




## CASE ORANGE



### **CONTRAIL SCIENCE, ITS IMPACT ON CLIMATE AND WEATHER MANIPULATION PROGRAMS CONDUCTED BY THE UNITED STATES AND ITS ALLIES**

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If we can stand up to them, all Europe may be free and the life of the world may move forward into broad, sunlit uplands. But if we fail, then the whole world, including the United States, including all that we have known and cared for, will sink into the abyss of a new Dark Age made more sinister, and perhaps more protracted, by the lights of perverted science.

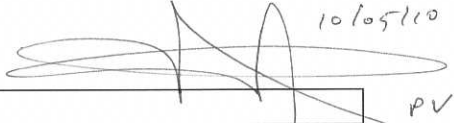
Winston Churchill, 'This was their finest hour' speech to the House of Commons, June 18<sup>th</sup> 1940.

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**LIST OF ABBREVIATIONS:**

AFB	Air Force Base
ATP	Airline Transportation Pilot
ATSDR	Agency for Toxic Substances and Disease Registry
AWACS	Airborne Early Warning and Control System
BKN	Broken clouds
°C	Degrees Celsius
Ci	Cirrus
Cc	Cirrocumulus
CO	Carbon Monoxide
DLR	Deutsches Institut für Raumfahrt
DOD	Department of Defense
DTR	Diurnal Temperature Range
ECM	Electronic Counter Measures
ELF	Extreme Low Frequency
EPA	Environmental Protection Agency
FAA	Federal Aviation Administration
FIR	Flight Information Region
ft	Feet
GWP	Global Warming Potential
HAARP	High Frequency Active Auroral Research Program
HC	Hydrocarbons
HMSO	Her Majesty's Stationary Office
Hz	Herz
ICAO	International Civil Aviation Organization
IPCC	International panel for Climate Change
Kg	Kilogram
KW	Kilowatt
Lbs	Pounds
NASA	National Air and Space Agency
NATO	North Atlantic Treaty Organization
SALT	Strategic Arms Limitations Talks
Sct	Scattered clouds
SN	Smoke Number
SOP	Standard Operating Procedure
UEA	University of East Anglia
UIR	Upper Information Region

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USSR	Union of the Socialist Soviet Republics
VLF	Very Low Frequency
WMO	World Meteorological Order

## 1. EXECUTIVE SUMMARY



## 1. EXECUTIVE SUMMARY:

This unclassified research paper has been compiled on request of the Belfort Group, a Belgian environmental watchdog. It highlights the specific problems associated with contrails emitted by aircraft, the manipulation for geo-engineering or defense purposes of some of these trails by the United States government and the subsequent effect on quality of life. In order to force public debate on the subject this document has not only been transmitted to embassies of states that organize weather manipulations projects, news agencies and interest groups in this field but also to organizations in countries that are not considered as allied forces by the United States and NATO.

Contrails are not the harmless emissions of aircraft at high altitude that only have an esthetic impact on the sky as meteorologists suggest. They do not only contain huge amounts of water vapor, but also significant amounts of Carbon Dioxide, Nitric Oxide, Sulfur Oxide and soot that have a significant impact on public health. In that respect it is noteworthy that derogations for emissions of Hydrocarbons and Carbon Monoxide have been granted for engines of some military aircraft, which exceed civil regulatory levels in a very significant way. Chapter 3 contains a detailed description how contrails are formed, its detailed chemical composition plus a very interesting case study of the KC135 tanker & E-3 Sentry (AWACS) aircraft, the latter being operated on a Luxemburg registration without complying to civil standards.

Persistent contrails have a devastating impact on eco-systems on Earth. They develop in men made Cirrus cloud that can cover a significant part of the sky. It is scientific evidence that those aviation-induced clouds already occupy 3 to 5% of the sky in Europe and this figure increases by 1 to 2% per decade. As these types of clouds are not classified as such by the WMO, the World Meteorological Organization, there is obviously no tendency to research this subject thoroughly and subsequently civil aviation authorities and other government bodies write the thesis of 'chemtrails' off as a hoax. Nevertheless it is proven that the existence of these persistent contrails has a negative impact on temperature and they can alter precipitations levels. It also induces the dehydration of the stratosphere. Chapter 4 provides a summary of the most striking results of scientific research on this subject.

Given the extensive history record of weather manipulation projects, conducted mainly by the United States armed forces, the relationship between men made contrails and its impact on different climatologic parameters creates a scientific basis for a weather manipulation system. Chapter 5 contains a detailed overview of the major weather modification operations in human history, starting from relatively innocent endeavors such as cloud seeding with silver iodide over ionospheric heating to large-scale geo-engineering projects through commercial aviation. Patents, previously classified documents, order forms for Barium and maps with daily spraying schemes irrevocable denote the existence of a global military sponsored and governmental approved project for alteration of the upper troposphere for global control purposes. The technical details, including the nature of the seeding material and its possible impact on public health, are also included in chapter 5.

Finally the investigation group, which wants to remain anonymous until further notice, comes to the final conclusion that atmospheric seeding for the sake of military interests and a global business model has a devastating impact on eco-systems on this planet and quality of life in general. This practice is therefore considered as unacceptable.

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## 2. NOMENCLATURA

Give me a long enough lever and a place to stand on and I will move the earth.

Archimedes (287 – 212 B.C.)

## 2. NOMENCLATURA:

A distinction is made between contrails, distrails, wingtip vortices and 'chemtrails'. In this research paper only contrails and chemtrails are subject to an in-depth study.

### 2.1. CONTRAILS:

**Contrail** is the contraction of the words 'condensation' and 'trail', the condensation of engine exhausts. The word dates back to World War II and contrails were considered as a nuisance as they attracted enemy fighters in the fray.



B-17 heavy bombers are on their way to Schweinfurt, emitting substantial amounts of contrails. German pilots could easily pick out the exact position of individual planes by their contrails.<sup>1</sup>

In contrary to popular belief contrails are not exclusively formed by jet aircraft, but also by propeller driven airplanes, providing that their operating altitude is suitable for their formation. This phenomenon is temperature related. As temperature drops with 2°C/1000 ft altitude gain in a standard atmosphere and a cold air parcel can only hold very limited water vapor any hot exhaust fumes automatically condense into artificial clouds. This usually happens above 26,000 ft where the ambient temperature is below -40°C.

As can be noticed on the picture above the intensity of the contrails vary with altitude / temperature, the bombers on the top right emitting heavier contrails than the planes at the bottom. A very important feature is that these early contrails are short lived. However modern jet aircraft with more powerful engines and high turbine temperatures emit more persistent contrails, which usually 'trail' for 20-30 miles along.



Contrails from a Qantas Boeing 747, Australia (Source: Wikipedia, contrails)

<sup>1</sup> Air & Space Power Chronicles, Schweinfurt – the battle within the battle for the 8th US Air Force, Capt. D. Reichert, USAF



Contrails may have strange shapes and even be horizontally dispersed over large areas by jet streams, strong winds in the upper atmosphere that exceed a velocity of 100 knots.

## 2.2. DISTRAILS:

A distrail is the abbreviation for 'dissipation trail'. When an aircraft passes through a thin, stable cloud, even when the conditions for the production of contrails are not met, it produces a tunnel like path through that cloud.

Distrails are created as a result of the elevated temperature of the exhaust gases absorbing the moisture from the cloud. Clouds exist where the relative humidity is 100% and temperature and dew point are thus equal, but by increasing the temperature, the air can hold more moisture, so the relative humidity drops below 100% even for the same absolute moisture density, thus causing the visible water droplets in the cloud to be converted back into water vapor.



This picture shows a contrail that changes into a distrail at the top right, cutting through a layer of Altocumulus clouds.<sup>2</sup>

## 2.3. WINGTIP VORTICES:

Airplanes fly as a result of an equilibrium of lift, drag, mass and thrust. When a wing generates lift it causes a vortex to form at the wingtips and sometimes also at the trailing edges of the wing flaps. It causes wake turbulence, which is quite persistent and potentially dangerous to other, mostly smaller planes. The higher the angle of attack of the wing the higher the lift coefficient will be with stronger vortices in the end. High angles of attack in commercial aviation are achieved in landing configuration (flaps & landing gear down) or during initial climb after take off (high thrust & body angle).

The reduction in pressure and temperature across each vortex can cause water to condense and make the cores of these wingtip vortices visible. The effect is more common on humid days and in anticyclones with strong temperature inversions. These visible cores contrast with contrails and distrails, the latter being produced directly behind the engine at higher altitude.

Military aircraft travelling at transonic speed and making high performance maneuvers may produce a vapor cone or Prandtl-Glauert singularity as a result of a sudden drop in air pressure, sometimes nicknamed the shock collar or 'shock egg'.

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<sup>2</sup> Contrail science Home Page, <http://contrailscience.com/contrail-to-distrail/>



A U.S. Air Force F-22 'Raptor' executes a supersonic flyby at low altitude, producing pronounced wingtip vortices and a 'shock egg'.<sup>3</sup>

#### 2.4. 'CHEMTRAILS':

Chemtrail is the contraction of 'chemical trail' and is used by some sources to denote intentional spraying by airplanes for military or political purposes and that may be harmful to public health. A more general name is 'aviation smog', which combines contrails, distrails and 'chemtrails'. Authors referring to chemtrails claim that this phenomena is much more persistent than contrails and when sprayed in a grid it is able to cover vast area's.

Although officially denied by government sources many countries performed tests for 'cloud seeding' to either generate precipitation where it was needed or to prevent precipitation where it is unwanted. At this moment only the Russian and Chinese governments admit that they use particular matter in order to manipulate weather patterns.<sup>4</sup>



This picture shows an interesting combination of contrails (right hand side), distrails (bottom left) and possibly 'chemtrails' (left hand side) over Belgium in the vicinity of Brussels, September 2009. Note that the contrails have spread over a large area.

<sup>3</sup> Live Science, Britt R.R., Editorial Director, June 30th 2009, Picture by courtesy of DOD/Petty Officer 1st Class Dejarnett, U.S. Navy.

<sup>4</sup> Michaels Jay, Meteorology News, 19th October 2009, 'Moscow testing cloud seeding'

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### 3. CHARACTERISTICS OF CONTRAILS

The intuitive spirit is a gift from God. The rational brain is its servant. We have created a society that worships the servant and has forgotten the gift.

Albert Einstein (1879 – 1955)



### 3. CHARACTERISTICS OF CONTRAILS:

#### 3.1. PREVIOUS SURVEYS ABOUT CONTRAILS:

Meteorologists ignore and even deny the effects of aviation on the weather, stating that contrails and in a lesser extend distrails only have an esthetic influence on the way the sky looks. As they do not induce precipitation nor reduce the visibility or affect sunshine they are not worth mentioning in a weather bulletin. On a few occasions meteorologists refer to it as veil shaped clouds, actually making the public belief that its origin is natural and not human. Because contrails are not considered as a weather phenomenon there are subsequently very few scientific surveys covering this topic.

Appleman was the first in 1953 to present charts that forecast the likelihood of contrail formation based upon the temperature profile of the 700–100-Hectopascal layer where commercial jets usually operate.<sup>5</sup> Pilie and Jiusto in 1958<sup>6</sup>, Scorer and Davenport in 1970<sup>7</sup> and Hanson & Hanson in 1995<sup>8</sup> modified his work. They identified a unique range within which a contrail should theoretically form.

However, the lack of field tests to verify these models and the fact that contrails have been noted to form and spread during conditions deemed unfavorable according to some of the models described above. With the introduction of new technology, such as satellites, more accurate surveys were within reach. This resulted for instance in the development of a new empiric model developed by Travis to predict widespread occurrences of contrails<sup>9</sup>.

But even with the aid of geostationary satellites it proves extremely difficult to predict formation, size and life span of contrails that may remain isolated or cluster in groups. Extensive survey is mandatory in order to understand fully the nature of contrails. However there is an economic drawback to this, as aviation is the backbone of fast transport and commerce spanning the globe. Any survey can potentially be turned down by lobby groups that do not want to see unwanted attention unleashed on an ignorant public with undesirable side effects of aviation. Officially science does not work that way, but in practice researchers generally do not bite the hand that feeds them. This is also why contrails are politely classified as veil clouds. Travis D.J., Carleton A.M. and Lauritsen R.G. performed a very interesting survey immediately after the 9-11 attacks in 2001, when all commercial aviation was stuck on the ground for a period of 3 days. It was probably the only opportunity to perform a comparative study. The results were only released two years later and proved the evidence of jet contrail influence on climate,<sup>10</sup> although it was suggested by some other researches that 'the sky was unusually clear during that period'.<sup>11</sup>

The results of some of these surveys are used in the next paragraphs.

<sup>5</sup> Appleman, H., 1953: The formation of exhaust condensation trails by jet aircraft. *Bull. Amer. Meteor. Soc.*, **34**, 14–20.

<sup>6</sup> Pilie, R. J., and J. E. Jiusto, 1958: A laboratory study of contrails. *J. Meteor.*, **15**, 149–154..

<sup>7</sup> Scorer, R. S., and L. J. Davenport, 1970: Contrails and aircraft downwash. *J. Fluid Mech.*, **43**, 451–464..

<sup>8</sup> Hanson, H. M., and D. M. Hanson, 1995: A reexamination of the formation of exhaust condensation trails by jet aircraft. *J. Appl. Meteor.*, **34**, 2400–2405.

<sup>9</sup> Travis J.T, An Emperic model to predict widespread occurences of contrails, American Meteorology Society, Volume 36, Issue 9, September 1997.

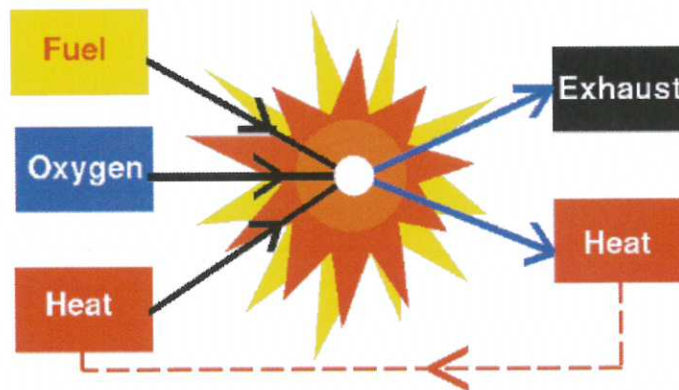
<sup>10</sup> Travis D.J., Carleton A.M. and Lauritsen R.G, Regional variations in U.S. diurnal temperature range for the 11-14 September 2001 aircraft groundings: evidence of jet contrail influence on climate, Journal of Climate, Volume 17, March 1st 2004.

<sup>11</sup> Kalkstein and Balling Jr., Climate Research, 26, 1-4, 2004

### 3.2. CHEMICAL COMPOSITION OF CONTRAILS.

#### 3.2.1. Standards for measurement:

In order to understand what is being done, we first have to understand some basic concepts. A jet engine is an internal combustion engine, just like an automobile engine is. In a jet engine, the fuel and an oxidizer combust (or burn) and the products of that combustion are exhausted through a narrow opening at high speed.<sup>12</sup>



The substances contained in a contrail depend on the following parameters:

- Engine type, its by-pass ratio and its pressure ratio & rated output: newer technology is usually much more environmentally 'friendly'.
- Type of fuel: modern jet engine fuel is primarily kerosene, which is a fossil fuel. However a distinction can be made between civil and military operations. Civil airplanes used in commercial aviation fly on JET A-1, while aircraft used for defense operate on a different fuel that provides optimal viscosity, heat sink and thermal stability in any operational theatre ranging from arctic to equatorial.<sup>13</sup> In this respect it is noteworthy that NATO-forces currently use JP-8 (Jet Propellant 8), a relative new fuel type whose additives are legally protected by a patent.
- Power setting: at take off power and cruise setting combustion is optimal, burning more than 99% of the fuel through complete combustion to carbon dioxide and water. At idle conditions, much less fuel is consumed and, in the interest of maintaining stable combustion at lower power conditions, some sacrifice in combustion efficiency occurs even though this inefficiency is still only a percent or so. Any combustion inefficiency of Hydrocarbon fuel will result in emissions of some combination of CO and incompletely oxidized Hydrocarbons, as well as some carbonaceous particles.<sup>14</sup>
- Maintenance standards and engine age: older engines or retrofitted power plants (e.g. upgrade to stage III of obsolete DC-8 aircraft in the years 2000 and beyond) emit significantly more pollutants than newer designs. Nano sized metal particles

<sup>12</sup> Picture by courtesy of Aerospaceweb.org.

<sup>13</sup> Shawn P. Heneghan and William E. Harrison III, JP8+100: the development of high thermal stability fuel, Aerospace Mechanic Division, University of Dayton, OH and USAF Wright Laboratories, N. Wright Patterson AFB, OH, 6th international conference on stability and handling of liquid fuels, Vancouver, October 13-17 1997

<sup>14</sup> Aircraft Engine Speciated Organic Gases: Speciation of Unburned Organic Gases in Aircraft Exhaust, Assessment and Standards Division Office of Transportation and Air Quality U.S. Environmental Protection Agency and AEE-300 - Emissions Division Office of Environment and Energy Federal Aviation Administration, FAA publication. May 2009.

originating as a result of wear may also appear in the contrail. The same problem occurs in countries where maintenance standards are somewhat lower.

