The critical point is that jet clouds present a growing danger to human life, no matter which of the conspiracy theories is true or false.

**The jet trail phenomenon has been with us for years, growing quietly, unnoticed by our occasional glances at the sky. We see “clouds.” But they aren’t ordinary clouds. All of these clouds were made by jets, including the gray area at the bottom of the photo.**

## OBSERVATIONS

**Artificial clouds around the globe**
Stratospheric jet trails—or *ice crystal wakes*— can persist all day *on some days* and form clouds. If environmental conditions are right, ice wakes can in fact cover a large section of a continent with clouds.

Until we watched this for ourselves, we would not believe it: a trail growing and widening over the hours, blurring into other trails until they no longer resemble trails at all... just strange clouds. We know that a prolonged change in global cloud cover will affect Earth's climate, but no one can predict exactly what the long-term impact these additional clouds will have on the climate and on humans and other species. Private sector and government scientists should be more interested in chemtrails (still euphemized in news reports and most science papers as “contrails”), not only because of their affects on the sky and cloud cover, but also on the weather, climate change, and health.

**Ice wakes and ice clouds**
Visible, persistent jet trails are not simply “chemical” trails or “condensation” trails. Ice wakes are literally ice crystal paths forged by planes. This happens when jet engines, which burn at thousands of degrees Fahrenheit, move at hundreds of miles per hour through sub-zero-temperature air, diffusing any moisture in the fuel and air into tiny super-frozen particles.

The basics of this part are pretty straightforward: engines burning that hot completely and instantly vaporize any moisture in the fuel. When the fuel is burned, the carbon combines with oxygen to form carbon dioxide; the hydrogen also combines with oxygen to form water, which emerges as steam in the exhaust.

For every gallon of fuel burned, approximately one gallon of water is produced, in addition to the water already present as humidity in the air used to burn the fuel. In the super-freezing temperatures, the wind-wake spreads the ice dust across the sky with the force and wind chill factor of a nuclear explosion.

Jet contrails appear with the right combination of temperature and moisture above about 30,000 feet. On days when contrails are visible, a vessel can be ascending and accelerating into an altitude cold enough to create a thick, visible wake while *appearing* to be heading downward because of our awkward perspective on its trajectory. This jet is gaining altitude, burning the most fuel while it climbs.

On some days, brilliant trails can develop at lower altitudes, so if two identical jets fly at different speeds and altitudes, one might leave a persistent trail while the other isn't in a cold enough environment to form a persistent ice wake.

**Confounded vision**

What we see from the ground are multiple illusions. First, the ice clouds are usually much higher than they appear and higher than normal clouds—generally over 25,000 feet and often at 35,000 or 40,000 feet.

Ice wakes are formed in a very cold environment, so they don't just melt right away. Instead, the wake of the aircraft can become a widening, moving band of tiny ice crystals, floating down slowly as the wind shreds it and pushes strands in different directions as they grow and spread. Ice clouds in the stratosphere are also much bigger and shinier than you may first imagine.

To further complicate our observations, these newly-forming clouds stratify at varying altitudes, spreading in different patterns and directions until they lose their recognizable long shape and become blobs or streaks of varying shades of white and gray, blotting out the sky completely on some days.

The artificially-created ice clouds appear to darken as they stack together on the horizon, blocking each others' reflections, and then move on. Sometimes the ice clouds become transparent at night, when direct sunlight no longer reflects from their surfaces. But you may notice that on bright nights with a full moon you can still watch their formation.

Another illusion is that it looks like the pilot can "start it and stop it," but if you realize that we are seeing light reflecting from "white" clouds of super-frozen ice dust, you can probably also see that when a jet's trail seems to stop and start, either warm currents of air are disrupting the path of a frozen wake or—more frequently—it is because shadows of other trails fall on the trail you are watching, creating the appearance of a "blank" spot where light does not reflect from it. This illusive characteristic alone is enough to cause an observer to believe the planes' visible trails are optional, but in fact, in most cases, some planes' wakes are invisible because moisture is too low or temperature is too high to form ice wakes. Jets also can dump excess fuel before landing to reduce weight, and sometimes the dumped fuel is visible in the air.

This satellite photo shows the glaring truth: aircraft are directly affecting the weather.

The highly-reflective clouds created by jets have an immediate cooling effect, shading vast areas of the globe. (According to Tim Flannery, author of *The Weather Makers*, when the US grounded all planes in 2001 between September 11 and 14, the global average temperature rose abruptly by 2 degrees Fahrenheit.)

However, these toxic stratospheric clouds also absorb and re-emit solar energy, warming the stratosphere; and greenhouse gases introduced by jets into the upper atmosphere cause additional heat to be trapped, preventing its escape into space and ultimately warming the Earth, altering our climate.


NASA

A group of amazed observers watched as *all* of this sky cover was formed by jet aircraft over a period of about seven hours, in September 2005.

**Human technologies, human problems**
Visible ice wakes and artificial clouds are growing in number and impact, and more people are starting to notice them. Planes fly faster and higher than ever before, with engines thrusting hotter than ever before, and every decade for a hundred years now, our air traffic has increased dramatically.

The only clouds that might form naturally at the high altitudes where jets fly are thin cirrus clouds. But most people who see the sky full of thick ice clouds from jets would think they are naturally formed.

Does this scene look familiar? If you already recognized that all the clouds in the photo are artificially formed, even those at the very bottom of the picture, you are far more informed than the average person in America. Most people I have asked do not recall ever watching a jet trail for more than a few minutes.

**Environmental variations**
The chemtrail phenomenon manifests differently every day due to environmental conditions. In order to see contrails, it must be moist and cold enough. To understand why ice dust clouds would persist, we have to realize that the sky in the stratosphere where the jet is flying is extremely cold—well below zero and sometimes minus fifty degrees (F) or colder.

This is not to say the ice wakes are only visible on cold days. every day on Earth has a unique fingerprint, with different wind, moisture and temperature patterns at every level of the sky; it may be a warm day on the ground, but it's still frigid at high altitudes.

**Behavioral variations**
If you study these planes carefully with a telescopic lens, you will probably see that they are mostly commercial jets... unless you live in an area with military jets, which usually have very different flight paths. If you see military jets, you are unlikely to see a lot of commercial air traffic in that same airspace, so you'll probably see one or the other (though sometimes air space is shared by both at different times or altitudes).

But military or civilian, jets have about the same effect on the right days. Other days it's cold enough to form a trail, but not cold enough to make it persist and it scatters more quickly. Large, thick clouds can form if conditions are right. The base factors for visible jet trails are 1) airship's velocity, 2) the environment in which it flies, and 3) the jet engine combustion process, which is complicated by variations in fuel additives. Additives like colloidal metals would most often create larger, plumier trails (but few people could test that); silver iodide is used for cloud seeding, and some metals can also be used as lubricants.

The turbine engine, designed by Englishman John Barber in 1791, used a compressor, combustion chamber and turbine wheel, the same basic components used by modern jet engines. Today's jets attempt to achieve as much thrust as possible by producing turbine *inlet temperatures of over 2,300°F*, or 1,300°C. The exhaust nozzle converts potential energy into thrust, the fastest planes achieving enough velocity to exceed the speed of sound… which in the air at sea level is about 658 knots, or over 750 miles per hour.

To maintain their cruising speeds of about six hundred miles per hour, big jets each have to carry *30,000-60,000 gallons of fuel*. If your car's gas tank holds 18 gallons, a large airplane holds more than 2,500 times that much fuel.

How much faster does a jet burn the fuel up, compared to your car? At 30mpg, you would use about two gallons per hour. The new $300M Airbuses, commissioned in 2006, use a gallon of jet fuel *every four seconds*. And to be profitable, large commercial planes must fly continuously, refueling their gigantic tanks daily, and resting only for maintenance.

If a 747 jet uses two-thirds of its tank over a ten- hour flight, it might use about five gallons or so per mile. On the other hand, if it is carrying 500 passengers, that's about 100 miles per gallon on a per-person basis. Still, they are going much further than your car (more on this next chapter) and they are not always full.

**Communication gaps**
The reason it might seem like we get the run-around from agencies and all the other “officials” we talk to has a lot to do with how we ask the questions... and apparently that few people at the local level have all the pieces to the puzzle.

For example, when I first talked to a meteorologist in California, he explained the “condensation trail” principle, but he did not believe that all the clouds we saw that day all came from aircraft... though my neighbors and I watched it happen over a period of half a day.

Though thousands of official and scientific reports on these subjects are freely available through government agencies and commercial organizations, I couldn’t find anyone with a complete picture of this fascinating phenomenon.

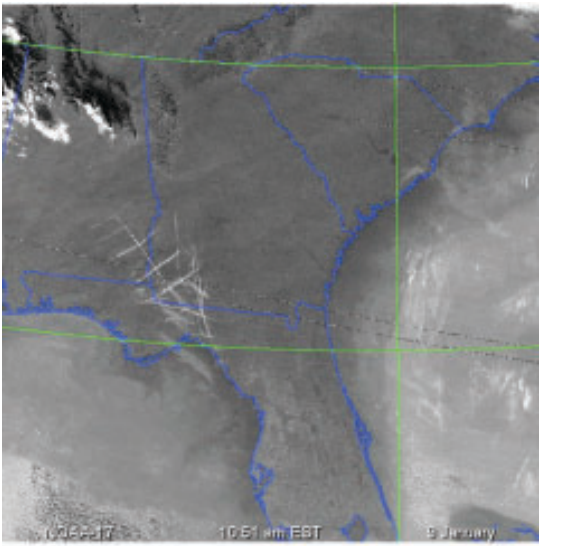
This old snapshot is one of many taken from my ship in the 1980s that shows contrail clouds. But the satellite photos, publicly available in NASA’s image library, tell a lot more about the patterns of the clouds they form.

Jet trails in the sky are not just an American problem. This satellite photo shows a European airway incubating clouds over thousands of square miles.