### 3.2.2. Chemical composition of jet aircraft emissions:

Burning fossil fuels primarily produces the following gaseous emissions:<sup>15</sup>

- Carbon Dioxide (CO<sub>2</sub>).
- A large amount of water vapor (H<sub>2</sub>O) that immediately freezes upon contact with the free air. This makes the contrail visible for the human eye.
- Nitric oxide (NO) and nitrogen oxide (NO<sub>2</sub>), which together are called NO<sub>x</sub>.
- Sulfur Oxides (SO<sub>2</sub>).
- Soot.

However very few tests have been performed in order to assess and evaluate a detailed chemical composition in terms of Hydrocarbons (HC) of contrails. Of special interest is the survey of the US Environmental Protection Agency (EPA) and the Federal Aviation Agency (FAA) of May 2009, which uses data from a set of studies initiated by NASA called Aircraft Particle Emissions eXperiment (APEX). This project was supported by a wide range of sponsors (NASA, FAA, CARB, EPA, DoD ...) and focused attention on commercial aircraft Particulate Matter (PM) emissions.

The main objective of the APEX research was to characterize both gaseous and particulate emissions to advance the understanding of emissions from commercial aircraft engines. APEX1 was conducted in April of 2004 with a NASA-owned DC-8 aircraft equipped with CFM-56-2C1 engines. APEX2 was conducted in August 2005 for typical in-use aircraft engines (CFM56 engines on B737 aircraft), APEX3 testing was conducted in October and November of 2005 spanning a range of engines from a small business jet, through a modern regional turbofan, a single-aisle transport turbofan, to a large high bypass ratio turbo fan, representing five different engine types, some measuring more than one example. In all studies, exhaust plumes were sampled at the engine exit plane and several downstream measurement locations.

Test results on the CFM56-3 engines running on JET A-1 fuel revealed that the most important compound in emissions is Ethylene, followed by Formaldehyde, Acetylene, Propene, Acetaldehyde and another 46 substances including Benzene. The most important compounds of Hydrocarbon engine emissions on a molar basis are as follows:<sup>16</sup>

<sup>15</sup> NASA Facts, Glenn Research Center, Article FS-2000-04-010-GRC, Safeguarding our atmosphere, Glenn Research reduces harmful aircraft emissions.

<sup>16</sup> Shawn P. Heneghan and William E. Harrison III, JP8+100: the development of high thermal stability fuel, Aerospace Mechanic Division, University of Dayton, OH and USAF Wright Laboratories, N. Wright Patterson AFB, OH, 6th international conference on stability and handling of liquid fuels, Vancouver, October 13-17 1997 .

Compound	Emission Ratio (mmole / mole)	Compound	Emission ratio (mmole / mole)
Ethylene	0,770	Acrolein	0,061
Formaldehyde	0,572	I-butene	0,044
Acetylene	0,211	Glyoxal	0,044
Propene	0,151	1,3-Butadiene	0,044
Acetaldehyde	0,135	Benzene	0,030

The other 41 compounds have a weight below 0,030 mmole per mole. Full test results are included in appendix 1, page 6.

### 3.2.3. Impact of fuel specifications on aircraft engine emissions:

In commercial and military aviation the following fuel types are being used<sup>17</sup>:

FUEL TYPE	APPLICATION FIELD	REMARKS
JET A-1	Commercial aviation and some air forces not being a NATO-member (e.g. Austrian AF)	Jet fuel as analyzed in paragraph 3.2.2. nowadays also used in recreational aviation & flight training, referred to for fiscal purposes as Aero Diesel.
JP-4 Avtag	US Airforce, NATO Code F-40	50/50 Kerosene – Gasoline, phased out in 1996 in favor of JP-8.
JP-5	US Navy, NATO Code F-44	Still in use in naval operations, highest flash point, higher than JET A1 and JP-8.
JP-7	US Air Force	Specially designed for supersonic operations above Mach 3 (Example: former SR-71 Blackbird)
JP-8	US Air Force, NATO Code F-34	Replacing JP-4, transition should be completed by the year 2010.

Aircraft operators are constantly refining their fuels to deal with specific performance concerns. A major problem with gasoline is that it has what is known as a low "flashpoint." This is the temperature at which it produces fumes that can be ignited by an open flame. Gasoline has a flashpoint of around 30 degrees Fahrenheit (-1 degree Celsius). This makes fires much more likely in the event of an accident. So engine designers sought to develop engines that used fuels with higher flashpoints.

The U.S. Air Force during the 1990s switched from JP-4 to JP-8 because it had a higher flashpoint and was less carcinogenic, among other things. By the mid 1990s, the Air Force further modified JP-8 to include a chemical that reduced the buildup of contaminants in the engines that affected performance. JP-5 has even a higher flashpoint than JP-8, but its high cost limits its use to aircraft carriers. JP-8 has a strong odor and is oily to the touch, which makes it more unpleasant to handle and less safe in some ways.

<sup>17</sup> Air BP, the history of Jet fuel, [www.bp.com](http://www.bp.com).



Military personnel who work with it complain that it is difficult to wash off and causes headaches and other physical problems.<sup>18</sup>

Market is big and ever increasing with the military operations in Iraq, Afghanistan and the restless efforts on 'war on terror'. About 60 billion gallons (227 billion liters) were used worldwide by the late 1990s, with the U.S. Air Force, Army, and NATO using about 4.5 billion gallons (17 billion liters). It is also used to fuel heaters, stoves, powered electric generators, and combat vehicles. The M1 Abrams battle tank also uses JP-8 in its gas engine turbines. The use of a single fuel for most military applications would greatly simplify wartime logistics.

A latest development is JP-8+100, a version of JP-8 with an additive that increases its thermal stability by 56°C (100°F). The additive is a combination of a surfactant, metal deactivator, and an antioxidant. It was introduced in 1994. The additive reduces coking and fouling in engine fuel systems. Commercially, this additive is used in Boeing aircraft operated by KLM, and in police helicopters in Tampa, Florida. It is also used as fuel for Canadian CF-18 Hornets.

Of special concern is the comparison between JET A-1 and JP-8 / JP-8+100. Officially the fuel types are similar, except that the military variant contains additional icing inhibitor, corrosion inhibitors, lubricants, and antistatic agents.<sup>19</sup> A patent protects the exact composition of additives of JP-8, which is quite obvious in order to prevent espionage and transfer of technology to hostile parties.<sup>20</sup> Nevertheless it is possible to establish a comparison between Jet A-1 and JP-8+100 as several civil organizations are part of the engineering program.

More than interesting is the conclusion of the 6<sup>th</sup> International Conference on Stability and Handling of Liquid Fuel, held in October 1997 in Vancouver, Canada. In this paper the effects of the selected additives in JP-8+100 are examined on properties that are unrelated to thermal stability characteristics. For instance the comparison between Jet A-1 and JP-8 of additive 'Specific Aid 8Q405' is of special interest.<sup>21</sup> For a given concentration the conductivity of JP-8 jet fuel is much higher, which underlines the usefulness of the proposed additives. However one can logically assume that aircraft engine emissions will also significantly increase as a result of these additional icing inhibitor, corrosion inhibitors, lubricants, and antistatic agents. Official tests results have never been released by the US government, which is also the beneficiary of the patent.

The full paper of the 6<sup>th</sup> International Conference on Stability and Handling of Liquid Fuel, as well as the detailed specifications of military aviation fuels are included in appendix 2.

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<sup>18</sup>[www.centennialofflight.gov/essay/Evolution\\_of\\_Technology/fuel/Tech21.htm](http://www.centennialofflight.gov/essay/Evolution_of_Technology/fuel/Tech21.htm)

<sup>19</sup> MIL-DTL-83133F 11 April 2008 Superseding MIL-DTL-83133E 1 April 1999

Detail Specification Turbine Fuel, Aviation Kerosene Type, JP-8 (NATO F-34), NATO F-35, and JP-8+100 (NATO F-37).

<sup>20</sup> US patent 20050274063 – jet fuel additive concentrate composition and fuel composition and methods thereof, filed June 13th 2003, published December 15th 2005.

<sup>21</sup> B. Dacre and J. Hetherington, Electrical Conductivity of HITTS Additive Packages for the JP-8+100 Program, Rutherford Laboratory, Royal Military College of Science, Swindon, UK, 1997, Table 1, page 325.

### 3.3. AIRCRAFT EMISSION REGULATIONS:

#### 3.3.1. Regulatory standards:

Engine emissions for civil aircraft are regulated. The UK Civil Aviation Authority publishes a databank with information on exhaust emissions of only those aircraft engines that have entered production. Engine manufacturers, who are solely responsible for its accuracy, provide this information based on a test run. It was collected in the course of the work carried out by the ICAO Committee on Aviation Environmental Protection (CAEP) but has not been independently verified unless indicated. The UK CAA is hosting this Databank on behalf of ICAO and is not responsible for the contents.<sup>22</sup> This already reveals two weak links:

- The manufacturer provides data, based on few tests. Its reliability is not verified by any agency. Therefore one must rely entirely on the quality system of that company.
- Military aircraft are actually exempted from this regulatory system as some aircraft are equipped with engines that are no longer used in commercial aviation.<sup>23</sup> Although aircraft equipped with older engines mostly do not have a noise certificate and are subsequently denied landing rights on civil airports they can still cross our airspace and land on AF Bases where those restrictions do not exist.
- As ICAO only publishes standards & recommended procedures, which must be integrated into national legislation, some countries can promulgate derogations on emission regulation.

The regulatory standards are those found in the Standards & recommended procedures of the ICAO, Annex 16, Volume 2 (subsonic engines), Part III and include a standard for smoke, unburned Hydrocarbons (HC), Carbon Monoxide (CO), Oxides of Nitrogen (NOx):

PARAMETER	REGULATORY LEVELS <sup>24</sup>
Smoke Number (SN)	$83,6 \times (F_{\infty})^{0,274}$ or 50, whichever is lower; and $F_{\infty}$ = rated engine output
Hydrocarbons (HC)	$D_p / F_{\infty} = 19,6$ ; and $D_p$ = mass in grams of any pollutant emitted during the reference landing and take off.
Carbon Monoxide (CO)	$D_p / F_{\infty} = 118$
Oxides of Nitrogen (NOx)	Variable level in function of engine age and engine pressure ratio, ranging between $DP / F_{\infty} = 40 + 2 \Pi^{\infty}$ (production before 31-12-95) And $DP / F_{\infty} = 36 + 1,6 \Pi^{\infty}$ (engine pressure ratio 82,6 or more) And $\Pi^{\infty}$ = engine pressure ratio

Refer to appendix 3 for a detailed explanation of these parameters.

<sup>22</sup> ICAO Aircraft Emissions Engine Databank, UK CAA, Updated July16th 2007.

<sup>23</sup> Aircraft Engine Speciated Organic Gases: Speciation of Unburned Organic Gases in Aircraft Exhaust, Assessment and Standards Division Office of Transportation and Air Quality U.S. Environmental Protection Agency  
and AEE-300 - Emissions Division Office of Environment and Energy Federal Aviation Administration, FAA publication. May 2009, page 3.

<sup>24</sup> ICAO Aircraft Emissions Engine Databank, chapter 7, regulatory standards, UK CAA, Updated July16th 2007.

### 3.3.2. Case Study: civil versus military engine emissions.

#### 3.3.2.1. Outline

The introduction of these regulatory levels was a good move to wipe out obsolete commercial jet Aircraft, unless the engine were retro fitted and upgraded to stage III.<sup>25</sup> Furthermore the databank includes data of engines, which do not have to comply with the emission standards, but instead received wide derogations. This clearly shows that this system is not fail safe, as it leaves too many backdoors.

In order to make a point let us examine more closely 3 different engine types:

- a) The PW4048, new generation, which equips the Boeing 777.
- b) The JT3D-3B that is still used on KC135 and B-52H bombers.
- c) The CFM56-3C as used on the NASA APEX research as set in paragraph 3.2.2.



Engine tests on the Pratt & Whitney PW4084 as used on the Boeing 777 were performed from April 26th till May 2nd 1994 for the measurement of data for the ICAO data bank.<sup>26</sup>



*The KC135 tanker, which is the military version of the Boeing 707, is equipped with JT3D-3B engines, tested between 1972 and 1974. Another version, the E-3 Sentry, better known as the Awacs (Airborne Early Warning and Control System), is equipped with TF33-PW100A of Inter Turbine Technologies, which are not included in the ICAO Aircraft Emissions Engine Databank.<sup>27</sup>*

<sup>25</sup> Air Navigation (Aircraft Noise) Regulations, Statutory rules 1984 N°188 as amended, February 22nd 2002, Office of Legislative drafting, Attorney-General's Department, Canberra, Australia.

<sup>26</sup> Boeing Photo, credit K63367-05

<sup>27</sup> Image Courtesy of the United States Department of Defence



**3.3.2.2. Test results**

Comparison of aircraft emission data as obtained on the test data sheet between the three engine types reveals quite interesting information:

PARAMETER	PW4084 (Boeing 777) <sup>28</sup>	JT3D-3B (KC135 / B52H) <sup>29</sup>	CFM56-3C (APEX test) <sup>30</sup>
Smoke Number SN (standard 50)	10,50	54,50	9,9
Hydrocarbons HC (standard 19,6)	2,90	303,90	4,3
Carbon Monoxide CO (standard 118)	19,50	288,10	65,7
Oxides of Nitrogen NOx (standard 42,69 for KC135; 79,38 for B777; 23,35 for the APEX test engines)	62,80	34,30	53,1

The test results have to be interpreted as follows:

- The data obtained with the CFM56-3C-1, labeled in green color in the table, acts as reference. This engine type meets all regulatory standards and will be used to establish the HC-emissions by the other engine types.
- Older aircraft such as the KC135 tanker and the strategic bomber B-52H do emit substantial amounts of gaseous emissions. The NOx value of the JT3D-3B engine is lower than the data for the Boeing 777 engine due to its lower engine pressure ratio. To put in simpler words: the more engine power available the higher the emission of Nitrogen will be. This is considered as normal.
- For some unknown reasons derogation for the JT3D-3B engine has been granted in the ICAO data sheet (see appendix 3): 395,4 for the HC-parameter and 328,2 for CO. This is in fact an increase of a very royal 2017,6% for the emission of Hydrocarbon and 278,2% for Carbon Monoxide.
- If one extrapolates the test results as published in paragraph 3.2.2 for the CFM56-3C engine the actual weight of each chemical compound is magnified by an unknown factor. One can assume that for instance the emission of Ethylene could well exceed a hundredfold the test data of 0,77 emission ratio in mmole / mole (see appendix 1). There is no doubt that operation of airplanes with such obsolete engines has a negative influence on public health.
- Apart from some minor airline companies on remote places the JT3D-3B engine is exclusively in use in military forces that are not subject to any restrictions of that kind. Although no data is available for engines used on the E-2 / E-3 Sentry 'Awacs' model one can assume that its emissions are similar, because some air forces such as the Royal Air Force, the French Armée de l'Air and the Saudian forces already have retrofitted their E-3's with more contemporary CFM-engines.

Copies of the ICAO documents for the 3 engine types can be found in appendix 3.

<sup>28</sup> ICAO Engine Exhaust Emissions Databank, Subsonic Engines, PW4084, July, 18th 2007.

<sup>29</sup> ICAO Engine Exhaust Emissions Databank, Subsonic Engines, JT3D-3B, October, 1st 2004.

<sup>30</sup> ICAO Engine Exhaust Emissions Databank, Subsonic Engines, CFM56-3C-1, October, 1st 2004.

**3.3.2.3. Production numbers of the KC-135 Stratotanker:**

In order to know if excessive emissions of these military aircraft are statistically significant one must assess how of them have been build and the percentage of military traffic in global aviation. Production of the KC135 ceased in 1965. In 1988 Boeing Company performed a mid life upgrade on 746 airplanes, clearly denoting the long active service of that airplane.<sup>31</sup> About 410 airframes have been upgraded since with CFM56 engines.<sup>32</sup>

Additionally a batch of 33 E-3 Sentry aircraft has been build of whom 17 are in use in NATO forces. These aircraft, which have not been retrofitted with CFM-engines<sup>33</sup>, operate mainly from Geilenkirchen AFB (German – Dutch border) with a multinational crew under Luxemburg flag with apparently a civil registration number. The reason for this is quite complex. In summary official NATO sources state that it is not possible to use markings of all member countries and they had to find a member nation 'whose legislation in this area was sufficiently accommodating to provide the Force Commander with enough latitude and flexibility to make up his crews as required and organize maintenance operations'.<sup>34</sup> Thus Registration of the E-3As with NATO 's smallest member nation, Luxemburg, was proposed.



Note the flag of Luxemburg on the tail section and underneath the wing of this E-3A at Geilenkirchen AFB. Its registration number is a civil LX-code. This airplane is still equipped with older TF33-PW100A engines (credit: official NATO AWACS website).

It is quite intriguing that airplanes with a Luxemburg (semi) civil registration do not need to comply with the ICAO engine emission databank and can do things at their own convenience. Furthermore Mr. D. Rumsfeld, former minister of defense under the Bush administration, declared that an upgrading program of the B-52 and KC-135 would only be partly implemented as a result of cost cutting programs.<sup>35</sup> A NATO survey suggests that the Awacs aircraft are 'sustainable beyond 2025'.<sup>36</sup> These old aircraft with high HC- and CO-emissions are likely to stay in the air for a while. The fact that Geilenkirchen AFB will not be closed in the year 2025 as planned but even see its runway extended underlines

<sup>31</sup> Boeing Integrated Defence Systems website, Stratotanker overview.

<sup>32</sup> CFM News, USAF expands CFM56-2-powered KC-135 fleet, July, 22nd 2002.

<sup>33</sup> CFM News, USAF expands CFM56-2-powered KC-135 fleet, July, 22nd 2002.

<sup>34</sup> Official NATO Airborne Early Warning and Control Force website [www.e3a.nato.int](http://www.e3a.nato.int), E-3A Component, FAQ, Question 14 'Why is there a red lion on the tail?'

<sup>35</sup> Global Security, SECAF lays out case for tanker upgrade, Master sgt S. Elliott, Air Force Print News, March 7th, 2003.

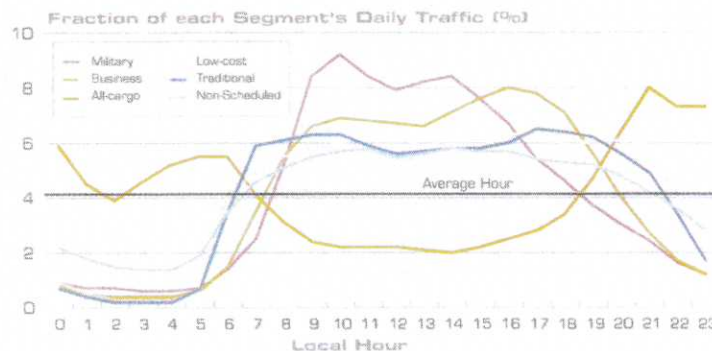
<sup>36</sup> NATO Airborne Early Warning and Control Program, US Air Force Maj. Gen. G. Winterberger, NAEW&C Force Commander and P. McCaffrey NAPMA, Plans and Evaluation Division, March 2nd, 2005.



this.<sup>37</sup>

### 3.3.2.4. Percentage of military traffic in global aviation:

Although the majority of air traffic on this planet is civilian, military operations represent almost the most important segment in aviation<sup>38</sup>:



According to the Eurocontrol statistics military traffic is actually the biggest segment between 8 AM and 3 PM. Of course not all military traffic consists of KC-135 tankers and E-3 Sentry aircraft, but one must bear in mind that very substantial resources in an Air Force are used to keep the Defense Force (Multi Role Units & Ground units in crisis zones) operational and this includes a lot of logistics in the form of transport wings. This does not only include modern aircraft as the C-17 Globemaster but also obsolete planes as the Lockheed C-130, which is still in use in many Air Forces and is not subject to study in this survey.

However, when taking into account that some part of civil cargo traffic is performed on behalf of the military then we can assume that the military segment tops above 10% at regular intervals.

### 3.3.2.5. Conclusions of this test case:

The logical conclusion obtained by combining the data as mentioned above is that the military segment is statistically important and that airplanes with excessive HC-, CO- and NOx-emissions are still widely used, although airplanes such as the KC135 and E-3 'comply' with ICAO-Standards and Recommended Procedures.

This is actually unacceptable in the view of the efforts being made by civil operators in order to comply with environmental requirements. Efforts should be made by politicians to phase out those aircraft equipped with engines that do not meet the basic regulatory levels as set in the ICAO. This encompasses the workforce of about 300 KC-135 in the United States and all of the E-3 Sentry aircraft based at Geilenkirchen. In this respect it is a total contradiction that these aircraft are allowed to operate under a Luxemburg LX-registration number, bearing in mind that its engine types are even not listed in the ICAO-databank.

<sup>37</sup> De Limburger, Limburgs dagblad, 'Basis Awacs blijft ook na 2025 gewoon open', December 15th, 2009.

<sup>38</sup> Eurocontrol Trends in Air Traffic, Volume 5, Dependent on the dark: cargo and other night flights in European Airspace, 2009.

## 4. EFFECTS OF CONTRAILS ON CLIMATE

No more than a few decades remain before the chance to avert the threats we now confront will be lost and the prospects for humanity immeasurably diminished. We, the undersigned members of the world scientific community, warn all humanity what lies ahead. A great change in the stewardship of the Earth and life on it is required if vast human misery is to be avoided and our global home on this planet not to be irretrievably mutilated.

"World Scientists, warning to humanity", document signed by 1600 senior scientists from 71 countries, published in Time, Planet of the Year, November 18<sup>th</sup> 1992,

Publication rejected by the New York Times and Washington Post as not newsworthy



#### 4. EFFECTS OF CONTRAILS ON CLIMATE:

##### 4.1. Effects of contrails on cloud formation:

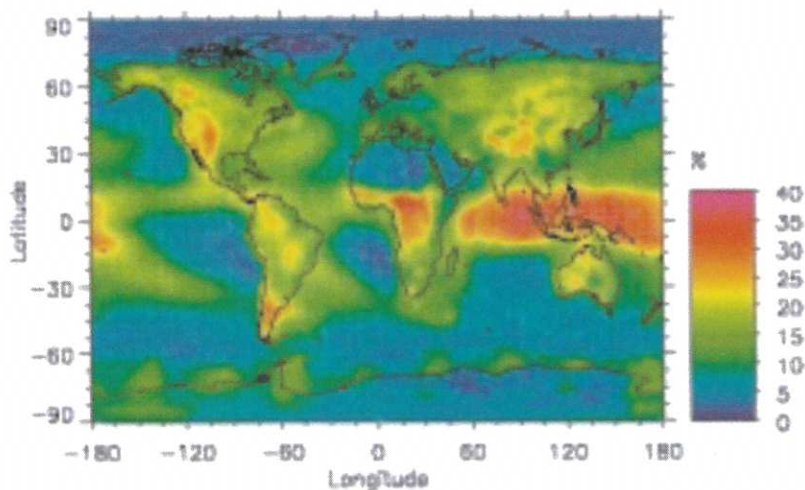
###### 4.1.1. Characteristics of Cirrus clouds:

Cirrus clouds (WMO abbreviation Ci) are formed in a natural way when water vapor freezes into ice crystals at altitudes above 8000 meters (26,000 ft) in the higher part of the troposphere. The exact altitude depends also on the height of tropopause, the boundary with the stratosphere and the higher levels of earth's atmosphere. That means that Cirrus clouds in polar regions will appear at a much lower altitude than at the equator.

Due to the sparse moisture at a high altitude, Cirrus clouds are very thin. Fall streaks, sometimes also called Virgae, form when ice crystals fall from Cirrus clouds. The change in wind with height and how quickly these ice crystals fall determine the shapes and sizes the fall streaks attain. Since ice crystals fall much more slowly than raindrops, fall streaks tend to be stretched out horizontally as well as vertically. Cirrus streaks may be nearly straight, shaped like a comma, or seemingly all tangled together. As wind velocity increases with altitude they may be spread over large areas. This is particularly the case in the vicinity of jet streams, which splits the cells of the different tropopause layers. Sometimes one can even see the clouds moving fast from the ground.<sup>39</sup>

There are other cloud types associated with Cirrus such as the Cirrostratus (WMO abbreviation Cs) and the Cirrocumulus (WMO abbreviation Cc), but these are generally related to incoming frontal systems and are further omitted from this survey.

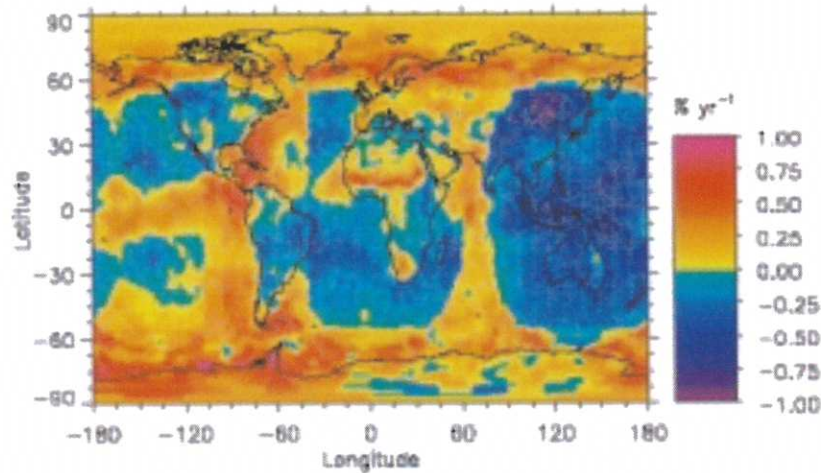
Although Cirrus clouds look thin they may occupy a significant part of the sky up to 30% and even more in some areas – in meteorological terms called 'scattered' (SCT) up to 'broken' (BKN). Transmittance of direct and diffuse sunlight is about 80%.<sup>40</sup>



Global map of average Cirrus cloud cover based on the ISCCP cloud database for the period 1984 - 1999 (in % cloud cover)

<sup>39</sup> WMO website, Meteorological Codes for high altitude clouds.

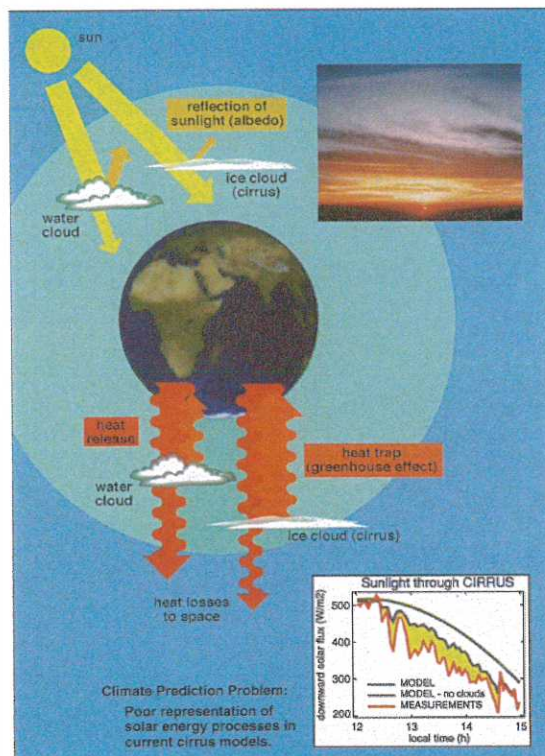
<sup>40</sup> Is there a trend in Cirrus cloud cover due to aircraft traffic?, F. Stordal et al., Atmos. Chem. Phys., 5, (2005) 21555-2161.



Changes in the Cirrus cloud cover in percentage between the two periods 1992-1999 and 1984-1991.<sup>41</sup>

#### 4.1.2. Impact of Cirrus clouds on climate:

The climate of the Earth results from an energy balance between absorbed sunlight and radiative losses of heat from Earth and its atmosphere to space. Clouds are an important modulator in this balance. Clouds reflect sunlight back toward space, which reduces the solar energy available to the Earth – also called the Albedo effect. Clouds also reduce radiative heat losses to space (greenhouse effect). Which of these two opposing processes dominates depends on many parameters including cloud particle composition, cloud structure, cloud cover, and cloud location.<sup>42</sup> Changes to only one of these parameters can have significant implications for climate.



<sup>41</sup> Idem as footnote 40.

<sup>42</sup> Kinne S., Cirrus Clouds and climate, NASA Ames Research Center webpage.



The greenhouse effect is weak for low altitude clouds, so their Albedo effect dominates and they cool the Earth's climate. In contrast, cold high altitude Cirrus clouds may either cool or warm the climate. This will prove to be a key element whether to determine if weather modification programs are being conducted on the planet in order to reduce 'global warming'.

Cirrus clouds have thus a strong greenhouse effect, which may outweigh their Albedo effect losses. As the importance of both opposing effects depends critically on little understood Cirrus properties, theoretical calculations of the climatic effects of Cirrus are controversial. The main uncertainty stems from a current inability to calculate the scattering of sunlight in Cirrus clouds, since they contain a multitude of ice crystal shapes and sizes, and are irregular in structure. Even more, Stefan Kinne of the NASA Ames Research Center states clearly that the Cirrus Albedo effect is severely underestimated by calculations.<sup>43</sup>

This proves that knowledge in this field of science is quite limited and extensive research is mandatory in order to fully understand the impact of Cirrus clouds on climate. In this respect it is noteworthy that evidence of thin Cirrus clouds in the Stratosphere has already been established.<sup>44</sup>

#### 4.1.3. Development of contrails into Cirrus clouds:

Contrails, a man made phenomena, are not listed as such in the WMO cloud coding. In the high cloud section of the document the only possible link with contrails is the 'Cirrus in the form of hooks, filaments, or both, progressively invading the sky' – WMO code 0509, section 4. Refer to appendix 4 for the full cloud coding as provided by the WMO.

Because contrails are not listed in the WMO decoding table there is logically no instrument to catalogue them or to make them an inherent part of a weather forecast (TAF in aviation). When contrails turn into Cirrus clouds they are just incorporated in the actual weather report (METAR in aviation). As there are no instruments for measurement most meteorologists just limit their impact on climate as being only 'esthetic'.

Not all contrails develop into Cirrus clouds and if they do, what is the exact scientific base? Well, aircraft emissions as explained in paragraph 3.2.2. are actually aerosols, microscopic particles suspended in the air.<sup>45</sup> They act like seeds: water molecules can condense or freeze on to them to form cloud particles.

Sulphuric Acid ( $H_2SO_4$ ) increases as a result of gas-phase oxidation processes. Soot particles become chemically activated by adsorption and binary heterogeneous nucleation of Sulphur Trioxid ( $SO_3$ , a chemical compound of Sulphur and Oxygen) and  $H_2SO_4$  in the presence of  $H_2O$ , leading to the formation of a partial liquid  $H_2SO_4/H_2O$  coating. Upon further cooling, volatile liquid  $H_2SO_4/H_2O$  droplets are formed by binary homogeneous nucleation, whereby the chemi-ions act as preferred nucleation centers. These aerosols grow in size by condensation and coagulation processes (clotting).

Coagulation between volatile particles and soot enhances the coating and forms a mixed  $H_2SO_4/H_2O$ -soot aerosol, which is eventually scavenged by background aerosol particles at longer times. If liquid  $H_2O$  saturation is reached in the plume, a contrail forms. Ice particles are created in the contrail mainly by freezing of exhaust aerosols. Scavenging of exhaust particles and further deposition of  $H_2O$  leads to an increase of the ice mass. The

<sup>43</sup> Kinne S., Cirrus Clouds and climate, NASA Ames Research Center webpage.

<sup>44</sup> Keckhut P., Hauchecorne A., Bekki S., Colette A., David C., and Jumelet C., Evidences of thin Cirrus clouds in the stratosphere at mid-latitudes, Service d'Aéronomie/Institut Pierre-Simon Laplace, CNRS, Verrières le Buisson, France, Received: 28 December 2004 – Accepted: 17 January 2005 – Published: 21 June 2005

<sup>45</sup> NASA Facts, Glenn Research Center, Article FS-2000-04-010-GRC, Safeguarding our atmosphere, Glenn Research reduces harmful aircraft emissions.

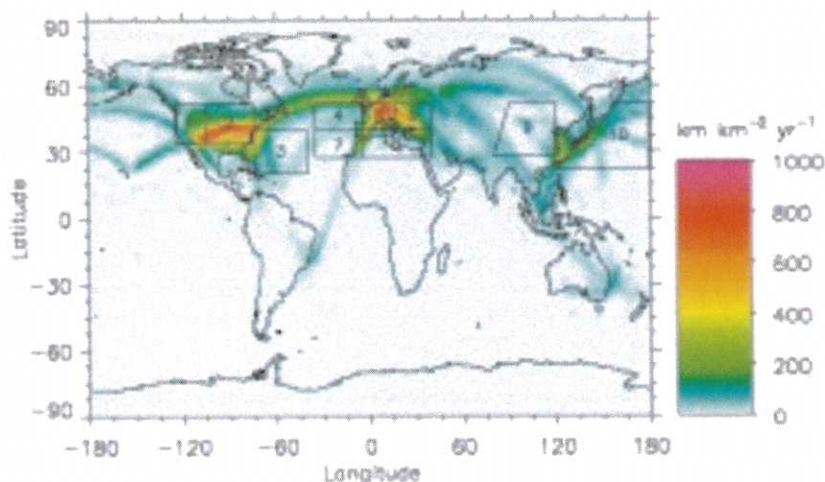
contrail persists in ice-supersaturated air and may develop into a Cirrus cloud. Short-lived and persistent contrails return residual particles into the atmosphere upon evaporation. The scavenging timescales are highly variable and depend on the exhaust and background aerosol size distributions and abundances, as well as on wake mixing rates.