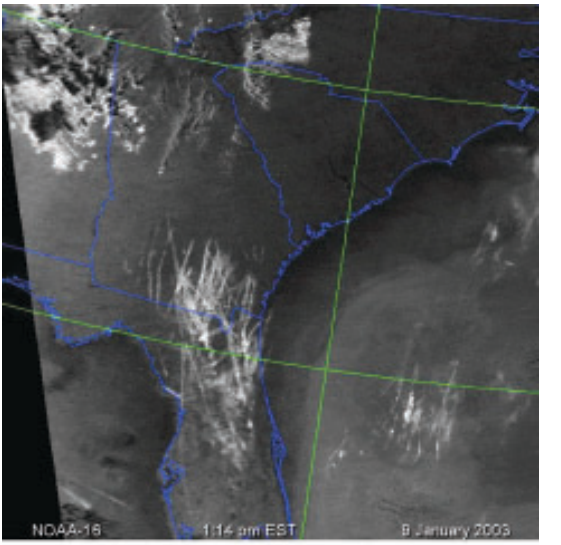
*NASA*

**Tracking Contrails**
From the perspective of a single location, contrail clouds seem to disappear. But often they just moved to another region.

**10:51am**
These satellite photos from NASA on January 29, 2003 illustrate the development and movement of contrail clouds as they form, blur and move across the horizon to neighboring states.




**1:14pm**
Over a two and a half hour period, contrails form and thicken, moving along stratospheric paths. They disappear from sight by late afternoon in some areas, but loom on in others.



## CLOUDSAT

Clouds can cool our planet by bouncing sunlight back to space and, according to 2006 NASA research, can also create a warming effect at the same time because of their ability to absorb and reemit heat.

By modulating the distribution of heating within the atmosphere and at the surface, clouds fundamentally influence our sky, ocean and climate. As we have seen, aerosols affect where and how clouds form, and how much rain falls.

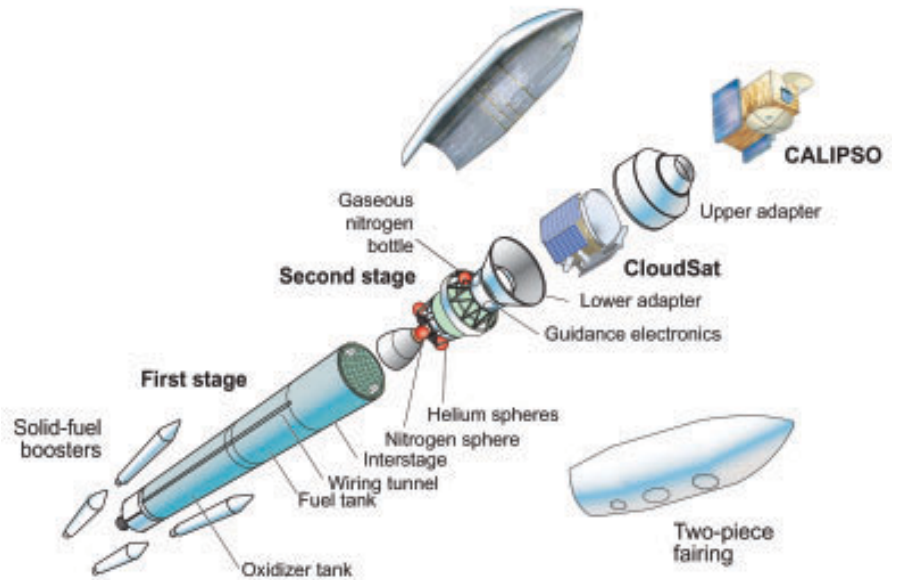
April 28, 2006, NASA launched two new satellites from Vandenberg Air Force Base specifically to study how aerosols affect clouds and precipitation. *CloudSat* and *CALIPSO* (Cloud-Aerosol Lidar and Infrared Pathfinder Satellite Observations) will give us a new 3-D view of Earth's atmosphere. The satellites will answer questions about chemtrails: how clouds and aerosols form, evolve and affect water supply, climate, weather and air.

CloudSat and CALIPSO will provide the first space-based global survey of cloud and aerosol profiles and physical properties across seasonal and geographic variations. Together these observations will help our scientists to see clouds and aerosols interact in global models, ultimately contributing to an improved view of weather, climate, and cloud-climate dynamics.

*Says NASA*: “CloudSat seeks to overcome shortcomings in our understanding of how cloud processes influence climate and will provide the observations needed to accurately characterize these processes and validate climate model predictions. These observations are a significant advance over present cloud observing capabilities.

“The objective of the CloudSat mission is to provide, from space, the first global survey of cloud profiles and properties with seasonal and geographic variations, needed to evaluate the way clouds are parameterized in global models, thereby contributing to predictions of weather, climate and the cloud-climate feedback problem.”

The Principal Investigator for the science team is David Winker of NASA's Langley Research Center, in collaboration with French scientists, the Air Force, DOE and numerous universities.




The $185M CALIPSO mission is a 22-month, multi-sensor satellite experiment that will fly with the "A-Train," a group of several other Earth-observing satellites. The mission's three broad objectives are:

1. To quantitatively evaluate the representation of clouds and cloud processes in global atmospheric circulation models

2. To quantitatively evaluate the relationship between the vertical profiles of cloud liquid water and ice content and the radiative heating of the atmosphere and surface by the various cloud systems

3. To evaluate cloud properties retrieved from other satellite systems

You can see Cloudsat updates at calipso.larc.nasa.gov.

**Preliminary deductions**
What we are discussing, to begin with, is *ice dust wakes and clouds caused by jets flying in the stratosphere.* Ice dust wakes persist on many days, depending on conditions, and incubate other clouds via particles of ice and pollutants which provide cloud-forming nuclei.

The phenomenon of jet trails and clouds we can observe from the ground is a combination of the physical principles of *speed, temperature, and moisture reacting with light* under the right conditions to form large areas of sky cover.

The difficulty we have recognizing this immediately is that from the ground *you can't tell how high they are*, and we are used to thinking of clouds as hovering much closer to the planet's surface... and imagining them as water, not ice.

In other words, the artificial clouds formed by ice wakes are much higher, larger and colder than they appear. They are also much drier, as they are made of super-frozen "ice dust," so they don't really act like "normal clouds" either. The texture of one of these clouds is probably more similar to the light snow dust that blows from atop the highest high mountain peaks.

Again we see the tricks inherent in our limited language: a word can create an impression, and therefore a way of looking at something.

Based on our previous experience with the word *condensation*, which means "the change of water vapor into a gas or liquid," we expect clouds to be wet. Stratospheric clouds are not wet, and cannot behave the way a low, naturally-formed cloud would.

Combined with the misleading distance, and the light tricks, and our lack of perspective, and our limited faculties for perception, and the missing information, and our busy lives... considering *all the things working against clarity*, maybe this multi-faceted phenomenon involving crazy conspiracy theories evolved the only way it could have.

Stratospheric clouds aren't "wet;" their texture is more like dry, powdered ice.


NASA

Some people believe health problems are related to chemicals or colloidal metals like barium and aluminum added to fuel to create thicker, more reflective plumes, or possibly to cause them to form at lower altitudes...but no one has offered any real evidence besides high levels of these metals appearing in water sources, which are not proven to be caused by jet emissions.

Most scientists will agree that anything is possible, but it seems unlikely that “someone” mixes other strange chemicals with the fuel to deliberately exterminate us, either. Both of these variations of the same rapidly-spreading theory have motives and delivery models that don’t make sense to me for too many reasons to list. Jet fuel is probably mixed to maximize profit and thrust. (More on this next chapter).

But whether conspiracies are true or not, there would still be ice dust clouds in the stratosphere, and in this report I am referring strictly to the wide-spread jet trails that create varying quantities of global cloud cover. Considering that, even if we are not being “deliberately sprayed” we still have a problem: whether you can see trails or not, jets are there every day.

It may not the part we can see—the ice—that presents the biggest problem. Our most urgent problem might be that *we are introducing large quantities of toxic chemicals* into the air we breathe. Ozone depletion aside, the invisible gases rapidly collecting in the air we breathe *and* in the stratosphere should be of concern to human life.

Considering the impact of the large areas of reflective surfaces created by jet wakes is a tricky study, because they not only cause light to reflect away from earth, at night clouds have a blanketing affect that helps the Earth stay warm.

We do not know what long-term climatic effects the ice clouds and other artificially-formed clouds will have. Still, the impact of jets on global warming could be greater than all other contributing sources combined. The exact amount will always be debatable, but considering the facts that jets are the only machines we have that spray greenhouse gases directly into the stratosphere, and require many, many other machines and factories, it’s a much bigger problem than we want to believe...

Gravity means that those chemicals, as well as the frozen particles comprising the ice clouds, are earthbound, and *after these chemicals mix with tropospheric clouds, they ultimately wind up in our air, water and soil.* We *are* in effect "spraying" toxic chemicals on ourselves from above. The fact that planes fly high in the air seems less important than the fact that all the pollutants eventually fall down on us. Meanwhile, the greenhouse gases that are lighter than air remain trapped precisely where we don't want them to be. To conceive the quantities of fuel used by jets, consider:

> **If one car**, over 10 years, at 30mpg, drives 15,000 miles per year, that equals 500 gallons of gasoline per year. That's 5,000 gallons of gas consumed in ten years. (Gasoline contributes about 19.5 pounds of $C0_2$ emissions into the atmosphere per gallon burned.)
> **If one 747 Jet**, over 10 years, refills its tank only once per day on average, it would consume 176,824,250 gallons in ten years. (Jet fuel contributes about 21 pounds of $C0_2$ emissions per gallon burned.)

The jet will use more than 35,000 times the amount of fuel as the car over ten years, and contribute more than 50,000 times the amount of $C0_2$ as it makes clouds...3,713,309,250 pounds of $C0_2$, high into the stratosphere.