This means that the formation of contrails not only depend on the amount of HC-, CO and NOx engine emissions but also on the fuel type being used. In this respect it is likely that older engines operating on fuels with additional additives as highlighted in the case study produce more persistent contrails.

#### 4.1.4. Impact of aviation on the formation of man made 'Cirrus':

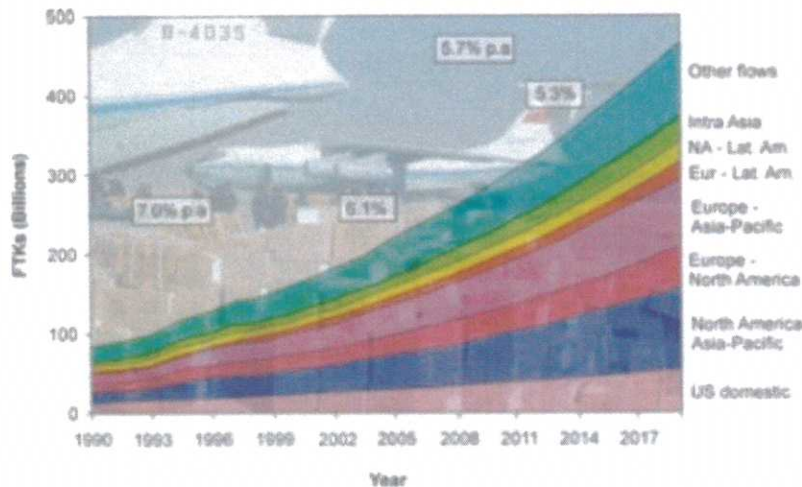
Before discussing the possible impact of contrails on climate one has to assess the most popular flying routes as well as the projected evolution of aviation on the globe.

The most congested traffic patterns are situated between the East and West coast of the United States, overhead the North Atlantic and between major cities in Europe. When we look at the trend in commercial aviation the number of flights may well double in the next ten years. In order to avoid airspace saturation on the busiest routes Air Traffic Control agencies such as CANAC in Brussels anticipated this development by introducing new transponders (Mode S) in November 2009 to allow smaller separation standards between airplanes.



This map shows the distances flown with aircrafts for the year 2000 between 9800 and 11600 m altitude. It shows also 10 regions from which a correlation between aircraft density and Cirrus trends has been analyzed and proven.<sup>46</sup>

<sup>46</sup> Is there a trend in Cirrus cloud cover due to aircraft traffic?, F. Stordal et al., Atmos. Chem. Phys., 5, (2005) 21555-2161.



This graph shows the projected growth in freight in freight ton kilometers (FTK), according to estimation from Boeing Corporation in 2002.<sup>47</sup>

The predicted increase in air traffic for the year 2009 has been hampered by the worst financial crisis since the great depression in the thirties, but it still at its 2007 level – an increase of about 28% in comparison to the year when the above graphics have been designed.

According to the Quantify Project Group, which studies the climate impact of transport systems in Europe, the amount of Cirrus clouds tends in general to decrease on our planet, except in regions with high air traffic. For Europe it is estimated that the amount of Cirrus clouds, which can be attributed to air traffic increases by 1-2% per decade. Aviation induced cloud cover is maybe 3-5% over Europe.<sup>48</sup>

According to the same source there are trends observed that increase in Cirrus cloud cover and in the fuel used by aircrafts go parallel. However, the consumed fuel increases over the years less fast (33% for 1992 to 2000) than the distance traveled by plane (+44%) since engines became more efficient. Military air traffic has also significantly increased since the second Gulf war and the subsequent 'war on terror' – putting reserve squadrons of the National Guard with older technology back in action.

Whiteleg and Cambridge from the Stockholm Environment Institute even expressively states that aviation poses a threat on different stakeholders:<sup>49</sup>

- On global level: affecting whole eco-systems.
- Regional: e.g. the European theatre.
- Local: e.g. living in the vicinity of Frankfurt airport.
- Community: living in the immediate surrounding of Frankfurt airport.
- Health impact: possible diseases on all levels.

<sup>47</sup> Whiteleg J and Cambridge H, Aviation and Sustainability, Stockholm Environment Institute, 2004.

<sup>48</sup> EU FP6 Integrated Project Quantify, Quantifying the climate impact of global and European Transport Systems., 2006.

<sup>49</sup> Whiteleg J and Cambridge H, Aviation and Sustainability, Stockholm Environment Institute, 2004, page 15.



GLOBAL	REGIONAL	LOCAL	COMMUNITY	HEALTH IMPACT
Carbon Dioxide	<b>Contrails</b>	Sulphur Dioxide	Noise exposure	<b>Pulmonary disease</b>
<b>Cirrus cloud formation</b>	Acidification	Ozone	Sleep disturbance	<b>DVT - Deep Vein Thrombosis</b>
Nitrogen Oxides	Potential loss of habitat	Airport pollution	Building damage	<b>Radiation exposure</b>
<b>Climate change</b>	Reduction in biodiversity	Local traffic congestion	Rural disturbance	
<b>Ozone depletion</b>		<b>Particulate matter (PM)</b>	Poorer education performance	
<b>Global warming</b>				

Contrails and formation of Cirrus clouds were thus in 2004 already 'known' problems. However no action of any kind has been taken to solve this issue. The situation is even worse: international aviation emissions are excluded from the Kyoto Protocol and therefore aviation 'enjoys the freedom to continue to pollute the atmosphere'. It has now been recognized by the UK government (HMSO, 2004) that if aircraft emissions are taken into account, it will not be able to meet its target of 60% reduction in greenhouse gases by the year 2050.<sup>50</sup>

There are other hints that any effort to reduce jet engine air emissions and subsequent pollution is systematically torpedoed for the sake of global economy. For instance the Reuters news agency reported on November 23<sup>rd</sup> 2004 that local air pollution agencies in the United States were pulling out of talks with the U.S. Environmental Agency and the Federal Aviation Administration after 5 years of work with no acceptable results. The aim of this voluntary program was to develop a scenario for reduction of pollution and particulate matter (PM) of jet aircraft.<sup>51</sup> Recently some new surveys have been conducted in order to develop acceptable scenarios with a minimum financial impact on companies for contrail control. For instance Robert Sausen of the DLR-Institute for physics of the atmosphere in Germany suggested a change in cruising altitude of commercial airplanes, with the best option a reduction of 6000 ft.<sup>52</sup> However reducing the cruising altitude would signify a noticeable increase in fuel consumption. It does not come as a surprise that these initiatives are kept silent for the sake of return on investment, which is very low to negative in the sector ('Start with a big fortune in aviation to acquire a small one').

It is undeniable that aviation has a significant impact on climate and some scientists agree that it has not been quantified. Sausen even describes in this survey the level of scientific

<sup>50</sup> Same source as footnote 48, page 17.

<sup>51</sup> Truth in aviation: efforts to reduce jet engine air pollution take a set back, Newsletter of the Regional Commission on Airport Affairs, December 2004.

<sup>52</sup> Sausen R, Climate impact by aviation and minimising it by operational means, DLR-Institut für Physik der Atmosphäre, Oberpfaffenhofen, Germany, meeting on environmental impact of air traffic, Brussels, May 3rd 2007.

knowledge on Cirrus clouds and contrails as 'poor'. Refer to appendix 5 for an updated aviation radiative forcing for the year 2000.

A different pathway is the introduction of a carbon tax on aviation operations. Besides the fact that it would be a very profitable operation for some interest groups it is clear that many airline companies would be forced to file for bankruptcy if a carbon tax would be levied on their operations, resulting in a net loss of 4 million jobs in the United States alone.<sup>53</sup> Also other countries such as Australia and India have objected against such tax and even if the European Community votes such a law it would not only be delayed significantly by rearguard battles, but low cost flying would certainly be a thing from the past.

Bearing in mind that the Copenhagen summit in 2009 was deliberately torpedoed by the main industrial nations with the United States on top one can only conclude that the ongoing scenario is to develop options that ensure 'Business as Usual'. Even the Kyoto Protocol can be considered as mere occupation therapy for the development of a lucrative cap & trade system.

## **4.2. EFFECT OF CONTRAILS ON TEMPERATURE:**

### **4.2.1. Variations in the daily temperature range as a result of contrails:**

Although it is clear that aircraft emissions have an impact on climate it is quite difficult to measure this, because aviation is just part of everyday life. However there has been one small window of opportunity to perform a reliable scientific survey, at the time that all commercial flights within the U.S. airspace were grounded for a period of 3 days after the events of 11 September 2001.<sup>54</sup>

This survey, performed by David J. Travis, Andrew M. Carlton and Ryan G. Lauritsen, released in final form 2 years later (!), revealed a departure of average diurnal temperature range (DTR) from the normal values derived from the 1971 – 2000 climatology data for the indicated 3-day period in 2001. DTR values for 11 to 14 September during the grounding period, measured at stations across the United States, show an increase of about 1,1°C in comparison with the normal values.<sup>55</sup>

This increase is larger than any during the 11–14 September period for the previous 30 years, giving ammunition to critics who state that weather conditions at this specific period were very extraordinary and no scientific based conclusions could be taken. However even more surprising is the fact that the 11-14 September increase in DTR was more than twice the national average for regions of the United States where contrail coverage has previously been reported to be most abundant, such as the Midwest, Northeast and Northwest regions.<sup>56</sup>

In the subsequent days after September 14<sup>th</sup> when civil flight operations resumed there was a temperature drop of about 0,8°C, denoting the return to 'normal' conditions. This underlines the impact of contrails on global surface temperatures with a noteworthy cooling down effect, especially reducing the maximum day temperatures. A new proof that aviation significantly affects climate emerged after the massive grounding in Europe in

<sup>53</sup> Kreutzer D, Ph.D., The economic impact of cap and trade, testimony before the energy and commerce committee U.S House of Representatives, April 22, 2009.

<sup>54</sup> Nature, Volume 418, August, 8 2002, Contrails reduce the daily temperature range, a brief interval when the skies were clear of jets unmasked an effect on climate.

<sup>55</sup> Travis D.J., Carleton A.M. and Lauritsen R.G., Regional variations in U.S. diurnal temperature range for the 11-14 September 2001 aircraft groundings: evidence of jet contrail influence on climate, Journal of Climate, Volume 17, published March 1st 2004.

<sup>56</sup> DeGrand J., Carleton A.M., Travis D.J. & Lamb, P.J. Appl. Meteorol, 39, 1434-1459, published in 2000.



2010 due to the volcano eruption in Iceland. It is too early to assess the quality of the survey, but the Kings College in London claims that 'airports are air polluters'.

The full paper covering the regional variation in U.S. diurnal temperature range during the 9-11 events, the summary from the magazine 'Nature' as well as the press release of April 22<sup>nd</sup>, 2010 from the Kings College London can be viewed in appendix 6.

#### 4.2.2. Global warming potential of aircraft engine emissions:

After the first reports of 'Climate Gate', the deliberate manipulation of weather data for IPCC purposes that emerged on the surface during the Copenhagen summit for climate change in 2009, one can even wonder if there is any global warming at all<sup>57</sup>. Climate change is a more appropriate term.

Nevertheless the potential of global warming of gaseous emissions from aircraft engines is not to be neglected. Global warming potential (GWP) is the impact a greenhouse gas has on global warming expressed over a 100-year time period. The GWP of each greenhouse gas depends on its ability to absorb heat in the atmosphere. By definition, CO<sub>2</sub> is used as reference case, with a GWP of 1.

Global warming potential values enable an increase or reduction of any of the greenhouse gases to be expressed as an equivalent reduction of CO<sub>2</sub> over a 100-year period. Table 4.2.2-1 lists the GWP of the greenhouse gases covered by Kyoto as well as those others related to aviation emissions:<sup>58</sup>

Greenhouse gas	Chemical formula	GWP 100 year time horizon
Carbon Dioxide	CO <sub>2</sub>	1
Methane	CH <sub>4</sub>	21
Nitrogen Oxide	N <sub>2</sub> O	310
Perfluorobutane	C <sub>4</sub> F <sub>10</sub>	7000
Perfluorocyclobutane	c-C <sub>4</sub> F <sub>8</sub>	8700
Sulphur Hexafluoride	SF <sub>6</sub>	23900

The GWP of greenhouse gases is quite high. According to the study of the Stockholm Environmental Institute aviation emissions account for around 3.5 per cent of man's contribution to global warming from fossil fuel use. By 2050, this percentage could grow to between 4 per cent and 15 per cent (IPCC data from 1999 and provided the data is not corrupted by 'Climate Gate').<sup>59</sup>

However this global warming potential is not realized as can be concluded in the post 9-11 survey. There are three possible reasons for this:

<sup>57</sup> Climate change: this is the worst scientific scandal of our generation, Daily telegraph, November 28th 2009.

<sup>58</sup> Intergovernmental Panel on Climate Change, Climate Change 1995: The Science of Climate Change (Cambridge, UK: Cambridge University Press, 1996), Table 2-9, "Radiative Forcing of Climate Change," p. 120.

<sup>59</sup> Whiteleg J and Cambridge H, Aviation and Sustainability, Stockholm Environment Institute, 2004, page 17

- The cooling down effect due to the formation of contrails and subsequent 'Cirrus' outweighs the Global Warming Potential of the gaseous engine emissions. There are no known scientific studies on this topic.
- Additional additives have been incorporated in jet fuel in order to counter global warming.
- A combination of both scenarios.

As will be explained in a different paragraph several patents and scientific research papers exist for cloud seeding in an attempt to counter global warming.

#### **4.3. EFFECT OF CONTRAILS ON PRECIPITATION:**

##### **4.3.1. Precipitation principles:**

Precipitation occurs when the following conditions are met:

- There must be moisture in the air. A cold parcel of air can contain less moisture than warm air. Relative humidity increases when the air parcel is adiabatically cooled (e.g. orographic lifting) or moisture is added to that parcel (e.g. air mass picking up moist from an ocean) or a combination of both.
- Condensation nuclei, such as dust particles, must be abundant.
- The droplets or ice crystals must be heavier than the updrafts. Mounting air currents are a result of instable air (cold air moving in over a warmer surface) and produce cumuliform clouds, the Cumulonimbus or Thunderstorm being its supreme form. The higher the updrafts the more violent the precipitation will be. In stable weather conditions the droplet tends to fall as soon as it is formed due to the limited updrafts.

Moreover precipitation is much more likely in low-pressure areas where frontal systems are allowed to slip in. However thermal thunderstorms may develop at any place on earth, except at the poles where temperatures do not permit this. A new development in climate change is the introduction of super cells with deep rotating updrafts that bust through the stratosphere, with extensive hail and extreme turbulence as a result. The crash of Air France flight 447 on its way from Rio de Janeiro to Paris in June 2009 with the loss of 224 lives is probably attributed to the presence of such cell on its flight path.

##### **4.3.2. Relation between contrails, air temperature and precipitation:**

The question arises if contrails and their switch into men made Cirrus have an impact on precipitation. In that respect 3 counter posing elements have to be distinguished:

- a) Jet engine emissions with extensive aerosol production deliver quite some condensation nuclei on which droplets can form. This increases the probability of additional precipitation.
- b) However as shown in the survey in paragraph 4.2.1 a significant temperature drop is noted due to the formation of contrails. As cold air can contain less moisture than a warm parcel of air precipitation could decrease.
- c) Because Contrails are formed in the upper part of the troposphere the subsequent reduction in temperature could trigger additional instability in the atmosphere. For example an ascending air particle in a Cumulonimbus cloud would indeed meet almost no resistance when nearing the tropopause because it is always warmer than the surrounding air. As a result it will bust through the tropopause and enter the stratosphere. Only the isothermal layer in the stratosphere prevents the thunderstorm shooting much higher. To put it in different words: contrails may induce the formation of super cells. Very limited scientific field research has been



performed on that topic, but this conclusion is only a matter of logic.

It is clear that there is a relation between these parameters, but scientists have failed to quantify the parameters. This is nothing new in meteorology: since the introduction of the Bergeron-Findeisen precipitation theory in 1935 it has been continuously evaluated and criticized<sup>60</sup>, but scientists can still not determine why a single cumulus develops into a thunderstorm while its neighbor doesn't.

The same applies in this discussion. A survey by Yun Qian and his colleagues, published in 2009, revealed long-term observational data that both the frequency and amount of light rain have decreased in eastern China for 1956–2005 with high spatial coherency and this as a result of increased aerosol concentration in the atmosphere.<sup>61</sup> Aviation has not been particularly targeted in this survey, but aircraft engine emissions have to be considered as a variant on this.