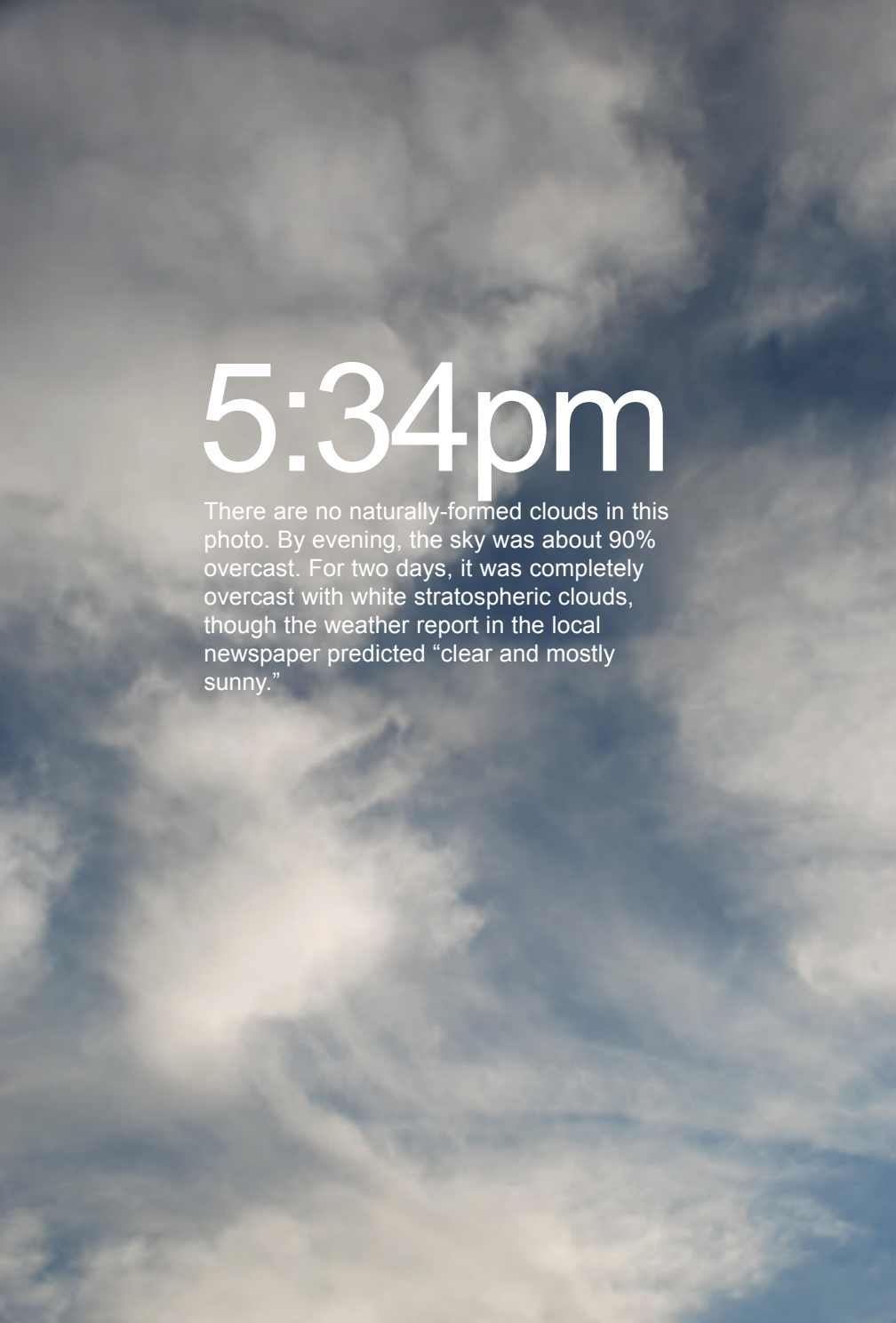
Most people are missing this and don't notice that jets make huge clouds, because to actually see jet trails forming clouds requires watching a single contrail turn into a cloud and linger until it looks like a real cloud and finally drifts off to the horizon—attention that most people do not take time for.

It is very difficult to get an accurate visual sense of the scale of artificial clouds from the ground, from satellite pictures, or even from a helicopter or airplane, and we can see how our lack of a complete picture and difficulty describing such an inconsistent phenomenon can blow us in the wrong direction. But it seems important that we are not misdirected from the real dangers. We discuss industrial pollution in our rivers and oceans, but it doesn't occur to most people that jet pollution is in *all* outdoor air, even when we can't see it.


8:51am
March 2, 2007; blue skies; jets have begun
laying paths on a typical “chemtrail day.”


11:40am
Line patterns begin to blur and look like natural clouds. By noon, the sky is about half covered as the contrails scatter.


3:31pm
Contrails gather mass. The sky is about three-quarters covered.

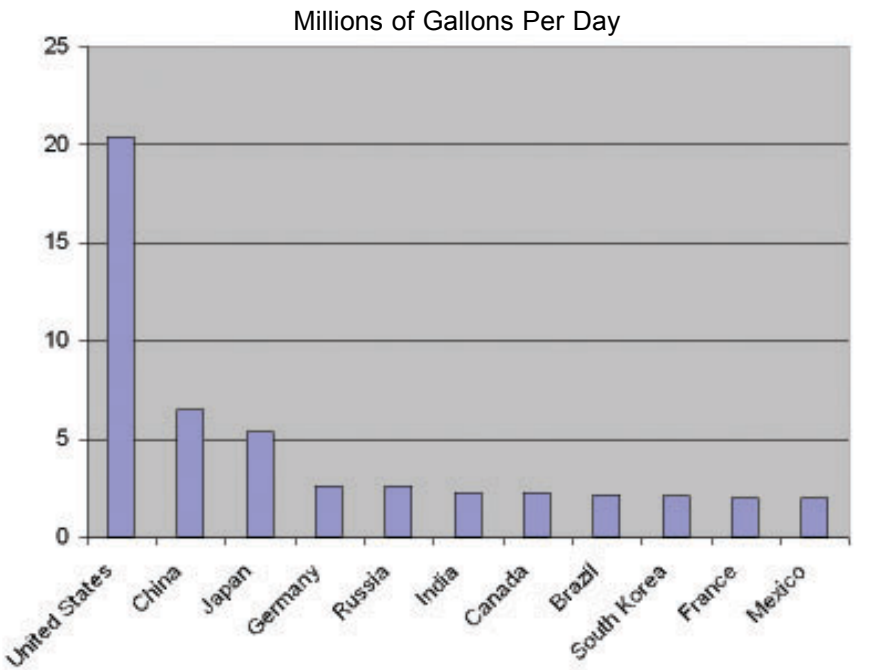

5:34pm
There are no naturally-formed clouds in this photo. By evening, the sky was about 90% overcast. For two days, it was completely overcast with white stratospheric clouds, though the weather report in the local newspaper predicted “clear and mostly sunny.”

# PART TWO:
# CONNECTING FLIGHTS

Because science is inseparable from the rest of human endeavor, it cannot be discussed without making contact, sometimes head on, with a number of social, political, religious and philosophical issues.

*—Carl Sagan*

**TOP OIL CONSUMERS WORLDWIDE**
2004




Source: *Energy Information Administration*

## QUICK AIRCRAFT STATS

- As of 2006, there were 219,000 general aviation aircraft based in the United States, according to the General Aviation Manufacturers Association.

- In the U.S., general aviation aircraft (not including military) in 2005 flew over 28 million hours. Annual general aviation operations alone in the United States alone totaled 87.7 million. Business trips comprise nearly two-thirds of the hours flown.

- According to the Air Transport Association, we burned 19.5 billion gallons of jet fuel in 2005 (over 50 million gallons daily)... in the United States alone; U.S. airlines consume about 1.6 million barrels of jet fuel on a daily basis. The FAA predicts that through 2030, aviation activity will continue increasing at over 3% annually.

- Worldwide, there were over 4,200 aircraft manufacturers in business in 2005 and about 4,000 paved general aviation airports open to the public in the U.S.

- General aviation directly contributes more than $41 billion ($102 billion indirectly) to the U.S. economy annually, but the U.S. airline industry posted a $10B loss in 2005.

- In the last decade, the airline industry delivered over 500 million television impressions “designed to create and reinforce a positive message”—aside from individual airline advertising—as well as several hundred million “motivating and engaging media impressions through radio, television, and magazine and newspaper coverage, including major outlets such as *TIME*, *Forbes*, and *Business Week* about general aviation, personal flight, and its many benefits.”

*Department of Defense*

## SEEKING THE DRAGONS

**Switchfacts**
If a medieval knight in shining armor was seeking dragons and found dinosaur bones, he would consider dragons a fact, even if he didn't believe in them previously. In fact, many facts are no longer facts: the Earth being flat, phrenology, the impossibility of flying through the air and, most recently, to other planets (in 2007 we discovered large quantities of ice on Mars). Faster and faster, facts change.

But our human pattern is *not noticing accelerated change... and often not believing it*. Now we're moving so fast as a culture that we have to fix mistakes quickly. This mistake is a becoming a big, dirty problem, and a lot of scientists think we have tipped Earth's atmospheric balance to the point where we can't ever restabilize it.

The facts about contrails and air travel have changed. Previously considered temporary sky litter, today's jets flying in the stratosphere are greater in number and use more fuel than ever. Constrained by economics, airlines plot their courses based on costs associated with airspace fees, competition, demand, and other non-conservational criteria.

**Global Heat**
This is the first time in known history that we have millions of aircraft flying around the planet. And aside from the obvious toxic-air problem of having many thousands of jets flying around the globe at any given time... why would we ever think injecting greenhouse gasses directly into the stratosphere would have no effect on Earth's natural weather patterns and temperatures?

We have two clear problems related to aircraft: new, highly toxic chemical compounds in the air, and the warming effects of lighter-than-air gases that rise to the top atmosphere, where they are trapped, increasing in mass and ability to trap radiant heat. Since we are introducing these gases directly into the upper atmosphere, this seems worth looking at more closely.

It may not be easy to accurately tally all the planes in the whole wide world, but according to a 2006 General Aviation Manufacturer's Association report (GAMA represents 56 leading aircraft manufacturers) there are over 200,000 general aviation aircraft in the United States alone. Our US-based commercial planes are provided by 124 airlines that carry 658 million passengers annually, collectively flying over 28 million hours each year. And rising. This does not, of course, include military aircraft.

While cars might still *appear* to be the largest direct contributor to our air toxicity (burning about nine million barrels per day), the 1.6 million barrels a day added by jets (Source: US Energy Information Administration) rains down on us (and the light gases emitted stay trapped in the upper atmosphere).

This view of the quantities still doesn't give us an accurate picture for several reasons. One reason to begin with is, while a "barrel" is 42 gallons of crude oil, when it's processed we realize a five or six percent gain, further complicated by the fact that energy is required for processing. We also have to look at what gains are made with additives in jet fuel production, and few people know exactly what's in it.