Professor D. Rosenfeld of the Institute of earth Sciences at the Hebrew university of Jerusalem (Israel) has come up with a surprising finding to the disputed issue whether air pollution increases or decreases rainfall. The conclusion of the study group is as follows: both can be true, depending on local environmental conditions. The amount of aerosols is the critical factor controlling how the energy is distributed in the atmosphere.<sup>62</sup> According to this survey they followed the energy flow through the atmosphere and the way it is influenced by aerosols and other 'airborne' particles. On this planet there is indeed an interaction of energy between the different cells within the troposphere in order to obtain a life sustaining temperature (15°C in the International Standard Atmosphere at sea level).

Aerosols act twofold: on one hand they act like a sunscreen reducing the amount of energy reaching the ground. Accordingly less water evaporates and the air mass at ground level stays cooler and drier, with a reduced tendency to rise and form clouds.

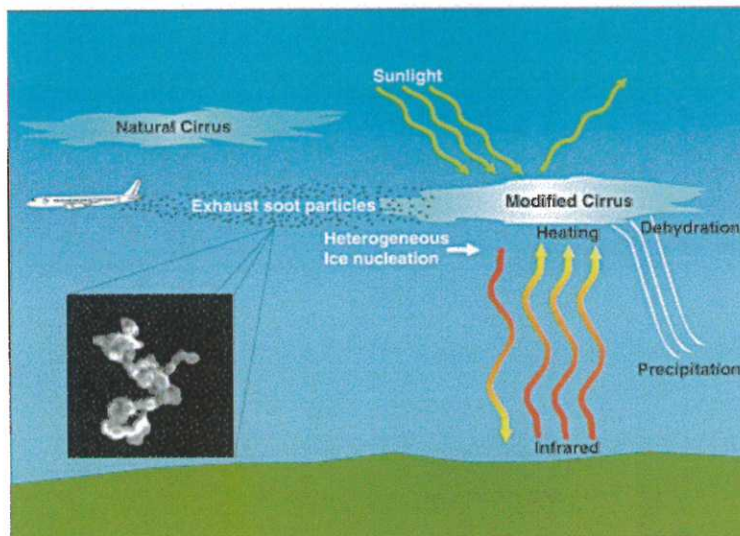


Figure 1: Ice cloud microphysical model

Aerosols act as a sunscreen with a subsequent reduction of energy reaching the ground. Some sources refer to this phenomenon as 'global dimming'.<sup>63</sup>

<sup>60</sup> Stickley A.B., An evaluation of the Bergeron-Findeisen precipitation theory, Monthly Weather Review, October 1940.

<sup>61</sup> Qian, Y., D. Gong, J. Fan, L. R. Leung, R. Bennartz, D. Chen, and W. Wang (2009), Heavy pollution suppresses light rain in China: Observations and modeling, *J. Geophys. Res.*, 114, D00K02, doi:10.1029/2008JD011575.

<sup>62</sup> Rosenfeld D, Does air pollution increase rainfall?, Hebrew University of Jerusalem, September 5th 2009.

<sup>63</sup> [geo.arc.nasa.gov/sge/jskiles/fliers/gif\\_folder/image10/image10a.gif](http://geo.arc.nasa.gov/sge/jskiles/fliers/gif_folder/image10/image10a.gif)

On the other hand, without natural aerosols such as dust particles there would be no cloud droplets because they act as gathering points for air humidity, the so called condensation nuclei as explained in the previous paragraph. When the droplet is formed, energy is released in the form of heat during the condensation process. This energy level for the evaporation – condensation process is significantly higher than during the freezing / melting process (540 Calories /g versus 80 Calories /g). Due to the released heat the air parcel gets lighter than the surrounding air and is allowed to rise further. However, if there is a surplus of these condensation nuclei as a result of natural activity (e.g. Vulcan eruption) or men's intervention (e.g. industrial pollution, contrails), the droplets never reach the critical mass needed to fall to earth as precipitation because there is just not enough water to share between all the aerosol particles. Furthermore with a rising number of droplets their overall surface increases, which on turn increases the amount of sunlight reflected back to space with subsequent cooling and drying of the Earth.

In a nutshell the study of Prof. Rosenberg shows the following: with rising pollution, the amount of precipitation at first rises, then maxes out and finally falls off sharply at very high aerosol concentrations. Of even more interest is his conclusion: 'The practical result is that in relatively clean air, adding aerosols up to the amount that releases the maximum of available energy increases precipitation. Beyond that point, increasing the aerosol load even further, lessens precipitation.' This opens of course an interesting window towards future climate control by regulating the amount of aerosols that are released in the upper troposphere. To put it in the words of Prof. Rosenberg: 'The determination of this issue is one with significant consequences in an era of climate change and especially in areas suffering from manmade pollution and water shortages, including Israel'. This is indeed very true: domestic water supplies are the emerging assets on Earth. The outline of the survey of Prof. Rosenberg can be found in appendix 7.

#### 4.4. OTHER EFFECTS OF CONTRAILS:

##### 4.4.1. Dehydration of the stratosphere due to contrails:

The extreme dryness of the stratosphere is believed being caused by freeze-drying of air as it enters the stratosphere through the cold tropical tropopause. Sedimentation of ice crystals in the thin Cirrus may provide a significant downward flux of water vapor. It has also recently been suggested that gravity waves generated by convection may drive the formation of ice clouds in the lower stratosphere and that precipitation of crystals in these clouds may serve as a stratospheric dehydration mechanism.<sup>64</sup>

A quite intriguing article appeared on the USA Today website on January 28<sup>th</sup> 2010 in the very evening hours, stating that water vapor may flatten the global warming trend.<sup>65</sup>

This statement has first been published in the Science Journal by senior scientist Susan Solomon of the National Oceanic and Atmospheric Administration in Boulder, Colo. Solomon was also a co-chair of one of the groups within the Intergovernmental Panel on Climate Change that put out the definitive forecast of global warming in 2007. The fact that the IPCC got stuck in one of the greatest climate scandals revealed by the Daily telegraph on November 28<sup>th</sup> 2009, also better known as 'Climate Gate' with huge fraud of climatologic data by Prof. Phil Jones of the University of east Anglia (UEA) over long years<sup>66</sup>, does not improve credibility of any panel member.

In this respect it is noteworthy that the UK Information Commissioner's Office that leads

<sup>64</sup> Jensen, E. J., O. B. Toon, L. Pfister, and H. B. Selkirk (1996), Dehydration of the upper troposphere and lower stratosphere by subvisible Cirrus clouds.

<sup>65</sup> Doyle R., water vapor may flatten the global warming trend, USA Today with contribution of Associated Press, January 28<sup>th</sup> 2010.

<sup>66</sup> Booker C, Climate change: this is the worst scientific scandal of our generation, Daily Telegraph, November 28<sup>th</sup> 2009.



the investigation decided that the UEA failed in its duties but said that it could not prosecute those involved because the complaint was made too late.<sup>67</sup> Although it looks that 'Climate Gate' will end in the bin as a result of administrative red tape and carefully planned lobby work, a new leak has already emerged on January 30<sup>th</sup> 2010 when the Daily Telegraph (again) published that the UN expert panel claims on climate change are based on a student's dissertation and an article in a mountaineering magazine.<sup>68</sup>

At a closer look the claim in Mrs. Solomon's '10/10/10 paper' goes even further: 10% decrease in water vapor at 10 miles above our heads during the last 10 years has slowed down the rate of earth's warming by 25%.<sup>69</sup> The question where the water vapor went to, remains open. But according to this survey it is surprising how big the impact is of such 'small change' (10%!) in water vapor on the surface climate. But according to that survey this isn't an indication that predictions on global warming are overstated: "This doesn't mean there isn't global warming," notes Solomon. "There's no significant debate that it is warmer now than it was 100 years ago, due to anthropogenic (man-made) greenhouse gases."

No one can be surprised that this survey has been ridiculed as a hoax in the aftermath of 'Climate Gate'. However when combining the study material obtained by Jensen in 1996 with the very recent survey by Mrs. Solomon it is obvious that there is a link between the occurrence of natural plus man made Cirrus clouds near the tropopause, the dehydration of the stratosphere and the flattening of the global warming trend. When this knowledge is linked with the surveys of previous paragraphs it becomes crystal clear that aerosols emitted by aircraft engines have a significant impact on precipitation patterns and surface temperatures.

#### **4.4.2. Other factors affecting climate change:**

Although changes in precipitation patterns, surface temperature and stability of the air mass are quite measurable parameters there might be other intangible factors:

- One of the most obvious side effects of the formation of contrails is the impact on astronomy. One has seldom a clear sky available for observation in areas with dense air traffic.
- With changing cloud cover and subsequent temperature drop in the upper layer of the troposphere, hurricane activity may be increased as a result of the released instability. It is noteworthy that storms and major floods have more than tripled since 1981.<sup>70</sup> No apparent relationship between aircraft engine emissions, aerosols, contrails and hurricane activity has been established yet on a scientifically basis.
- It is accepted that knowledge on man made Cirrus cloud is relatively poor and that study of the impact of contrails on the Stratosphere is only in its initial phases. However one can assume that it might have an impact on higher layers and the ozone layer. Ozone depletion does not only occur as a result of industrial activity, but also due to multiple nuclear tests conducted in the 20<sup>th</sup> century.

<sup>67</sup> Webster B., Scientists in stolen E-mail scandal hid climate data, London Times, January 28th 2010.

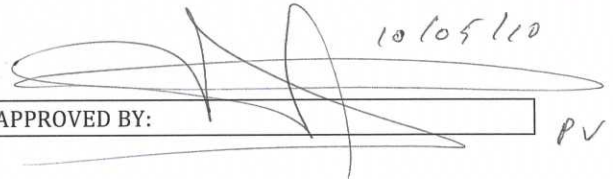
<sup>68</sup> Gray R. And Lefort R., UN Climate change panel based claims on student dissertation and magazine article, Daily Telegraph, January 30th 2010.

<sup>69</sup> Solomon S., ten percent decrease water vapor in the stratosphere slows earth's warming trend, the Science Paper, January 28th 2010.

<sup>70</sup> Global Environmental Outlook, GEO4 Environment for Development, United Nations Environmental Programme, 2007.

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## 5. CONTRAILS AND WEATHER MANIPULATION

"If the ionosphere is greatly disturbed, the atmosphere below is subsequently disturbed."

Charles A. Yost, author of "Electrical forces applied to basic weather phenomena", 1992.

## **5. CONTRAILS AND WEATHER MANIPULATION:**

### **5.1. FROM 'CHEMTRAILS' TO GEO-ENGINEERING:**

#### **5.1.1. Scientific basis for a weather manipulation system:**

In the previous paragraphs it has been clearly denoted that man made contrails do have a significant and measurable impact on temperature and precipitation on the planet. Especially the data obtained by Professor D. Rosenfeld (see paragraph 4.3.1) proves to be quite solid to sponsor a weather manipulation theory, since altering the aerosol doses in the atmosphere can either increase or decrease precipitation patterns.

This opens a window on a scientific basis in order to produce scenarios to counter global climate change, providing that the designers of that system bear the following considerations in mind:

- Development of a reliable matrix of aerosol ingredients versus field conditions.
- Engineering of a efficient, reliable but low cost system in order to seed the atmosphere.
- Sponsorship through government agencies with a far-reaching commitment of captains of industry.

Actually all elements – except the reliability factor - are in place in order to justify the creation or even the existence of such a system: advanced technology is at hand and financing the system through cap & trade systems ensures nearly unlimited funding. If operated for the benefice of mankind a weather modification could solve many environmental issues, such as reversing desertification and avoid the worst consequences of a global climate change.

However, from a military point of view the organization owning the property rights of such a system also has capability to manipulate temperature and precipitation patterns of other nations, and this at very low cost. Imagine what could happen if such a system falls in the hands of a 'rogue state': it would change global domination patterns. Therefore it is unimaginable that civilians run a weather modification system if it came into existence.

Conspiracy theories flourish nowadays as never before. It is of no surprise that stories of weather manipulation systems, such as 'chemtrails' and HAARP, already have found their way to the Internet. Policy makers write these off as a hoax, because there is no hard scientific evidence for their existence. And if they exist, they are kept secret – which is quite obvious. However it is common knowledge that government policy annex history is manipulated at the discretion of the manipulated state. There are countless examples of this in human history and 'Climate Gate' is without doubt also one of them. All these elements necessitate a closer look to the chemtrail phenomenon, starting from its origin. This is covered in the next paragraph.

This chapter will furthermore not only prove that weather manipulation through contrail formation is not that fictional, but will also produce evidence through patents and research documents that this system is in place and fully operational.

#### **5.1.2. Conspiracy theory character of 'chemtrails':**

With the huge explosion of aviation traffic during the last 10 years it was a matter of time before someone would question the ever-increasing amount of contrails. The first reference to production of contrails for specific purposes as described in paragraph 2.4, seems to date from an article by William Thomas dated January 8<sup>th</sup>, 1999. In that text the suspicious of three people about contrails is recounted. Soon afterwards this man was invited onto a popular radio show at that time (Art Bell), marking the beginning of a real

Internet phenomenon.<sup>71</sup> Apparently it has cross-fertilized itself. A comparison of Internet hits for 'chemtrails' between the years 2004 and 2010 is as follows:<sup>72</sup>

	<b>2004</b>	<b>2010</b>	<b>Change in %</b>
Google	791.000	1.260.000	+59,3%
Blogs	4828	152.000	+3148,3%
Images	9180	170.000	+1851,8%
Videos	2123	47.800	+2251,5%
News	5	22	+440%
Forums	38	110.000	+289.473,7%

This reveals a number of interesting developments:

- Attention by the general public for the 'chemtrail' phenomenon has increased significantly during recent years.
- Images on the Internet with contrails and / or 'chemtrails' have skyrocketed.
- Mainstream news does not hook in on the existence of 'chemtrails'.

The relative strength and importance of the 'chemtrail movement' becomes quite clear when it is compared with other popular topics, such as global warming, UFO's and 'morgellons' (polymers floating in the sky):<sup>73</sup>

<b>Google (total)</b>	<b>2004</b>	<b>2010</b>	<b>CHANGE in %</b>
Tour de France	Unknown	788.000.000	Not applicable
UFO's	36.700.000	36.900.000	+0,5%
Global warming	67.500.000	32.400.000	-52%
'Climate gate'	0	12.100.000	Not applicable
'Chemtrails'	791.000	1.260.000	+59,3%
Morgellons	236.000	249.000	+5,5%

<b>Google (news)</b>	<b>2004</b>	<b>2010</b>	<b>CHANGE in %</b>
Tour de France	Unknown	21.600	Not applicable
Global warming	32.584	23.100	-29,1%
UFO's	929	1890	+203,4%
'Climate gate'	0	401	Not applicable
'Chemtrails'	5	22	+440%
Morgellons	4	9	+225%

<sup>71</sup> Contrail science, a brief history of 'chemtrails', [www.contrailscience.com](http://www.contrailscience.com)

<sup>72</sup> Combination of Contrail Science data and own investigation.

<sup>73</sup> Idem as footnote 72.



These tables denote clearly that 'chemtrails' are widely regarded by the general public as well as mainstream news agencies as a marginal, dubious phenomenon that is certainly not threatening everyday life and does not need further attention.

In this context it is noteworthy that attention for global warming has fallen dramatically over the last years. It is possibly a result of the ever-increasing controversy of that topic combined with a deep widening economic crisis, necessitating people to keep their feet on the ground. Or perhaps there is just a shift in nomenclature: global cooling, climate change... The sudden appearance of 'climate gate' related stories with high hit rates on the Internet might support this theory.

There is more: association with topics that are not backed by hard scientific evidence puts the 'chemtrail phenomenon' automatically in the esoteric or conspiracy theory corner. There are 4 logical reasons for this:

- Because the phenomenon is basically Internet driven, there is no support whatsoever from scientists, political parties or environmental organizations. It is striking that the representative of the ecologist party (Grüne) in Vienna even expletively states that the subject is a mere conspiracy theory and there is neither time nor resources available to study the subject.<sup>74</sup>
- Most of the people posting the 'chemtrail' observations on the Internet are not academically qualified to do so. Estimating the cruising altitude of a jet airplane is indeed a tricky affair. Making the difference between contrails and 'chemtrails' is even more challenging. Last but not least posting pictures of grid-pattern contrails on the Internet without a valid caption does not promote any scientific seriousness towards the subject.
- Many websites that provide information about 'chemtrails' also cover other subjects, such as the existence of extra-terrestrial life on earth, global mind control programs and other stuff. As a result of this any story about 'chemtrails' is treated the same way as a hoax and this regardless the value of that information.
- Only a handful Internet sites are dedicated solely on 'chemtrails'. In fact they combine all 'chemtrail' reports within a single state and post it on the Internet. Examples of these are <http://arizonaskywatch.com/> and <http://www.chemtrails-info.de>. These websites often offer test analysis of water samples and reports of spraying actions. Sadly on many occasions the information presented contains scientific errors or wrong interpretations.
- Government instances officially decline in a systematic way the existence of 'chemtrails'. On the other hand all the available information on the Internet does not permit verification of any 'chemtrail' claim. Anonymous reports, such as the testimony of 'Agent Deep Shield' who claimed to be an insider in the 'chemtrail' business<sup>75</sup>, does again not improve credibility.
- Last but not least there are a number of websites that deny the existence of 'chemtrails' in a quite cynical but scientific way. An example of this is <http://contrailscience.com/chemtrail-myths/>. Its Webmaster, known as 'Unicus', does actually hide his real identity – adding fresh meat for the conspiracy theory grinder that it might be a government agency. However it is significant that this website deals with any of the websites mentioned above, reducing the argumentation of 'chemtrail' protagonists to a piece of rubble.

<sup>74</sup> Haderer C and Hies P., Chemtrails, Verschwörung am Himmel?; VF Sammler Verlag 2005, Graz, Austria.

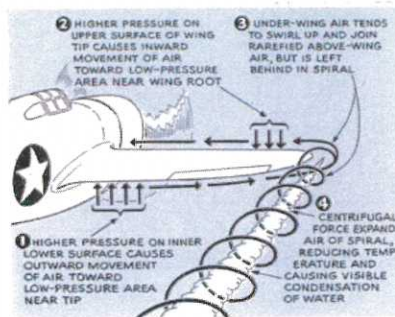
<sup>75</sup> Idem as footnote 74.



AIRPLANES leave trails in the atmosphere that can be picked up, if a spotter is quick enough, like those of game sought by a hunter. Some of them, especially trails left by a plane's exhaust at high, cold altitudes, endure for some time, while those made by wing tips creating vortices are audible as well as visible.

Both of these types of airplane trails are

explained by condensation. Invisible water vapor in a plane's exhaust condenses into a visible cloud when the vapor reaches an excess of what the atmosphere will hold. Wing-tip trails add no water to the air, but as their vortices expand, the air temperature in them drops and the dew point is reached if the vortices are strong enough and humidity is high.



MARCH, 1943



Noise like the whistle of a falling object may be heard when a heavily loaded plane pulls out of a low dive. It is from the wing-tip trail illustrated at left, and is audible after that of the motor dies away

55

Home page illustration of the 'contrail science' website. Contrails already exist since the beginning of aviation.<sup>76</sup>

All these elements induce that a scientific approach to 'chemtrails' automatically would compromise researchers and their career. Moreover, who wants to 'chemtrail' the population after all and for what sake? So in the best case the word is badly chosen, because public health is supposed to be one of the backbones of our consumer driven society. Nevertheless it comes as a surprise that some lone authors were able to persuade their editor to publish their book about 'chemtrails' — maybe because it has such a high conspiracy theory level that sells well. Although it is impossible to review all publications, here is a selection of them:

<sup>76</sup> [www.contrailscience.com](http://www.contrailscience.com), Popular Science, March 1943, Page 55.



AUTHOR	TITLE	COMMENT
Chris Haderer Peter Hiess	Chemtrails, Verschwörung am Himmel? <sup>77</sup>	Rather chaotic book, with a separate chapter about other conspiracy theories. Well documented with ample photographic material, but without any hard scientific evidence.  Contains a copy of a letter from a member of the German parliament (Bundestag), in which the limited spraying of barium and aluminum in the atmosphere is acknowledged.
Dr. Leonard G. Horowitz	Death in the air: globalism, terrorism & toxic warfare <sup>78</sup>	The author is a graduate of the Harvard School of Public Health.  Chemtrails are linked with jeopardize of public health and CIA's population control projects.  Contains many traceable references on bioterrorism.
Jeane Manning Dr. Nick Begich	Angels don't play this HAARP. <sup>79</sup>	Publication solely dedicated to HAARP. Describes the system as an extension of president's Reagan 'star wars project' with the ability to manipulate weather patterns and even produce earthquakes.

### 5.1.3. Establishment of a reliable research protocol:

Despite some interesting elements in the publications mentioned above and the numerous Internet articles It is quite clear that due to environmental bias it is impossible to analyze 'chemtrails' in a profound and scientific way.

The only option to approach this subject in a serene way is to restart investigation from zero, with new nomenclature and an acceptable research protocol that includes the following:

- History tracking of atmosphere and weather modification programs in Europe, the United States of America, the People Republic of China and Russia / former USSR with new searching tools, such as cloud seeding, geo-engineering and weather force multiplication. The term 'geo-engineering' fits best, because it encompasses all sorts of human intervention to manipulate climate patterns: atmosphere seeding, marine cloud whitening research<sup>80</sup>, carbon storage research and even cooling down the earth with a cloud of spaceships (!).<sup>81</sup>
- In-depth study of pending patents covering weather- or atmosphere alteration: patent holder identity, application field, a feasibility study and implementation records.

<sup>77</sup> Haderer C and Hies P., Chemtrails, Verschwörung am Himmel?; VF Sammler Verlag 2005, Graz, Austria, ISBN 3-85365-213-1.

<sup>78</sup> Horowitz L.G., d.m.d., m.a., m.p.h., Death in the Air: globalism, terrorism & toxic warfare, Tetrahedron LLC, Sandpoint, U.S.A, 2009, ISBN 978-0-923550-30-1.

<sup>79</sup> Manning J., Begich N. Dr., Angels don't play this HAARP: advances in Tesla technology, Earthpulse press, Anchorage, Alaska, U.S.A, second edition, 2007, ISBN 0-9648812-0-9.

<sup>80</sup> Copenhagen Consensus Center, press release: top economists recommend climate engineering, September 4th 2009, Copenhagen / Washington.

<sup>81</sup> Angel R., Feasibility of cooling down the earth with a cloud of small spacecraft near the inner Lagrange Point (L1), University of Arizona, 17184-17189 PNAS November, 14th 2006, Vol. 103, N°46.

- Analysis of recent scientific and military surveys regarding climate control or climate change mitigation by means of cloud seeding.
- Search through all available channels to obtain actual solid evidence of weather modification programs through reverse engineering: the existence of associations (academic, political, IPCC) that support such programs, order sheets of seeding material on behalf of government agencies and operational charts.

Witness reports, whether anonymous or not, that do not include a valid reference for crosscheck will not be included in the report. Photographic material in the context of this research protocol shall only be released when the probability of error is close to zero.

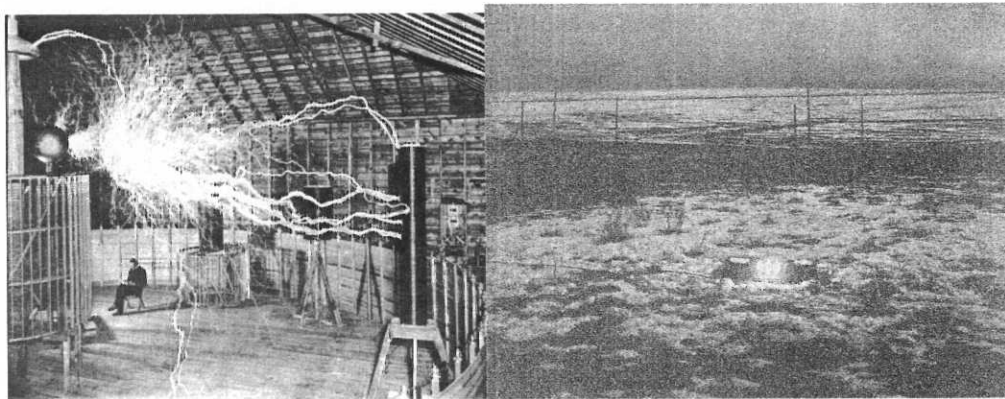
## 5.2. HISTORY OF GEO-ENGINEERING:

### 5.2.1. Period 1899-1940: the research work of Nicolas Tesla:

From an agricultural point of view mankind has always wished to intervene in weather patterns to avoid long periods of drought or adverse weather. The first known research in the field of engineering of nature forces is attributed to Nicolas Tesla (1856-1943), a brilliant but still underestimated inventor in established academic circles.

He was one of the most important contributors to the birth of commercial electricity (AC) and is best known for his revolutionary developments in the field of electromagnetism in the late 19<sup>th</sup> and 20<sup>th</sup> century. He clashed continuously with Edison's insistence that the United States should stick to his DC-technology for power distribution and electrical lighting – knowing that his system was far more efficient. The fact that only Thomas Edison appears in history records and schoolbooks will become quite obvious.

In 1899 Tesla performed wireless power experiments near Colorado Springs and was able to produce a 30-second golf ball sized lightning.



Left: publicity picture of a participant sitting in Tesla's laboratory in Colorado Springs, circa 1900. Right: actual photo of an experiment in Colorado Springs, during which the bank of light is receiving power from a distant transmitter.<sup>82</sup>

J.P. Morgan, still one of the most important banks on the globe, heavily financed his projects. The majority of the money was spent in the construction of the Warden-Cliff tower, which would be able to create voltages of 15 million Volt and 40-ft lightning-like discharges.<sup>83</sup>

<sup>82</sup> Both pictures in public domain.

<sup>83</sup> Cheney M., Tesla: man out of time. Simon and Schuster, 2001, ISBN 0743215362.





Actual photograph of the Warden-Cliff tower, prior to its demolition in 1917<sup>84</sup>

However, just as Victor Schauburger was in search of free energy through water vortices<sup>85</sup>, Tesla was pursuing electric energy without wires. He patented this invention on April 8<sup>th</sup>, 1905.<sup>86</sup> Results were satisfactory, but after Tesla admitted to his financiers that an experimental power station on Long Island was to send wireless electrical power as well as messages his public career ended. Although he continued to invent and depose further patents, he was kicked out of the spotlight for the sake of economic interests of J.P. Morgan's shareholders.<sup>87</sup> This is also the reason why Edison was lionized in mainstream history books.

Just before the destruction of the Warden-Cliff tower in 1917, Tesla offered his services for the development of a 'particle beam weapon' to the U.S. department of war and was subsequently kicked out of their office. Persuading people at that time that a magnifying transmitter could beam up electrical energy to the stratosphere and bounce it back to a predetermined place on earth was indeed hopeless, given the level of technology at that time.<sup>88</sup> Nevertheless if this proves to be true Tesla did excite the Schumann cavity (Earth's resonance frequency 7,83 Hz) already in 1899 – 53 years before W.O. Schumann identified it scientifically. He also had a deep insight in the behavior of the ionosphere, more precisely the existence of a skip zone – the extension of a radio signal well beyond the horizon after reflection in the Heaviside layers (invention officially attributed to Tellegen in 1933). A variant of Tesla's idea of the 'magnifying transmitter' has been put in practice in the HAARP-system for study and manipulation of the Aurora Borealis, although its designers repeatedly stress that there is no analogy with Tesla's theories.<sup>89</sup>

Tesla's research work is quite remarkable. In respect of this research one can conclude that he was the first to perform experiments to produce lightning at will and to offer it for both civil and military purposes. Similar projects to trap the enormous reserve of electrical current of a single thunder flash have been undertaken since then, but apparently without success. In Switzerland the test facility burned even down. An Egyptian company, Logico in Cairo, is one of the first enterprises that seem to specialize exclusively in the collection of renewable electrical energy from lightning.

<sup>84</sup> By courtesy of the Nikole Tesle Museum, Belgrade, Serbia

<sup>85</sup> Schauburger V., *das Wesen des Wassers*, AT Verlag, München, 2006.

<sup>86</sup> US patent 787,412, art of transmitting electrical energy through natural mediums, through U.S. patent office.

<sup>87</sup> Idem as footnote 82.

<sup>88</sup> Seifer M. Dr., *Nikolas Tesla: the history of lasers and particle beam weapons*, proceedings of the international Tesla symposium, 1988.

<sup>89</sup> <http://www.haarp.alaska.edu/haarp/faq.html>

### 5.2.2. Period 1940-1945: first atmospheric seeding:

In both World Wars weather was a considerable and sometimes decisive factor for success or disaster. Parallel to this armies started to rely heavily on camouflage after the stalemate that followed the initial German dash on Paris in 1914. Already less than one year later the German field army developed man-made fog through smokescreens in order to dissimulate troop movements or to go into the offensive through nerve gas attacks, although there are historical references to 'deliberate obscurity' dating back to at least 1565.<sup>90</sup>

The aerial bombing campaigns in World War II, first by the Luftwaffe and followed by very aggressive daylight raids by the 8<sup>th</sup> Air Force and the Royal Air Force at night marked the first deployment of what later would be known as ECM – Electronic Counter Measures. Although radar was only in its childhood stage during this conflict, it faltered the German 'Blitz' on England. The subsequent struggle between the belligerents was to become known as 'the battle of the beams'. Despite the fact that British intelligence had broken the German Enigma code, they allowed the mass destruction of Coventry by raiders equipped with the 'Knickebein System' in 1941 in order to keep the Germans unaware of this security breach.

In July 1943 the Royal Air Force made one of its most successful sorties by deliberately seeding the atmosphere with masses of small-aluminized paper strips, coded 'Window', to garble German radar. That night Hamburg was flattened with great loss of life. The Luftwaffe operated a similar system in 1944, called Düppel, for disturbing air traffic in the vicinity of allied aerodromes over South East England.<sup>91</sup>



The crescent-shaped white cloud on the left is formed by massively seeding the atmosphere with aluminum particles, thus jamming the German radar and rendering their defense useless, July 1943.<sup>92</sup>

This development is important in the context of this survey, because 'Chaff' as it is called in NATO-nomenclature today is still part of the ECM-defense system and there is evidence that it is tested on a regular basis. On July 19<sup>th</sup>, 2005 'Düppel' has been used during air exercises over Germany and the Netherlands, causing major disruption on weather radars.<sup>93</sup>

<sup>90</sup> The American Heritage® Dictionary of the English Language, Fourth Edition, 2009, Houghton Mifflin Company.

<sup>91</sup> The history of radar, BBC maths, science and technology, July, 14th 2003.

<sup>92</sup> United Kingdom Government through IWM, public domain.

<sup>93</sup> RTL, programm 'Guten Abend', Kartsen Brandt: Bundeswehr manipuliert Wetterkarte, July, 19th 2005.



Hardcopy from the RTL-broadcasting, with the 'Chaff' clearly visible in the area of Kassel. Meteorologists were 'not amused' at that time.

### 5.2.3. Period 1945-1950: operation Cirrus:

The Second World War ended with the atomic bomb tests, during which uncountable magnetic pulses were released in the atmosphere. As a result of this the U.S. was not only confirmed in its role as world leader, but unlimited funding became available for different projects, including the first weather manipulation programs.

The project, later called Cirrus, originated in 1947 and was led by Nobel laureate Dr. Irving Langmuir and his protégé Dr. Vincent Schaefer in co-operation with the U.S. Army, Navy, Air Force and General Electric. Dr. Schaefer was the man who dropped 1,4 kg of ice pellets on November 13<sup>th</sup>, 1946 into a super stratus cloud near Schenectady, New York and snow fell. This is the first known fruitful attempt to induce precipitation from a cloud.

To test his theories Schaeffer created a 'cold box' in a laboratory to recreate the same conditions. Breathing into the box produced a tiny cloud of super cooled water droplets, just as in real conditions in the upper part of a cloud. Furthermore Schaeffer discovered that the addition of any substance with a temperature below -40°C would cause million of ice crystals to form in the cloud.<sup>94</sup>

For actual cloud seeding the U.S. Signal Corps became involved in February 1947 and it earned the name Project Cirrus. 37 experimental flights took place in the first half-year that did not always produce the expected results, mainly due to the inherent variability of the weather. Modification of tropical typhoon through dispersion of 80 lbs dry ice in 1947 ended with major flooding in the Savannah area with damage totaling \$20 million as a result of a sudden course change.<sup>95</sup> Officially it was classified as an act of God.

After this the lawyers of General Electric told Dr. Langmuir not to discuss the hurricane case until the statute of limitations ran out for prosecution. Fear for a legal case necessitated further operation out of public eyes and the project was closed in 1950 due to a shift in government with different priorities. In 1958 three nuclear bombs were detonated in the Van Allen radiation belt (protective zone of charged particles trapped in the Earth's magnetic field starting around 2000 miles altitude), starting to deplete the ozone layer with each further attempt by the United States, the former USSR and

<sup>94</sup> Reilly C., Staff Historian, Rain men: scientists here tried to change the weather, Monmouth Message, February 20th 2009, U.S.A.

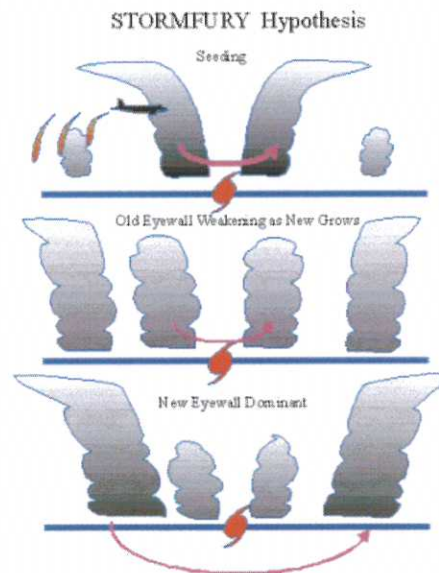
<sup>95</sup> Idem as footnote 94.