But this is a small variable compared to the incredible number of machines that exist only to serve aircraft. For example, the Air Transport Association reports that just in the United States, commercial planes used about 19.5 billion gallons of jet fuel in 2005, which itself must be transported by trucks and ships. The jet fuel alone accounts for over 50 million gallons each day, just in America.

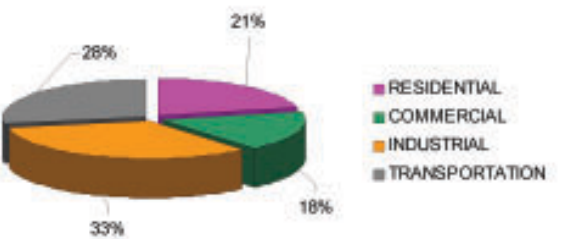
We should be keeping in mind that the number of cubic feet of breathable air surrounding Earth is finite while we look more closely at this picture, which seems more and more related to global temperature increases. ("Finally, we've reached a point where the actual changes in the world have become sufficiently clear," comments James Hansen of NASA [*Santa Barbara Independent*].) The American public may still not be convinced, but we'll be watching the sea levels rising at about an inch and a half per decade as we continue accelerating toward the hottest period in human history.

NASA

The U.S. Energy Information Administration, the agency that provides our official energy statistics, reports that we are up to about *ten quadrillion BTUs of energy use annually.* Like the stratosphere, this number is so far outside our normal reality that it sleights our understanding.

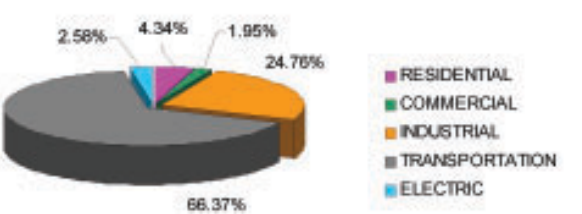
The EIA predicts ongoing increases in petroleum product use through 2030. In 2004, the United States used an average of *over 20,500,000 barrels of oil per day*. More than a quarter of overall BTUs went to transportation needs.

**U.S. ENERGY CONSUMPTION IN 2004**




More significantly, two thirds of that went to *combustion engines* that provide locomotion so we can move stuff around. (Source: US Energy Information Administration Annual Review, 2005; complete data for 2006 is unavailable at the time of this printing.) Aircraft are still a growing part of transportation fuel.

**U.S. PETROLEUM CONSUMPTION IN 2004**




About seventy percent of our energy is produced domestically, (but much of our oil fuel is not). It also seems worth noting that *two-thirds of our electrical energy input is lost in conversion*.

## THE GLOBAL NUTSHELL

You may have been trying to get a handle on “global warming” since the term first began to proliferate in the 1990s, but found that different descriptions and theories don’t seem to agree. Me, too. The EPA reports that two new climate modeling studies noted in *Science* (24 March 2006, pp. 1747-53) suggest global sea levels could rise faster than previously thought... while certain scientists claim they don’t believe it at all. But most scientists globally agree that the Earth’s climate is heating up, and humans are the primary cause.

Scientists recognized in the early 1960s that concentrations of carbon dioxide in the Earth’s atmosphere were increasing every year. The Intergovernmental Panel on Climate Change, the group of scientists commissioned by the UN, says there is new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities.

But the President’s statement (George Bush, June 11, 2001) that the surface of the Earth “has risen by .6 degrees Celsius over the past 100 years” trivializes the real point: What about the last *ten* years? And how about the next ten?

We would much rather hear the perspective of the Oregon Institute of Science and Medicine, which is a non-government, non-university “institute.” They say that predictions of harmful climatic effects due to future increases in minor greenhouse gases like CO2 are in error, and that the global warming hypothesis has “failed every relevant experimental test.”

What we must decide is whether we believe this because the evidence supports that conclusion, or because of its glaring “truthiness.”

The problems and challenges of energy sustainability and security are complex and intimidating, and we should beware of our congenital tendency to ignore the data that we don’t want in the way of the pre-conclusions we have. If we ignore this problem any longer, we will lose any chance we have to fix it. We need drastic, collaborative change quickly.

The consumption of energy in the form of fossil fuel combustion is the largest single contributor to greenhouse gas emissions by humans, in the United States and the rest of the world. Of the total 2005 U.S. carbon dioxide emissions (adjusting for U.S. Territories and bunker fuels), 98 percent, or 5,903.2 MMT, resulted from the combustion of fossil fuels—0.3 percent more than in 2004.

This chart shows emissions of greenhouse gases in terms of the full molecular weights of the native gases. Emissions of carbon dioxide and other greenhouse gases are given in carbon dioxide equivalents. In the case of carbon dioxide, emissions denominated in the molecular weight of the gas or in carbon dioxide equivalents are the same.

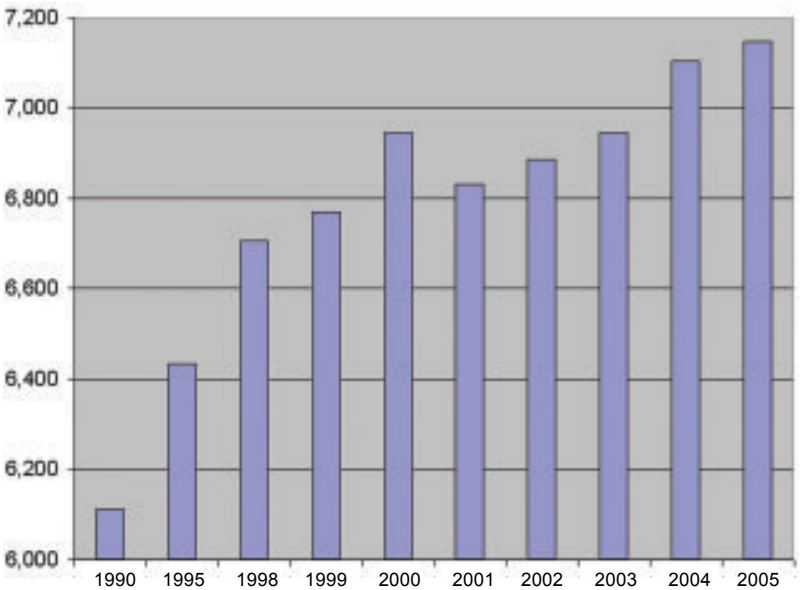
According to the DOE, during 2005 approximately 83 percent of total U.S. greenhouse gas emissions consisted of carbon dioxide from fossil fuels. Emissions data are reported here in metric units, as favored by the international scientific community. (One metric ton is 1.1 English short ton.)

CO2 emission sources include energy-related emissions (primarily from fossil fuel combustion) and emissions from industrial processes. The energy subtotal (5,945 MMTCO2e) includes petroleum, coal, and natural gas consumption and smaller amounts from renewable sources, including municipal solid waste and geothermal power generation.

The energy subtotal also includes emissions from non-fuel uses of fossil fuels, mainly as inputs to other products (from *Emissions of Greenhouse Gases in the United States 2005,* Energy Information Administration, November 2006).

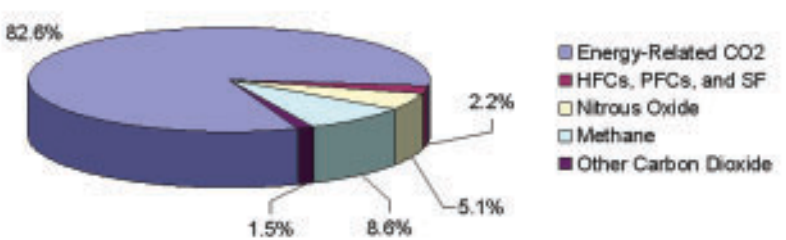
*Carbon dioxide equivalent data can be converted to carbon equivalents by multiplying by 12/44. Emissions of other greenhouse gases (such as methane) can also be measured in carbon dioxide equivalent units by multiplying their emissions (in metric tons) by their global warming potentials (GWPs). Carbon dioxide equivalents are the amount of carbon dioxide by weight emitted into the atmosphere that would produce the same estimated radiative forcing as a given weight of another radiatively active gas.*