France.<sup>96</sup> This information will be of major importance in the next chapter. Nevertheless project Cirrus is the first confirmed cloud seeding program in history. The full outline of this program can be found in appendix 8.

#### 5.2.4. Start of operation Storm Fury (1962) and Popeye (1967):

Project 'Storm Fury' continued on the knowledge obtained during operation Cirrus, with its main objective to weaken tropical cyclones by flying aircraft into them and seeding with silver iodide.<sup>97</sup> The partners were the U.S. Department of Commerce and the U.S. Navy. The hypothesis was that the silver iodide would cause super cooled water in the storm to freeze and subsequently disrupt the inner structure of the hurricane. Although this hypothesis proved to be incorrect the cloud seeding project continued officially until 1983 with the last experimental flight in 1971.



The hypothesis of operation Storm Fury was incorrect because tropical cyclones seem not to contain that much super cooled water to make cloud seeding effective. Additionally unseeded hurricanes often undergo the same structural changes as the 'treated' ones.<sup>98</sup>



The crew enlisted in Operation 'Stormfury' in 1963. Note the special belly of the Douglas DC6-B on the background for cloud seeding purposes.

<sup>96</sup> National Academy of Sciences, Long time effects of multiple nuclear weapon detonation, 1975, pages 6-7.

<sup>97</sup> Willoughby, H. E., D. P. Jorgensen, R. A. Black, and S. L. Rosenthal, 1985: Project STORMFURY, A Scientific Chronicle, 1962-1983, *Bull. Amer. Meteor. Soc.*, 66, 505-514.

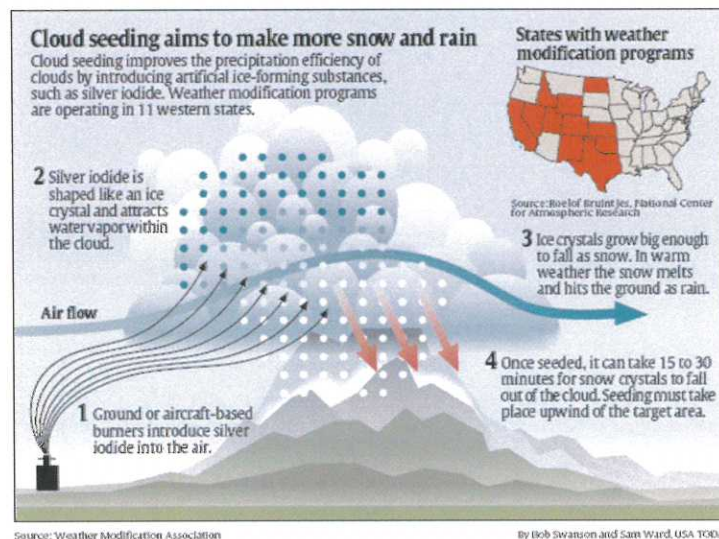
<sup>98</sup> Atlantic Oceanic and Meteorological Laboratory, Hurricane Research Division, Operation Storm Fury research paper.

In the wake of operation Storm Fury there was also a less known military application during the Vietnam War. From March 1967 until July 1972 the U.S. military cloud seeded 47,409 units of silver iodide to extend the monsoon over North Vietnam and especially in the vicinity of the Ho Chi Min trail. The objectives of this operation, called Popeye, was to deny the enemy the use of roads by softening road surfaces, causing landslides, washing out river crossings and to maintain saturated soil conditions beyond normal time span. It actually resulted in the targeted areas seeing an extension of the monsoon by an average of 30 to 45 days.<sup>99</sup> The full transcription of a U.S. senate hearing about weather modification in S.E. Asia is included in appendix 9.

Operation Popeye proves that weather modification explicitly forms part of the U.S. weapon portfolio ('make mud, not war'), shining new light on the Advisory Committee on Weather Control, which was created in 1953 under direct Federal Government control with Captain H.W. Orville as chairman. Its mission was to study weather-making activities with emphasis on rain making to 'benefit water supplies and land utilization'.<sup>100</sup> Despite the mixed results obtained during operation Storm Fury and Popeye it gave way to a very profitable but controversial business with companies offering local weather modification for agricultural purposes through hail cannons and cloud seeding by small aircraft. The successful outcome of such an operation is at least to say doubtful.



Cessna 210 with a device for cloud seeding with silver iodide.



Nowadays there are still several states in the U.S. running cloud seeding programs.

<sup>99</sup> Top secret hearing held on March 20, 1974 made public on May 19, 1974 weather modification, SEASIA rain making

<sup>100</sup> Substantially increased research programs needed in meteorology to benefit water supplies and land utilization, Journal of Agriculture and Food Chemistry, Page 1192, December 1953.

After the Chernobyl disaster in 1986 major A. Grusin described how the Soviet air force created rain clouds to protect Moscow from radioactive fall out. Sadly the population in Belarus was exposed to radiation doses 20 to 30 times higher than normal, causing intense radiation poisoning in children.<sup>101</sup> The article is included in appendix 10.

Silver iodide is still used on a large scale by the Russian and the Chinese air force for generation of clear skies during military parades or major sports events, such as the Olympic games.<sup>102</sup> In 2009 the mayor of Moscow was planning to spend several million Dollars to pay the Russian Air Force and spray a fine mist of particulate matter (cement dust in 2007, silver iodide or new chemicals) in the clouds. The ideas of operation Cirrus and Storm Fury still stand: seeding the clouds would increase moisture and thus force the clouds to release their precipitation before they reached the capital – ‘thus saving the city millions in snow removal costs’.<sup>103</sup>

Preliminary tests revealed strange hole punched clouds over Moscow that worried its inhabitants.



This strange cloud over Moscow in November 2009 is attributed to a cloud seeding test.

Unfortunately the ‘experiment’ proved to be a huge failure with 417.000 cubic meters snow shoveled between February 21<sup>st</sup> and 22<sup>nd</sup> 2010 – breaking the record of 1966.<sup>104</sup> It has not been determined if there is any correlation between the harsh winter conditions in Moscow or the rest of Europe in this period and any cloud seeding initiatives.

However, it is clear that extensive hard evidence exists of weather manipulation for both civil and military purposes on micro- and macro scale since the Eisenhower administration, with ever changing seeding material ranging from dry ice over silver iodide to cement and particulate matter. However one must bear in mind that mechanical cloud seeding is quite expensive and it was a matter of time before alternative and more efficient ways of manipulation of the atmosphere were to be developed.

<sup>101</sup> Gray R., How we made the Chernobyl rain, Daily telegraph, April 22nd 2007.

<sup>102</sup> Michaels J., China may attempt to alter weather for Olympics, Meteorology news, July 15th, 2008.

<sup>103</sup> Michaels J., Moscow testing cloud seeding; promises winter without snow, Meteorology News, October, 19th 2009.

<sup>104</sup> Moskou onder een dik pak sneeuw, De telegraaf, 22 Februari 2010.



### 5.2.5. U.S. and Soviet 'proof of concept' ELF-projects (1975 to 1995):

A 'proof of concept' project is one where advanced research experiments are designed to test, usually on a smaller scale, specific applications of research. These tests allow researchers to extrapolate results, which can be used to engineer full size technology systems. Within the scope of this survey a 'proof of concept' project for weather modification is the last step before full weapon system development (military applications) or geo-engineering around the planet (civil and military applications).

After the American debacle in Vietnam the two opposing blocks shifted to a more silent cold war and this despite extensive strategic arms limitations talks (SALT). Instead of dropping masses of silver iodide in the atmosphere and battering the troposphere with atomic tests –already totaling 400 kilotons at that time - a subtle battle of the frequencies between U.S. and opposing Soviet forces made its headway. Its ultimate target: replacing thermonuclear weapons by 'non lethal' electro pulses through manipulation of the ionosphere and the magnetosphere.<sup>105</sup>

Development of such devices started quite a long time ago. Already in 1966 Anthony Ferraro at the Penn State University performed the first military funded experiments with a 500kW ionosphere heater.<sup>106</sup> A high-power transmitter would heat a region of the lower ionosphere while a weaker transmitter was pulsing. Thus the experimenters could study wave interaction within that specific layer of earth's atmosphere. They had to shut down the project some years later because there was an unacceptable interference with air traffic control and other types of radio communication. As a result of this, military decision makers decided that all future projects would be located in remote places on the globe.

In 1974 Dr. R. Helliwell and J. Katsufakis of the Stanford University's Radio Science Laboratory showed that a very low frequency radio wave (VLF) could vibrate the magnetosphere<sup>107</sup> (The region above the ionosphere in which the magnetic field of the earth has a dominant control over the motions of gas and fast charged particles), thus confirming the research work of Anthony Ferraro.

Exact one year later in 1975 the U.S. Navy launched an ELF-facility (Extreme Low Frequency) capable to radio-contact deep running Polaris or Poseidon ICBM missile carrying submarines in case of extreme national disaster. This operation, with code name Project Sanguine, consisted of the development of a communication network in the 45 to 75 Hz frequency range plus a grid of deeply buried cables covering 1250 square miles. In this system, sited in specially selected rock and ground formations, the earth acts as a conductor, with the rock formations forcing the radio waves outward into the ionosphere instead of inward toward the earth's core.<sup>108</sup> The saturation of the ionosphere forces some of these ELF signals underwater to a considerable depth, enabling submerged submarines to receive and react to messages from a distance of over 2500 miles even if normal communication channels should be destroyed in a preemptive attack. A similar system, called ZEVS with its transmitter located near Murmansk, is still in use in Russian Navy.<sup>109</sup>

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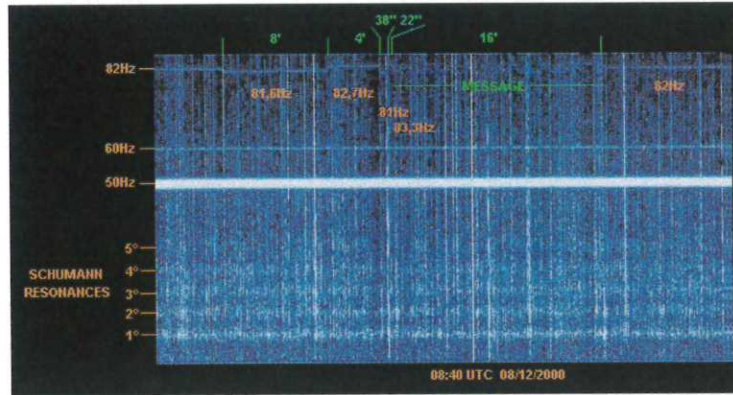
<sup>105</sup> U.S. patent 4,686, 605 – issued August 11th 1987 to Bernard J. Eastlund and assigned to APTI inc., Method and apparatus for altering a region in the Earth's atmosphere, Ionosphere and/or Magnetosphere.

<sup>106</sup> Ferraro A.J., Reflections on 40+ years of ionospheric research, Communication & Space Science Laboratory, Penn State University, United States

<sup>107</sup> Stanford University VLF group website <http://www.star.stanford.edu/people/rah.html>

<sup>108</sup> Wallechinsky D. And Wallace I., Major engineering events in history: Project Sanguine nears operation, 1981.

<sup>109</sup> Jacobsen T., ZEVS, the Russian 82 Hz ELF transmitter, Norway.



A ZEVS transmission recorded in Italy by Renato Romero on the 8th of December 2000, at 08:40 UTC. The "message waiting" signal, 81.6 Hz low for 8 minutes, 82.7 Hz high for 4 minutes is easily detected in the spectrogram. After the 16 minutes long message sequence of the transmission is again the carrier at 82 Hz. Because of the long exposure are the Schumann resonance bands easily visible at the bottom of the spectrogram.

However in the field of ELF-transmitters the Soviets proved to be far superior to the Americans at that date with significant amount of manpower and resources attributed for the development of a fully operational ionospheric heater in Zelanogradskaya near Moscow, which was completed in 1981. There are reports that the device was not only used for ionosphere study and modeling, but also for pulsing of ELF-waves on a 10 Hz frequency in the form of a 'woodpecker signal' –just above the natural Schumann resonance frequency of the earth of 7.83 Hz - in order to disturb communication and to resonate with neurons of human brains at key brainwave rhythms.<sup>110</sup> The existence of a U.S. radio frequency radiometry handbook, which contains mathematics for calculation of the dosages of radio frequency radiation necessary to cause changes in animals and humans, is a silent witness of the battle of the frequencies between the United States and the former Soviet Union.<sup>111</sup> After the collapse of the U.S.S.R. many projects were abandoned and the Americans took the lead in the research. Today 10 known ionosphere heaters or research facilities are operative around the globe (4 U.S. staffed, 1 in Norway operated by the German Max Planck Institute since 1991 and 5 Russian).



This 'ionosphere study station' at Zmiev, currently in the Ukraine, has been abandoned after the demise of the Soviet Union.<sup>112</sup>

<sup>110</sup> Dr. Begich J & Manning J., Angels don't play this HAARP, advances in Tesla technology, page 17, Earthpulse press, Anchorage, ninth printing, 2007.

<sup>111</sup> Radio frequency radiation dosimetry handbook, U.S. Air Force School of Aerospace medicine, Brooks Air Force Base, October 1986.

<sup>112</sup> Picture by courtesy of the Pravda, <http://english.pravda.ru/img/idb/photo/5-67.jpg>



The study of ELF-transmitters either for civil or military purposes is particularly important in the scope of this survey, because alteration or manipulation of the ionosphere at a specific place inevitably alters the weather below. When transmitting in the VLF or ELF frequency range the ionosphere is sliced about in the same way of a space shuttle entering or leaving the atmosphere, leaving an incision at the point of impact. Due to the nature of propagation of VLF and ELF-waves these signals cause streams of particles to rain down beyond the horizon far from the transmitter and in the outermost regions of the atmosphere with very little loss of signal, altering the motion of free electrons and causing electronic rain that influence weather patterns.<sup>113</sup> This opens a window towards peaceful applications but also military endeavors, as been demonstrated during the Vietnam conflict with operation Popeye.

In that respect it is worth to mention that the U.S. Air Force, the U.S. Navy and the Defense Advanced Research Projects Agency, together with an array of civil partners, have established HAARP in 1995 (test runs), the High Frequency Active Auroral Research Program. While the military provide technical expertise, management, administration and evaluation of the program its civil partners are partly responsible for the funding. According to official sources HAARP is a scientific endeavor aimed at studying the properties and behavior of the ionosphere by means of high power HF-transmitters aiming to manipulate the Aurora Borealis (Northern light), with particular emphasis on being able to understand and use it to enhance communications and surveillance systems for both civilian and defense purposes.<sup>114</sup>



The HAARP-antenna array at Anchorage, Alaska<sup>115</sup>

The main differences between the Russian or European stations and HAARP are as follows:

- When fully operational somewhere beyond 2010 the HAARP team will operate an ionosphere heater with an effective ERP well above 1 Giga Watt, in short the most powerful facility in the world.<sup>116</sup> That would actually allow a concentration of one Watt per cubic centimeter, where its Russian counterparts are only able to deliver a millionth of one Watt.<sup>117</sup>

<sup>113</sup> VLF, getting particles excited, Science News, Society for science and the Public, December 1982, P.392.

<sup>114</sup> Official HAARP website, <http://www.haarp.alaska.edu/haarp/factSheet.html>

<sup>115</sup> HAARP Cam, recorded on February, 7th 2010, official HAARP website.

<sup>116</sup> HAARP, Joint Program Plans and Activities, Air Force Geophysics Laboratory, Navy Office of Naval Research, February 1990.

<sup>117</sup> Amendment January 1987 to the original patent application of Bernard Eastlund for the subsequently issued U.S. patent number 4,686,605.



- Due to its high concentration of power HAARP can stab the ionosphere with a more focused beam, while the others spread it over an increasingly large area as the energy moves away from the transmitter.
- The safety limits for VLF-and ELF-waves in the HAARP final environmental impact statement were set a 1000 times higher than the level considered safe in the former Soviet Union.<sup>118</sup>

As a result of these developments in Alaska deputies held a heated discussion about HAARP in the Russian parliament, the Duma, in the year 2002. They even drew up an appeal to the President Putin and the UN. They demanded to set up an international commission for the investigation of the experiments conducted in Alaska, which has cynically been waved by the U.S. authorities, as HAARP is a 'pure scientific project'.<sup>119</sup>

Nevertheless, bearing in mind the outcome of project Sanguine and when looking closer at the mission statement of HAARP it is obvious that the system is more than a scientific project with possible leads for the D.O.D. (U.S. Department of Defense). It is actually a full-blown operational platform that greatly improves the performance of the U.S. military C3 system (Communications, Control and Command), combining all existing weapon systems in one device and making all other friendly or enemy systems obsolete.<sup>120</sup> In the 'National Defense Authorization Act for fiscal year 1995' it is even stated that the transmitter in Alaska, besides providing a world class research facility for ionospheric studies, could allow earth-penetrating tomography over the northern hemisphere, permitting the detection and exact location of tunnels and shelters.<sup>121</sup>

However, during communication with the public U.S. official sources have always denied that HAARP is a military system and on their official website nothing points in this direction. Moreover the military firmly contest that there is any link between HAARP and patent 4,686,605, a theory that is brought forward by Jean Manning and Dr. Nick Begich.<sup>122</sup> This patent, which has been deposited by Bernard J. Eastlund on behalf of APTI Inc. (ARCO Power Technologies Inc.), contains 15 claims, ranging from a method to alter at least one region above the earth's surface with electromagnetic radiation over methods of providing artificial particles in the atmosphere excitation of electron cyclotron resonance.<sup>123</sup> If such a device would exist man made earthquakes would be within reach by manipulating the Schumann frequency through resonance.