**U.S. Emissions of Greenhouse Gases**
Based on Global Warming Potential
(Million Metric Tons Carbon Dioxide Equivalent)

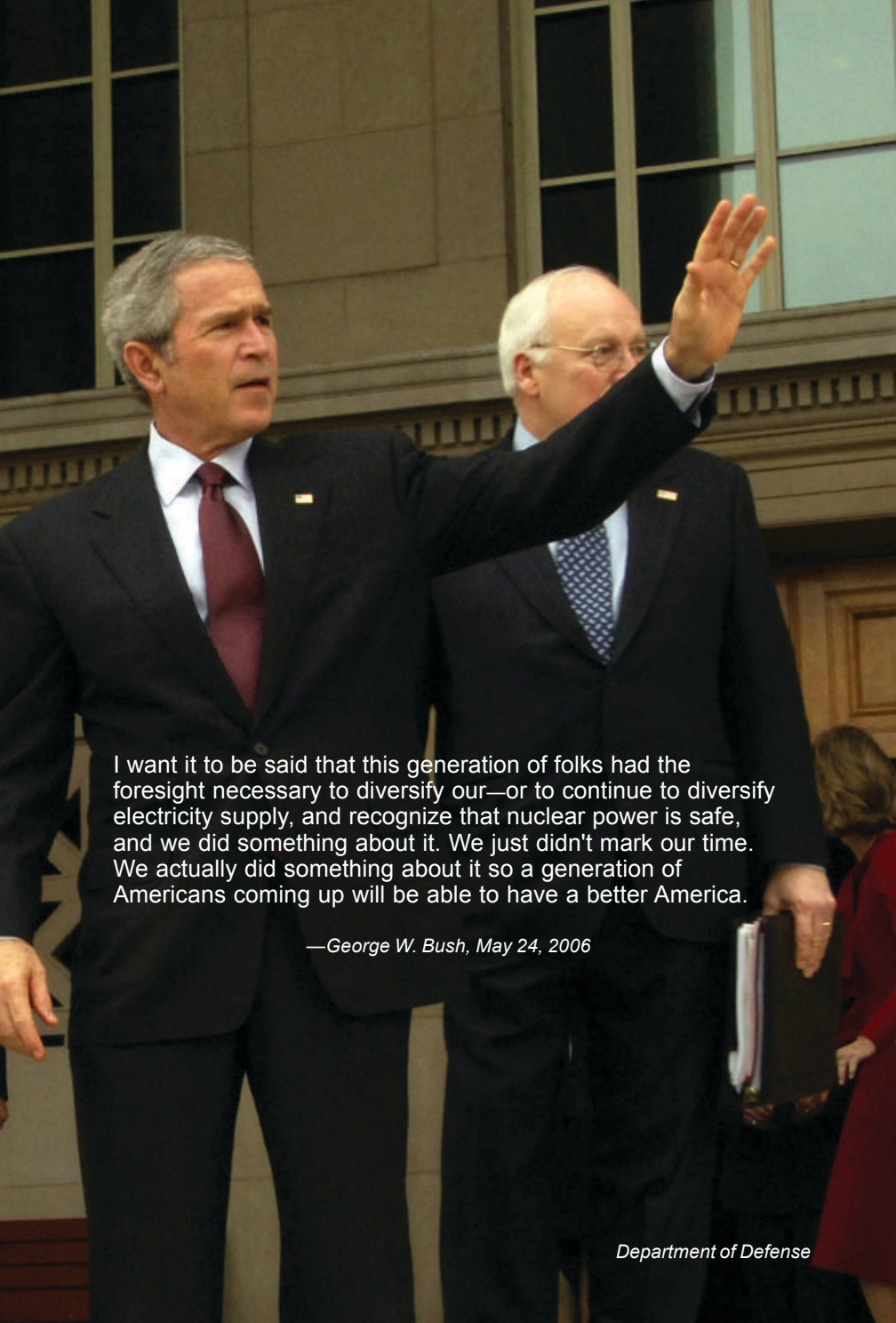



*Source: Department of Energy*

**U.S. Greenhouse Gases Emissions by Gas**
2005




*Source: Department of Energy*



I want it to be said that this generation of folks had the foresight necessary to diversify our—or to continue to diversify electricity supply, and recognize that nuclear power is safe, and we did something about it. We just didn't mark our time. We actually did something about it so a generation of Americans coming up will be able to have a better America.

*—George W. Bush, May 24, 2006*

*Department of Defense*

“Oil has become—it's an economic risk for us. I mean, after all, if the oil—if the demand for oil goes up in India or China, fast-growing economies, it affects the price of gasoline in the United States and in Germany. It's also a national security issue, obviously. Oil comes from unstable parts of the world. So I'm absolutely serious about getting off of oil.”

Based on these and other recent statements by President Bush, *the United States' greatest concerns seem to be economic* rather than about pollution or the global warming argument. (This is probably because, as the White House mentioned in a press release April 22, 2006, “.... America's air is cleaner, our water is purer, and our land is better cared for than when the President took office.”)

When asked about the issue of greenhouse gases, President Bush responded, “I've always said greenhouse gases are a problem. There is an argument there as to whether or not they're naturally made or man-made. And my attitude is, let's just get beyond that argument and do something about it. I believe that we need more nuclear power.” (Of course, nuclear power would only help if greenhouse gases *are* man-made.)

Still, the domestic and global demand for oil continues to grow, and the Advanced Energy Initiative means we could only reduce our reliance on foreign sources of oil by 75 percent by the year 2025. University of Washington scientist Richard Gammon says that carbon dioxide emissions from jets are rising faster than any other source (*USA Today*).

Nitrogen oxides ($N_2O$) emitted from aircraft react with other gases in the air to form another heat-trapping gas: ozone. Since they also remove methane, which has a cooling effect on the air, the overall affect on our climate studies is hard to know for sure.

What we do know is that toxic particulate matter and poisonous gases are in the atmosphere and stratosphere and pretty much everywhere, and we have many indications that they are increasing *roughly in proportion* to overall use of combustion energy.

There at least seems to be agreement that the natural levels of "greenhouse gases" ($CO_2$, $CH_4$, $N_2O$, NOx) are increasing, even though there is disagreement about the whys and hows.

As Earth's polar ice continues to melt rapidly (Peru's Andes have lost 22 percent of their ice since 1970), the MIT Center for Global Change Science believes that current studies "either ignored or oversimplified current general circulation models used for climate prediction" because certain data is missing, concurring with NASA's public archive.

But even with storms apparently brewing like we've never seen before, it seems very unlikely that tsunamis and floods end the journey for most of us before lung disease does.

It's possible that CALIPSO and CloudSat provide useful information to input into the formulae; meanwhile, we might want to turn our attention to our finite amount of global breathing space.

As of 2007, there are so many different kinds of pollutants in the air that the EPA page describing them breaks the information into sixteen categories, including data about nitrogen oxides, carbon monoxides, sulfur dioxide, lead, refrigerants, propellants, CFCs, HFCs, and radiation. They have information about smog and urban air pollution and acid rain and UVR and ozone.

It's not hard to see why some might be unclear about the EPA's specific mission and skeptical of the system's measuring procedures; the e-piles of dated and abbreviated content in our EPA's unGoogle-like public database and the growing amount of burning fuel belie their inability to protect us.

The FAA is designed to support air travel, and their concern is not for the consumer at all.

Yet the visual evidence alone is enough to tell us that artificial clouds and their toxic sources present an imminent danger to all humans, and to every living thing.

Some time this century, the day will arrive when human influence on the climate will overwhelm all natural factors.

*—Tim Flannery, The Weather Makers (2005)*

*NASA*

**Jet Fuel: An Overview**
One of the most toxic combustibles, jet fuel is similar to diesel fuel, and is even used in some ground vehicles instead of diesel. Jet fuel generally contains a number of additives: antioxidants to prevent gumming; antistatic agents to dissipate static electricity and prevent sparking; corrosion inhibitors; icing inhibitors; and performance-enhancing additives.

*Jet A is* the standard jet fuel type in the U.S. (*JET A-1* is the international standard.) The JET A we use is a paraffin oil-based fuel. Water particles can become suspended in Jet A fuel (which is considered acceptable for use, up to 30 parts per million), which enables contrails. (Jets too heavy for ideal landing weight actually *dump* this toxic fuel directly into the air while they descend.)

Militaries around the world use a different classification system for fuel. Some are almost identical to their civilian counterparts and differ only by the amounts of a few additives, while other military fuels are highly specialized for specific engines. Jet fuels are sometimes classified as kerosene or naphtha-type. Both Jet A and Jet 1-A are kerosene-type fuels.

According to the EPA, NOx emissions from jets are a precursor to the formation of ground-level ozone, also called smog. (Ozone also affects human pulmonary and respiratory health.)

NOx reacts in the atmosphere to form secondary particulate matter (PM2.5), which can cause detrimental health effects. In addition, NOx, ozone, and PM adversely affect the environment in various ways including visibility impairment, crop damage, and acid rain.

To protect public health and the environment, the EPA has established National Ambient Air Quality Standards (NAAQS) for several air pollutants, which includes ozone and PM. Recent air quality data show that about a third of Americans—111 million of us—live in areas that violate air quality standards for ground-level ozone.

About 70 million of us live in areas that already violate air quality standards for PM. But the demand for jets is rising.

**Jets could eliminate much of the contrail-created clouds by flying lower altitudes—but that doesn't address the problem of pollution or greenhouse gases.**

*NASA*

## COMPLICATIONS AND ELUSIONS

Humans are not going to stop flying. And we clearly need both the airline and oil industries in order to continue functioning.

We need aircraft, we need cars, and we definitely need electricity. So if we are looking at *realistic* solutions, we have to look at the possible outcomes of the current course we're flying. The only ones available are:

1) We fix this by creating new technologies for producing cleaner energy *and* for cleaning toxins.
2) We suffocate ourselves until we cannot go outside of specially-filtered buildings.
3) We find a new planet that is not toxic. Yet.
4) We don't make it far enough to find out.

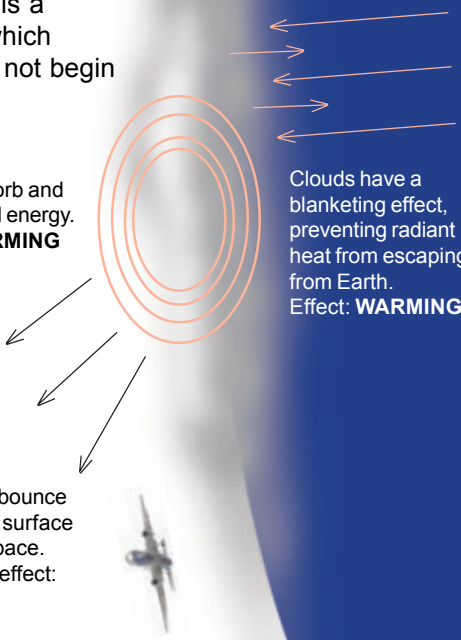
No one wants humans to be unable to go outdoors; finding a new planet will not happen quickly enough; and we don't want to entertain scripture-based ideas about Armageddon. Of *course* it is possible for God to intervene, because God is Nature. But that possibility looks even worse for surviving; as the polar ice melts into the oceans and sea levels rise over the next 100 years, land loss will be devastating.

People are already reporting strange illnesses all over the world and speculating that is it from the air. Most doctors and veterinarians are not currently trained to connect diagnoses of "lung diseases" directly to specific pollutants, but people are writing about it. *But why would we ever think that burning over a 100 billion pounds of jet fuel each year is harmless?*

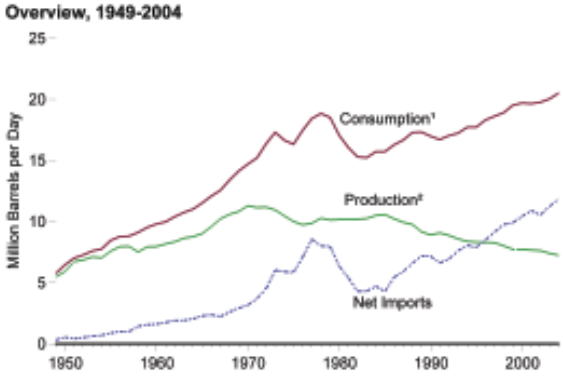
The world's leading climate scientists agree that the earth is warming and that human activity is causing it. What is the impact on the Earth's temperature of these vast, artifical cloud surfaces around the globe? Clouds have an immediate cooling effect on the ground, but the net warming affect resulting from heat absorption and emission by jet clouds—and from aircraft-contributed greenhouse gases—may be substantial.

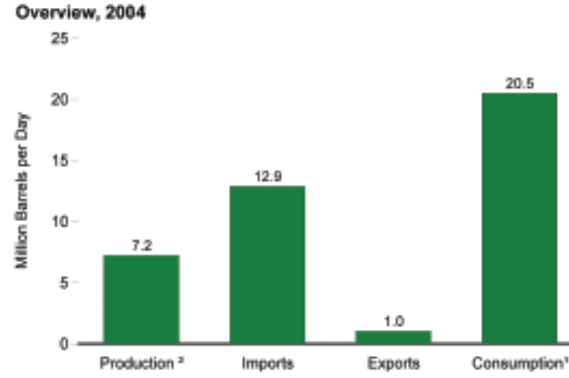
The hottest five years ever recorded were all in the last decade (1998, 2002, 2003, 2001, and 1997). The 1990s was the warmest decade since record-keeping began in the mid-1800s.

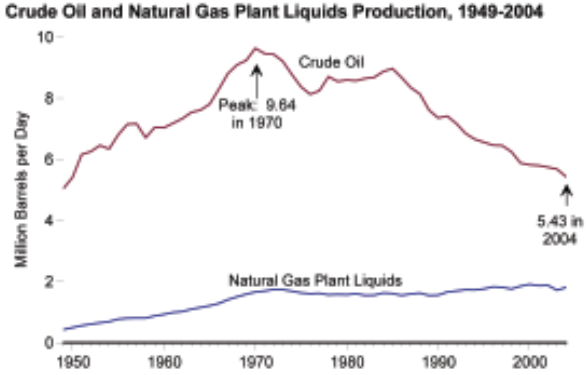
Back in 2004, the multinational Arctic Climate Impact Assessment (ACIA) reported that in Alaska, western Canada, and eastern Russia, average temperatures have increased as much as 4 to 7 degrees Fahrenheit (3 to 4 degrees Celsius) in the past 50 years. In Barrow, Alaska, average temperatures are up over four degrees Fahrenheit in the past 30 years. GRID-Arendal, the UN's environmental program, reports that most of the global surface temperatures increases have been over the past 40 years. Recent increases in temperatures and associated rising sea levels, as well as weather fluctuations, correspond ominously with our aircraft proliferation. Stratospheric flight is a relatively recent development, which started in the early fifties but did not begin in earnest until the 1970s.

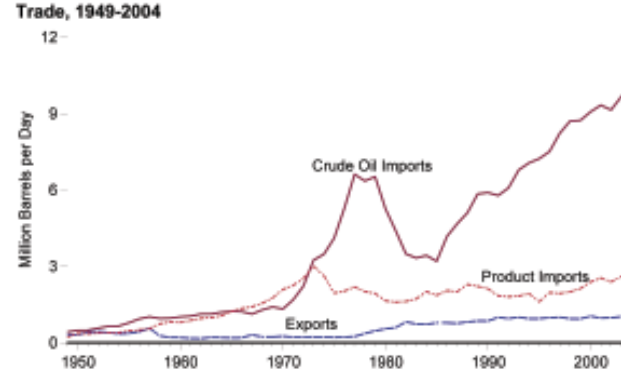


# Petroleum Overview, 1949-2004 (Source: US ATA)




¹ Petroleum products supplied is used as an approximation for consumption.

Note: Because vertical scales differ, graphs should not be compared.

## PROBLEMS WITH THE MATH

Based on the report that the United States uses 9 million barrels of oil a day for gas, while jet fuel use is only at 1.6 million barrels a day, it might at first appear that automobiles are responsible for over five times as much petroleum use. Now, let's look at just a few of the variables:

**1.** We used 19.5 billion gallons of jet fuel last year, according to an Air Transport Association report quoted in the White House Subcommittee on Aviation Hearing, *Commercial Jet Fuel Supply: Impact and Cost on the U.S Airline Industry*.

A gallon of jet fuel weighs over five pounds (probably closer to six, but there are different kinds of additives with different densities... you get the idea), so that's over 100 billion pounds of fuel that needs to be transported annually by trucks that contribute to the question on point. The exact weight has variables, and the fact that calculating the exact distance each gallon must travel is not possible, creates more variables.

**2.** The truck that transports the fuel to the jet had to be manufactured specifically for that purpose, and would not exist otherwise, so it is part of the equation too. It was produced at a factory that requires enormous power to shape metal and create a finished truck just for transporting jet fuel.

To figure out how much those trucks contribute, you would need to count all of them, but the number is constantly changing, and you have to take people's word for their count, from many companies in many countries, so a precise number cannot be reasonably predicted.

Further, the truck is made from components that are shipped from all over the world. You could only *estimate* the changing amount of energy required to make all the trucks to haul over a hundred billion gallons of jet fuel, so we have another significant variable.

**3.** The trucks wear out, so we also have to figure out how many we need altogether, and then compare that with the life span of the average plane.

And during the lifetime of the truck, it will also require new tires. The plant that makes the tires and *their* truck that's needed to bring the tires to the truck factory both use energy, and the garage that has to maintain the trucks and their energy and employees. To calculate this impact one would have to have to consider all those dynamic factors, too, which is impossible to do; another variable.

**4.** Besides requiring power for its truck-making machines, the factory where the *trucks that deliver the fuel to the planes* are made also needs parts that are made from raw materials, which need to be transported. To calculate this, you would have to consider every part manufacturer and every source of every kind; more impossible-to-determine variables, and we would need to estimate the number of mining vehicles needed and the fuel burned by all these things in support of the plane's existence...

It is probably not necessary to continue with that example. If we introduce just these first few variables into the equation, it already calls our initial conclusion into question. It *appears* that automobiles contribute five times more pollutants than airplanes, but that's only theoretical: direct fuel use. In real life, there are so many connected variables that we can't always see them all.

Which of the vehicles required to support airplanes and airports are included in the studies about aircraft emissions? Which of the machines required to build airports are included? Or the ones needed to ship parts and supplies?

Imagine the number of machines needed to build and operate a single airport... and so a practically infinite chain of fuel consumption exists only to serve our aircraft; published "calculations" seem inadequate.

In order to fly, airplanes require airports...and...

Factories to produce airplanes

Trucks to carry fuel

Factories to produce supplies

Freighters to carry fuel and parts

Factories to make fuel trucks

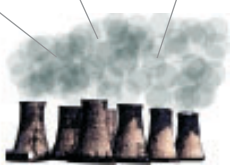
Trucks carrying parts & supplies

Millions of support vehicles

Airport support equipment and vehicles

Emergency vehicles

Factories to produce the support vehicles



Power to supply the factories

*Los Angeles International Airport*
*NASA*

## LUNG RESCUE

Combustion of fossil fuels, especially coal and oil, is the major source of fine particle emissions into the atmosphere... tiny particles that lodge in the lungs of any breathing species. According to the American Lung Association, hundreds of studies link daily increases in particle pollution to reduced lung function, disease and death. The long list of other conditions caused, complicated or aggravated by particle pollution include emphysema, pneumonia, chronic bronchitis, cystic fibrosis, and denial.

Problems involving other countries usually seem distant and disconnected from the daily reality of living in the USA. We generally feel pretty helpless when it comes to conflicts and strife outside our own space and “global problems” seem almost like a natural phenomenon... one that has “always” been there and “always” will be.

But right now let’s look in our backyards, and again only consider figures from the United States. And let’s not look at any more energy and oil and particle data. You can look to those data sources if you trust them and decide. Let us “forget” the other lung diseases for a second:

1. The American Cancer Society estimates 1,399,790 new deaths from cancer in 2006.

2. The American Lung Association reports that lung cancer is the leading cancer killer in both men and women in the United States. It causes more deaths than the next three most common ones combined (colon, breast and prostate).

3. The expected survival rate with lung cancer is much lower than with any other type. Over half of the people diagnosed with lung cancer live less than a year; 85% die within five years.

4. Between 1979 and 2002, the number of lung cancer deaths increased by 60 percent.

Prior to the 1930s, there were virtually no diagnoses of lung cancer. (Smoking is still considered the highest risk factor.)

Jets provide most of the clouds for California's colorful sunsets.


LAMPSON

Our children will pay the price for our addiction to oil.

*—Bill Clinton*

## WHAT WE CAN BE DOING NOW

We won't change our lives and, if it's too hard or costly, we insulate ourselves with denial. The bigger things are in government's hands, but we *are* the government. We all need to be aware of our collective effects and results, and demand and ensure swift change.

**Technology & regulatory changes**
Our future must not be in combustion energy. But meanwhile, there is an intermediate step we can take: bio-fuel. Ultimately, nuclear energy may be better, but with technology available to produce power from biomass, photovoltaics, wind and other innate sources, we could eliminate the need for nukes, but we haven't tried with a truly focused and committed effort.

It is in our hands to cause the government to make use of these technologies where the private sector cannot. Voluntary conservation is not enough to save our species. We need our government to intercede and make it *more profitable for power companies to sell less petroleum energy*, ensure profitability of biodiesel (most of our biggest machines are diesel), and provide greater incentives for reducing individual consumption. Our government budgets must focus resources toward production of bio-based diesel fuel, development of non-combustive engines, and environment-remediation technologies. We also need to offer more financial incentives for companies to use electronic meetings instead of air travel. Looking at the dozens of government organizations that need to work together makes me wonder if we need a public team dedicated to that collaboration... a team of scientists we can put on global TV and that we know by name. A team that knows we're counting on them and rooting for them, just like we do for the Lakers or the Mets or the Jets.

**Individual changes**
In addition to applying political pressure through emails and letters to our leaders, *we can buy less stuff*, and buy local products when possible; commit to the *habit* of turning things off; use bio-fuel in your diesel car; travel closer to home so you don't require a jet; fit your house with solar and contribute energy back to the grid (learn how at sierrasolar.com); and write to your congressmen and senators expressing your concern and asking to see results. If we all contribute a tiny bit, like a billion drops of water, we'll form a giant wave of change.

**Biofuel: a possible mid-term solution?**
"Biomass" refers to the conversion of plant matter into fuel or electricity. The main reason biofuel is such an important important step toward cleanup is that it burns much more cleanly, leaving less toxic gas and particulate matter in the air. Currently jet turbine engines can't run on biofuels, but it's time to look in that direction more critically, too. Turbine engines can operate with a wide range of fuels, and it's possible that jet fuel can be made from biomass with a little human motivation. but using biofuel for aircraft would require vast amount of arable land used only for that purpose. We may be even further off from using non-combustive energy for aircraft, or even bio-based fuel, but we can start with the supporting chain of factories and trucks. Biofuels can be extracted effectively from many kinds of plants, including corn, soybeans, hemp, algae, and waste oils from cooking and other sources.

**Alcohol fuels: *less* petroleum use... or even *more*?**
Ethanol can be mass-produced by fermentation of sugar or by hydration of ethylene from petroleum and other sources, but it may not be a sustainable fuel alternative in the long run, as its production depends on specific crop production requirements. Methanol, propanol and butanol are also potential alcohol fuel sources that can be synthesized biologically from biomass like sugar cane and corn. Ethanol is used as an oxygenate additive for standard gasoline; 10% ethanol added to gas increases the octane, reducing engine knocks and performance problems associated with low octane fuel, but according to the EPA, ethanol might actually *increase smog, and it decreases gas mileage* significantly.

Petroleum-based fuels have been cheaper, so bio-fuel has been largely ignored for decades. Currently ethanol has political support in the United States, but it also presents more problems with the math. Research so far seems to indicate no *overall* petroleum product savings; after all, the farm equipment is mostly fossil-fuel-based, as is the transport of the farm equipment and supplies to the farms, the production of the fuel itself, and its transportation. Meanwhile, since ethanol comes primarily from corn, prices related to corn are rising wildly, which includes many food products, whose ingredients depend on corn or corn syrup.

Are we really conserving fuel with this exercise, or does mixing ethanol make us use even more petroleum overall? Biodiesel seems to make more sense today, and adding just a small percentage to diesel vehicles reduces emissions significantly.

**Biodiesel**
Energy Alternative Solutions is a biodiesel company in California that built two new fuel production plants in Gonzales and Watsonville with a combined capacity of about 6,000 gallons of biofuel per day. These plants' biodiesel fuel product is made from renewable resources using a chemical process called transesterification, by which the glycerin is separated from animal fats or vegetable oil, yielding an oil-based fuel rather than an alcohol-based fuel like ethanol. The plants will run on a combination of solar power and biodiesel and use only one unit of energy for every 4.5 units of biodiesel they generate. According to studies by the U.S. Environmental Protection Agency, biofuel has been proven to significantly reduce emissions of carbon monoxide and particulate matter. In fact, using a biodiesel blend of 20 percent biofuel and 80 percent petroleum diesel produces a 45 percent reduction in emissions of carbon monoxide and particulate matter.

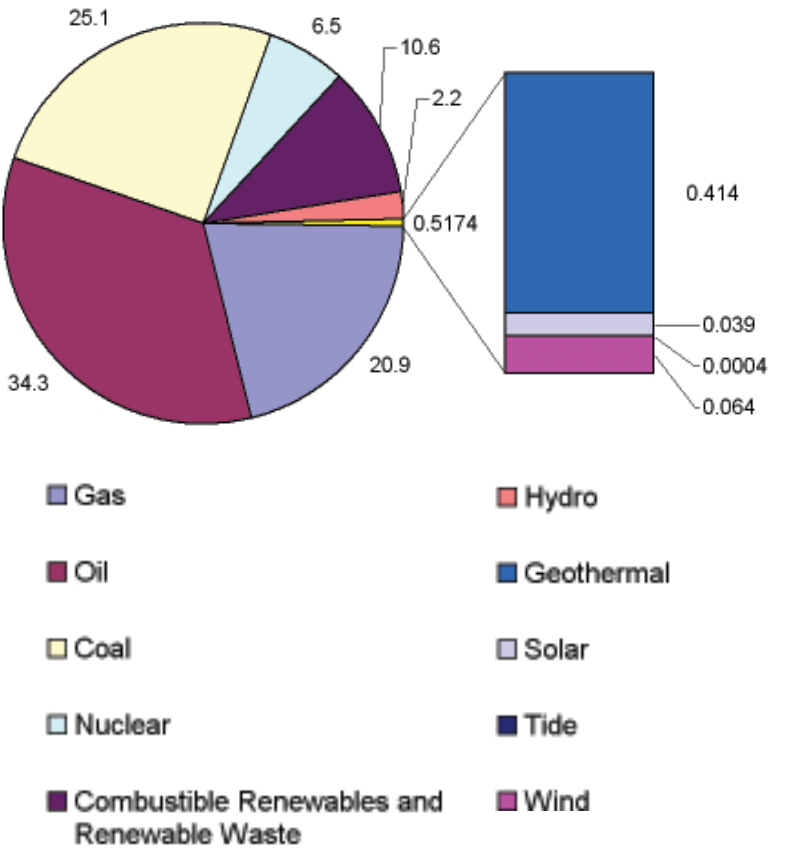
So far it look like oil-based fuels make more sense than alcohol-based ones. Growing algae may be the best way to create biomass for this kind of fuel, because algae is great for the environment, and is the most productive and fastest-growing biomass for fuel... yet doesn't require conversion of farmlands or impact food crops.

**Innate Energy Sources**
Earth holds immense powers already discovered but largely unused since, *economically*, our culture has always favored petroleum energy. Even electric cars need to be charged from power sources that are usually from petroleum- or coal-generated plants. Solar power, while available technologies are improved recently, is still poorly employed in the United States.

Wind power is free, perpetual energy. That is, as long as the wind blows... which is the foreseeable future. Using windmill farms to produce power makes a lot of sense in many areas, from which power generated can connect to a common grid. Some windmills can produce electricity for as little as 3 cents per kilowatt hour (in 1980, cost per kilowatt hour was 80 cents).

According to the DOE, renewable resources provided only 2.3 percent of America's electricity supply in 2005.

**Global Energy Sources, by Percentage**
Department of Energy/EIA, 2006




Renewable biofuels come from plants, which use carbon from the surface environment. Fossil fuels bring carbon from the Earth's depths to the surface and, when burned, release it into the air, contributing to increased carbon dioxide levels in our atmosphere. Today only a tiny fraction of our energy comes from plants.

Even the most modern airplanes do not currently use alternative energy sources; jet aircraft require large amounts of high-density fuel, which currently is only provided by fossil-fuel sources.


*Photo from Airbus.com, 2006*

**Nuclear**
An infinite energy source from the universe, atomic power seems like a clean alternative, producing no greenhouse gases directly. But nuclear power has some problems that we have not learned to deal with yet.

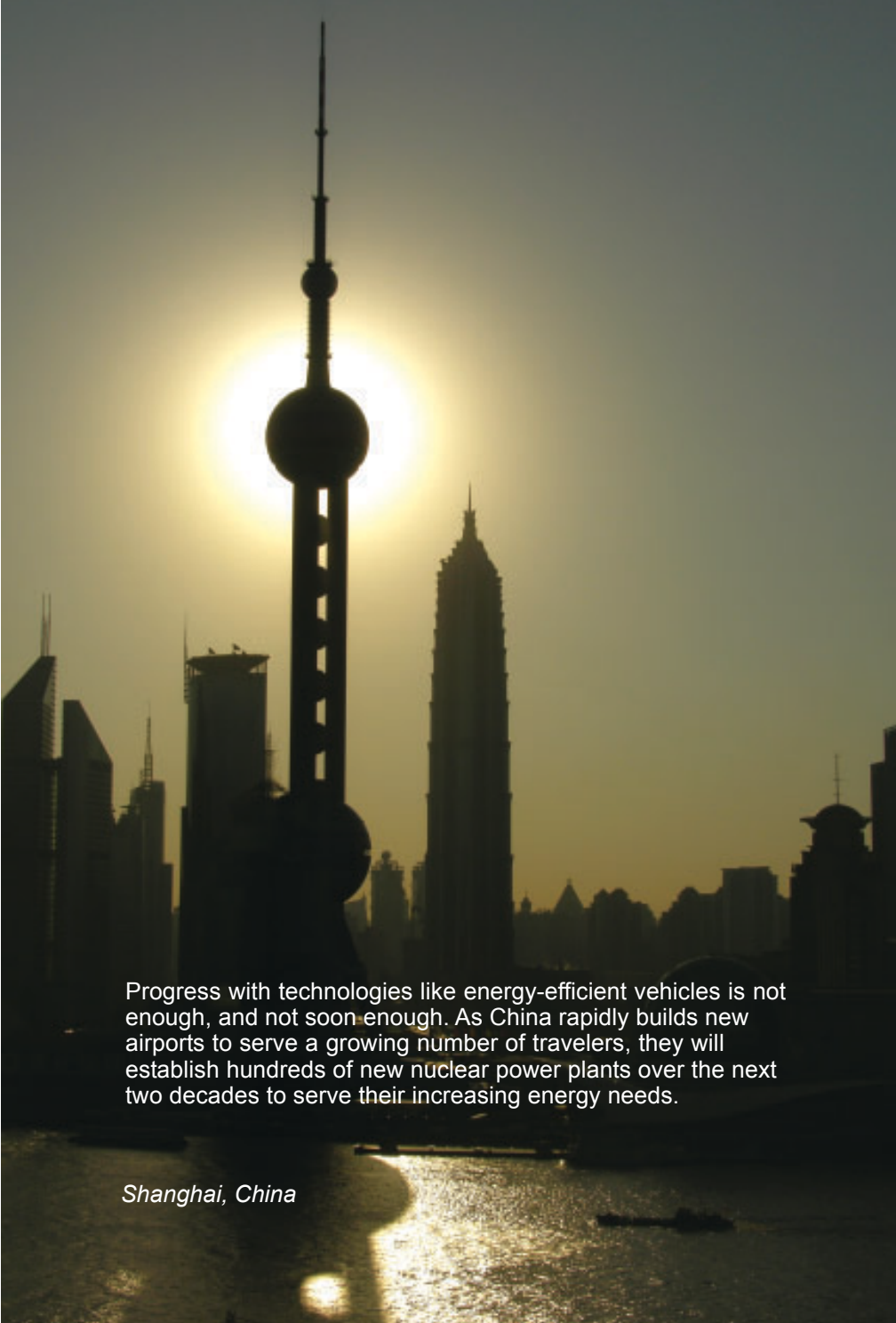
Nevertheless, according to Wikipedia, as of 2006, there are 442 licensed nuclear power reactors in operation in the world, operating in 31 different countries. Together they produce about 17% of the world's electric power (a large jump from the 2006 figures provided by the DOE, indicating nuclear energy's rapid (but quiet) growth.

Though nuclear power has been viewed in much better favor since the Atomic Energy Commission changed their name to the Department of Energy, fusion-based aircraft are also a long way from being a reality in our current world.

Nuclear waste material is less in quantity than other power sources, but nuclear reactors produce extremely dangerous radioactive chemical elements. Aside from thermal pollution (nuclear plants generate immense heat), the Department of Energy acknowledges that in the United States alone there are "millions of gallons of radioactive waste" as well as "thousands of tons of spent nuclear fuel and material" and also quantities of contaminated soil and water.

The United States currently has at least 108 sites it currently designates as areas that are contaminated and unusable... sometimes many thousands of acres. The DOE wishes to try and clean or mitigate many by 2025. However, it acknowledges that some will never be completely remediated, and just in one of these 108 larger designations, Oak Ridge National Laboratory, there were for example at least "167 known contaminant release sites" in one of three subdivisions of the 37,000-acre site. (Wikipedia, "radioactive waste," 12/09/07).

Nuclear fusion may be a great alternative in the future, but so far we have not created safe and sustainable means of using it. Still, in his 2006 State of the Union address, President Bush announced the Advanced Energy Initiative of the Global Nuclear Energy Partnership (first announced by United States Department of Energy Secretary Samuel Bodman on February 6, 2006), a plan to form an international partnership to reprocess spent nuclear fuel in a way that renders the plutonium in it usable for nuclear fuel but not for weapons.



Progress with technologies like energy-efficient vehicles is not enough, and not soon enough. As China rapidly builds new airports to serve a growing number of travelers, they will establish hundreds of new nuclear power plants over the next two decades to serve their increasing energy needs.

*Shanghai, China*


“There is a greater temptation to ignore inconvenient truths, to set aside knowledge that might challenge a prevailing policy.”
—Al Gore
NASA

## THE TERMINAL

Will humans survive long enough to explore other life-supporting planets? Based on the facts we can consider so far, it seems very clear that if we continue doing exactly what we are doing, we will not be able to breathe the air on Earth in just a few years.

This is not simply a “potential” outcome; it is certain unless we change our behavior. We will not run out of petroleum-based fuel in time to let the problem take care of itself. In this case, it looks like the “taking care of itself” part extinguishes many of us.

But looking at our historical patterns, it is likely that our culture will continue to remain in denial about the extent and progress of air toxicity until our life expectancy drops significantly. Some communities have adopted the standards outlined in the Kyoto Protocol, but the United States continues to refuse, based seemingly only on economic concerns.

We can continue rejecting the information that makes us uncomfortable, and continue poisoning the air without thinking about it further. So if, after reading this, you wish to ignore the sky and believe this is made up, you can probably still get away with that for a few more years.

If you have been observing chemtrails and wondering what in blue blazes is going on, as I was, I offer as a starting point the preceding facts and my interpretation of the data. We don’t seem to have all the answers yet, or at least, they aren’t all put together.

If you are just hearing about artificial clouds for the first time, watch the sky a little more... you’ll verify their existence soon enough, and from there you can draw your own deductions now. In the end, separating what *is* from what *seems* is our lifelong challenge… a challenge complicated by illusions and possibilities.

## Glossary of Related Terms
(and how I mean them)

**Aeronomy**: chemical and physical processes of the troposphere and stratosphere.

**Aerosol**: colloidal dispersion of a solid into a liquid or gas; suspended particles.

**Aerospace:** referring to Earth's atmosphere and the space outside of it.

**Anthropogenic**: resulting from the influence of human beings on nature.

**Bazillion**: virtually infinite number.

**Biomass**: plant material used to produce fuel.

**BTU**: British Thermal Unit, how we measure energy. One BTU equals the amount of energy required to heat one pound of water by one degree Fahrenheit.

**Chemtrail** (chemical trail): a jet contrail that persists for hours or days.

**Colloid**: microscopic particle larger than a molecule but small enough to diffuse through a membrane.

**Cognitive dissonance**: the human tendency to disbelieve and block undesirable facts.

**Confoundations**: puzzling, easy-to-misconstrue phenomena that are universal to the human experience.

**Conditioned response**: learned, habitual human behavior in response to a specific stimulus.

**Contrail**: visible trail of condensation or ice created by jets.

**Conundrum**: paradoxical, unsolvable problem or riddle.

**Counter-transcendent**: working against human progress.

**Dead ahead:** nautical term meaning directly in the path of the current course.

**Deductions**: the drawing of possible answers by reasoning.

**Dissonant:** condition adopted by the human mind when approached with information it does not wish to believe.

**Doublespeak**: double-talk; verbal trickery.

**Elusions**: the act or an instance of eluding or escaping; evasion.

**Hindsight:** the perspective after an event; realizing you could have known if you had pondered it more.

**Ice crystal dust** (ice dust): tiny frozen particles forming a powdery cloud from jet aircraft.

**Ice crystal wake** (ice wake): super-frozen, jet-blasted path created behind jet aircraft.

**Illusive**: illusory.

**Innate energy**: natural power sources provided by the earth.

**Intersecting infinities**: more than one infinite quantity as a variable in an equation.

**Jargon:** technical language of a trade or profession (e.g., medical terminology).

**Karma**: the effect of your own actions on your fate.

**Lemmas** (lemmata)**:** proven mathematical propositions or theorems that provide evidence leading to proof; from the Greek word *lemma*, meaning a *gift*, *benefit* or *profit*.

**Light wave** or light particle**:** a reference to the quantum mechanical concept of *wave-particle duality*, which provided evidence to help solve apparent paradoxes by showing that light and matter exhibit properties of both *waves* and *particles*.

**Lexicographer:** one who records words in a system of language.

**Maybes** (maybees)**:** possibilities; uncertainties.

**Mediated reality**: beliefs that are considered facts but are actually based on others' reports, not on proof.

**Misdirect**: (1) to aim badly; (2) distract; cause attention toward a different place or topic from the one in question.

**Misdirectional**: characterized by prolonged misdirected productivity; wasted human effort.

**Neurolinguistic programming** (NLP): the connotative affects of words on human behavior.

**Non-combustive**: not burning substances to create energy.

**Off-purpose**: referring to behavior that is not deliberate.

**Partisan**: pertaining to people, ideas, or communications that are unanimously pre-accepted or pre-rejected.

**Phrenology**: dated misbelief that specific mental traits can be read by feeling the shape of a person's skull (*switchfact*).

**Reperspect:** re-examine the view; look again.

**Revelation**: a revealing; an uncovering.

**Ridiculable**: beyond ridiculous; perhaps even *should* be ridiculed.

**Scriptitious** (scripturous): referring inappropriately or non-constructively to religious writings.

**Sharpitude**: the ability to continue operating with conscientiousness and awareness.

**Stratification**: forming or depositing inlayers, as in geological formations.

**Stratospheric:** 1) of or pertaining to the region between the Earth's troposphere and mesosphere; 2) seemingly close but actually outside of human perceptive faculties.

**Stratospheric ice** clouds (ice clouds)**:** super-frozen ice particles left by jet wakes that expand and can form clouds.

**Storying**: seeing our lives as a story or implying authorship of our destiny.

**Subperspective**: a position requiring additional information before drawing conclusions.

**Superspective**: what is knowable if all people could combine their knowledge; a collective effort to see farther.

**Switchfact**: a "fact" that no longer is true, as later discovered and reported (e.g., certain foods being good for you, then later considered unhealthy).

**Theorem:** an idea or mathematical principle that is demonstrably and consistently true.

**Toxic density**: in the context of air, the amount of toxic chemical fumes and particles in a measured volume of air.

**Trickle-down aeronomics**: the inverse relationship between airline profits and human health.

**Tropospheric:** 1) pertaining to the troposphere; 2) pertaining to earthly matters.

**Truthiness**: doublespeak; from Stephen Colbert's parodied self, the property of an untrue statement that makes it seem good enough to believe it is factual.

**Vacuum**: a void; space without no matter or light.

**Wake**: 1. disturbance left behind a moving ship
2. disruption of slumber
3. a watch; a vigil
4. a funeral

## ONLINE FACT-CHECKING SOURCES

Facts and figures quoted in this book are verifiable in reports provided for free by these organizations:

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http://www.aerostates.org

Air Transport Association (ATA)
http://www.airlines.org

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## ABOUT THE AUTHOR

Dave Dahl is a U.S. Navy veteran and former university teacher. He is co-founder of Web Associates, the Internet development company, and currently the president of Dragon Pearl Whole Teas in California. Recognizing his own part in air pollution, this report is his attempt to create awareness of the impact of aircraft, especially among our government representatives, to whom this will be sent.

Send suggestions or corrections to dave@dragonpearltea.com.

Under heaven all can see beauty as beauty
only because there is ugliness.

*—Lao Tzu*

*Natural tropospheric clouds forming at about 8-12,000 feet over Japan (2006).*

A summary
of this report is available
at artificialclouds.com, where updates, panoramas
and time-lapse videos will also be posted.

Also see Joe Firmage's
http://www.earthportal.org
...a new community directly connecting scientists,
journalists, policy makers and you.

**To help document observations** about contrails,
register with GLOBE (globe.gov).

**To contribute,** see climatesciencewatch.org
*Climate Science Watch* is a nonprofit, public-interest education and advocacy project dedicated to holding public officials accountable for the integrity and effectiveness with which they use climate science and related research in government policymaking, toward the goal of enabling society to respond effectively to the challenges posed by global warming and climate change. Climate Science Watch is sponsored by the Government Accountability Project.