By the matter of fact many bits and pieces of evidence do link the N°4,686,605 patent. First of all APTI, a small company holding an array of patents relating to weather modification and the initial HAARP contractor, was bought out to E-systems in June 1994<sup>124</sup> only to be bought out again in April 1995 by Raytheon Corporation – one of the main suppliers and biggest contractors in the U.S. Aerospace and defense industry.<sup>125</sup> A fact not to neglect is that Raytheon was also an initial and losing bidder for the HAARP project and the buy out some years later rewarded them instantly with the Eastlund technology plus the contract.<sup>126</sup> So it is pointless to argument that HAARP is civil

<sup>118</sup> Lt. Col. David J. Dean USAF, Low Intensity Conflict and Modern Technology, Air University Press, Center for Aerospace doctrine, Research and Education, Maxwell Air Force Base, June 1986.

<sup>119</sup> USA and Russia supposedly develop secret meteorological weapons, Pravda, English Edition, September 30th 2005.

<sup>120</sup> Idem as footnote 118.

<sup>121</sup> National Defense Authorization Act for fiscal year 1995, 103<sup>rd</sup> congress, 2<sup>nd</sup> session, Report 103-82, Calendar 459, Report to accompany S.2182, Committee on Armed Services United States Senate, June 14<sup>th</sup> 1994.

<sup>122</sup> Dr. Begich J & Manning J., Angels don't play this HAARP, advances in Tesla technology, page 17, Earthpulse press, Anchorage, ninth printing, 2007.

<sup>123</sup> U.S. patent 4,686, 605 – issued August 11th 1987 to Bernard J. Eastlund and assigned to APTI inc., Method and apparatus for altering a region in the Earth's atmosphere, Ionosphere and/or Magnetosphere, claims 1, 2 and 11.

<sup>124</sup> The New York Times, E-Systems buys ARCO Power Technologies", June 30<sup>th</sup>, 1994.

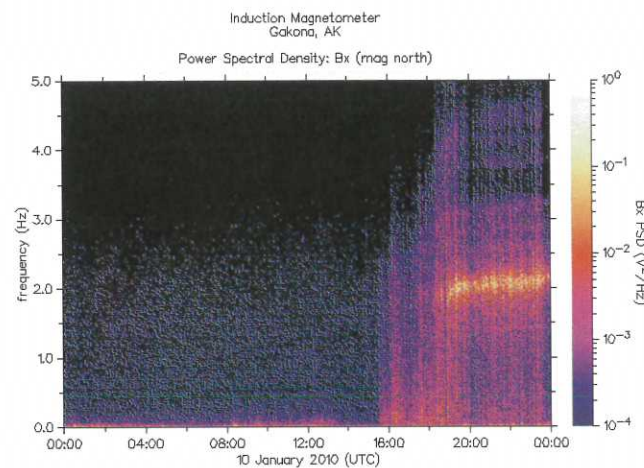
<sup>125</sup> The Wall Street Journal, Raytheon to acquire E-systems for \$64 a share, Page 1, April 3<sup>rd</sup> 1995.

<sup>126</sup> Idem as footnote 122.

technology: it is about the same as telling that the facility that engineered the first atomic bomb in 1945 was a pure scientific and peaceful project. Secondly a U.S. Air Force document that unexpectedly emerged in a public library explicitly states that it is the intention to have HAARP transmitting at 100 billions of Watts effective energy and that 'we have never seen anything like this on earth'.<sup>127</sup> Last but not least claim 15 of the N°4,686,605 patent describes a method of generation of electromagnetic radiation within the magnetic latitudes that encompass Alaska, exactly the same place where the HAARP facility is built. This last bit closes the loop between APTI, Raytheon and the real purpose of HAARP. The full description of patent 4,686,605 is included in appendix 11.

Of course HAARP does also open a window towards civil applications, such as replenishing of ozone holes and binding of excess CO<sub>2</sub> in the lower atmosphere as part of a solution for global climate change but also 'for owning the weather' and remodeling the ionosphere because the current layer is too unstable for the outcome of strategic military operations. This point of view is clearly underwritten by the Russian environmental monitor Valery Stasenko who states that HAARP is a very serious issue and that perturbations in the magnetosphere and ionosphere can really impact climate, even on a global scale.<sup>128</sup> Refer to appendix 12 for the full article from the Russian Pravda.

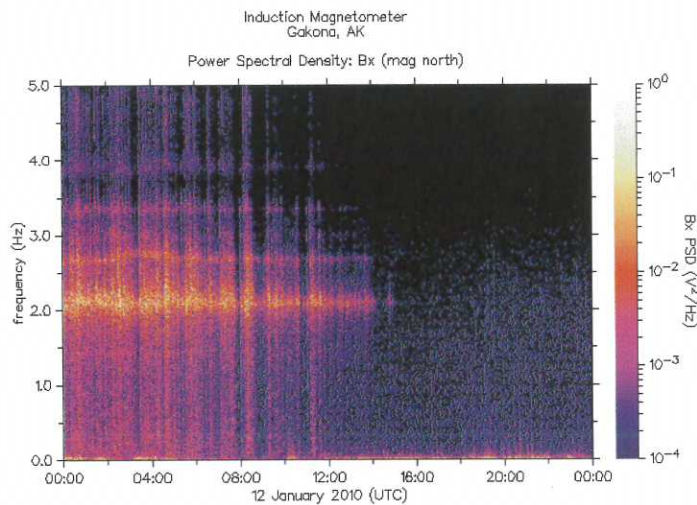
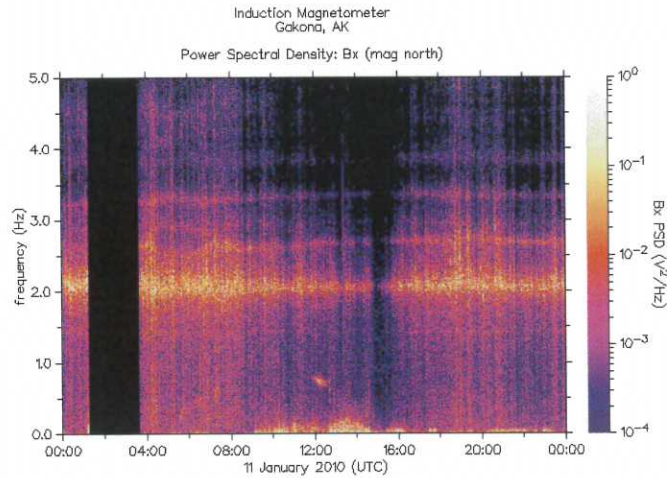
As explained at the beginning of this paragraph the 'war of the frequencies' between the Americans and the Russians continued well beyond the cold war and well into the 21<sup>st</sup> century. In 2005 the American meteorologist Scott Stevens accused Russian military specialists for the destruction of New Orleans by hurricane Katrina, although it is questionable if even high power devices as HAARP are capable to unleash such power. However, what to think about the out print of the HAARP induction magnetometer, which detects temporal variation of the geomagnetic field (flux), for the period between 10 and 12 January 2010? On Tuesday January 12<sup>th</sup> at 16.53 local time (21.53 UTC) Haiti was devastated by an Earth Quake. The official readings of the magnetometer were as follows:<sup>129</sup>



<sup>127</sup> A U.S. Air Force document, *Technical Memorandum #195, presentations from the HAARP workshop on ionospheric heating diagnostics*, issued October 1991, page 185, Phillips Laboratory, Hanscom AFB.

<sup>128</sup> USA and Russia supposedly develop secret meteorological weapons, Pravda, English Edition, September 30th 2005.

<sup>129</sup> <http://maestro.haarp.alaska.edu/cgi-bin/scmag/disp-scmag.cgi>



Variations in magnetic flux were extreme during the 24-hours preceding the earthquake, acting as a precursor of what was going to happen somewhere around the globe in the next hours. It is unknown if the U.S. military were fully proficient in decoding this information at that time in order to initiate an evacuation, whether information has deliberately been held for national interests or even worse.

Whatever American, Russian or European official sources state it is crystal clear that weather modification at the beginning of the 21<sup>st</sup> century is not a hoax nor a 'conspiracy theory' but an iron truth. It is undeniable that the United States is on top of research in this field and is deliberately withholding vital information on weather modification and possible infringement of international laws of sovereignty, not only to allied or neutral states but also towards their own citizens.



### 5.2.6. the year 1996 - Weather as a force multiplier: owning the weather in 2025:

The title of this paragraph is also the title of a research paper, presented by Col Tamzy J. House and his team to the U.S. Air Force on June 17<sup>th</sup> 1996. It forms part of a group of studies labeled '2025', designed to comply with a directive from the chief of Staff of the Air Force to examine the "concepts, capabilities and technologies the United States will require to remain the dominant air and space force in future".<sup>130</sup> As one might think it is not an isolated publication by some eager and combative military. On the contrary there are many more projects in this area of interest, such as the research paper 'Alternate futures for 2025: security planning to avoid surprises' that even introduces the concept of a global "Pax Americana".<sup>131</sup> When looking closer at the individual research papers the only relevant conclusion is that extensive human resources are allocated to U.S. strategic planning and all research papers are closely interconnected and fit into a global goal.

The research document 'owning the weather in 2025', combines all the previously obtained knowledge in the field of weather control and possible developments into the following operational capabilities matrix:<sup>132</sup>

DEGRADE ENEMY FORCES	ENHANCE FRIENDLY FORCES
<b>Precipitation enhancement</b> Flooding of lines of communication Reduce recce effectiveness Decrease comfort level / morale	<b>Precipitation avoidance</b> Maintain / improve lines of communication Maintain visibility Maintain comfort / morale
<b>Storm enhancement</b> Deny operations	<b>Storm modification</b> Choose battle space environment
<b>Precipitation Denial</b> Deny fresh water / inducing drought	<b>Fog and cloud generation</b> Increase concealment
<b>Space weather</b> Disrupt Communications / radar Disable / destroy space assets	<b>Space weather</b> Improve communication reliability Intercept enemy transmissions Revitalize space assets
<b>Fog and cloud removal</b> Deny concealment Increase vulnerability to recce	<b>Fog and cloud removal</b> Maintain airfield operations Enhance recce effectiveness
<b>Detect hostile weather activities</b>	<b>Defend against enemy capabilities</b>

This matrix is of particular interest, because it does not only include known weather manipulation instruments such as cloud seeding through silver iodide as used in the Vietnam conflict and modeling of the ionosphere through HAARP ('space weather'), but also precipitation and storm control by means of cloud or contrail generation. This option will be discussed in the next chapter.

<sup>130</sup> Col T.M. House and team, Weather as a force multiplier, a research paper presented to Air Force 2025, page ii, Department of Defense School, August 1996.

<sup>131</sup> Col J.A. Engelbrecht, Jr., PhD and team, a research paper presented to Air Force 2025, page 107, Department of Defense School, April 1996.

<sup>132</sup> Refer to footnote 130, page vii.

This research document is very clear and provides even the most skeptic climatologist who denies global weather manipulation by the U.S. and its allies an insight in what to expect in the 21<sup>st</sup> century: 'Current demographic, economic and environmental trends will create global stresses that provide the impetus necessary for many countries or groups to turn weather modification ability into capability. In the United States weather modification will likely become part of national security policy with both domestic and international applications. Our government will pursue such a policy, depending on its interests, at various levels.'<sup>133</sup> The research paper does however not specify if current environmental and economic crises are deliberately triggered or created in order to achieve the goals as set in the directive of the U.S. Chief of Staff.

The authors of the research papers explicitly admit that the U.S. forces possess a high capability for fog and cloud modification as well as an average capability for space weather modification, which reflects the fact that HAARP is not operating at full capacity.<sup>134</sup> In that respect they have established a core competence road map in order to obtain overall artificial weather control in the year 2025. As water sources become scarcer 'in volatile parts of the world' the importance of precipitation modification for economic as well as defense purposes is likely to increase.<sup>135</sup> It is a fact that water will become the most valuable commodity in the next decades and control of existing water supplies automatically generates the next world power.

On top of this the research paper also includes a system development road map to weather modification in 2025 with a very precise time line. It includes the following applications:<sup>136</sup>

- Introduction of artificial ionospheric mirrors around the year 2000 with a very sharp upraise of such operations as from 2008. One can extrapolate that the HAARP system will be fully operational after 2015.
- Use of chemicals for atmospheric seeding as from the year 2000 in order to obtain Weather Force Support in 2015 and fully controllable virtual weather by 2025. The aerospace delivery vehicles' graphic and the graph for the use of chemicals are identical, which indicates a huge increase of spraying actions. It is clear that the sum of all U.S. and NATO military assets are not sufficient to achieve the desired targets and civil aviation has to be included in order to achieve success.
- Introduction of smart clouds through nanotechnology around the year 2004 with an exponential increase of this application after 2010. The same applies to the use of 'directed energy' – a euphemism for ionospheric heating.
- A very curious application is the introduction of 'Carbon Black Dust' (CBD) as from the year 2005 – a technology that has to be developed by the DOD according to the document.

Although this unclassified research paper contains a disclaimer that it is a fictional representation of future scenarios and the viewpoints do not reflect the official policy of the U.S. Air Force, DOD or U.S. government its mere existence highlights the ambition of the military in the field of weather control. As has been adequately illustrated the technology for weather manipulation is already in place and the allocation of human resources to such projects is only possible after prior permission by the DOD, the intelligence services such as the NSA and finally senior decision makers in the U.S. government itself.

Last but not least there exists also a civil counterpart of the '2025 project', which is called the Weather Modification Association (WMA). This organization also publishes annually or more frequently the journal of weather modification. Its mission goals is to enable

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<sup>133</sup> Idem as footnote 130

<sup>134</sup> Idem as footnote 130, page 32

<sup>135</sup> Idem as footnote 130, page 34

<sup>136</sup> Idem as footnote 130

persons, political entities and other organizations to make informed decisions about the application of weather modification technologies, to provide adequate water supplies and to reduce natural weather hazards.<sup>137</sup> Although designed for beneficial use the mission statement has a strong resemblance with the operational capabilities matrix on the 'enhance friendly forces' side of the military '2025' project.

An excerpt of the research paper, which includes the front page, the disclaimer, the table of contents and the different graphics, is included in appendix 13.

#### **5.2.7. The bare necessity of geo-engineering through cloud generation for survival of the planet (1996 – 2010):**

In the first decade of the 21<sup>st</sup> century a new development took place on planet Earth: climate is gradually changing and whole eco systems are endangered as a result of human activity. The former secretary-general of the United Nations, Koffi Annan, put it crystal clear in the introduction section of the impressive GEO4-document released by the IPCC in 2007: 'Imagine a world in which environmental change threatens people's health, physical security, material needs and social cohesion. This is a world beset by increasingly intense and frequent storms, and by rising sea levels. Some people experience extensive flooding, while others endure intense droughts. Species extension occurs at rates never before witnessed. Safe water is increasingly limited, hindering economic activity. Land degradation endangers the lives of millions of people. This is the world today.'<sup>138</sup> In a short period of time 'global warming' came on top of many political agendas.



Between 2003 and the outbreak of the credit crunch in 2008 'global warming', dwindling natural resources and the safeguard of the planet in general proved to be a very popular media topic, partly as a result of the release of the movie 'an inconvenient truth' by Al Gore – who would later become the first billionaire in cap & trade.

Although 'global warming' remains a very controversial subject after the eruption of 'climate gate' in 2009 and 'climate change' would be a much more appropriate description of this phenomenon P.M. Della-Marta and his team of Meteoswiss proved through an analysis of 54 homogenised daily maximum temperature series in 15 European countries

<sup>137</sup> Weather Modification Association website,  
<http://weathermodification.org/organisation.htm>

<sup>138</sup> GEO4, United Nations Environment Program, Introduction section, 2007.



that summer heat waves have doubled since 1880, both in number of hot days as the length of the heat waves.<sup>139</sup> His research work confirms data obtained in earlier research papers, such as the Press Therm Climate document, prepared on presidential order after the extreme heat wave of 2003 in France that resulted in 14,947 excess casualties of whom 2200 people died in one single day - August 12<sup>th</sup> 2003.<sup>140</sup> Even when putting the effects of 'climate gate' into account one can logically assume that our quality of life is in great danger and immediate action is needed to safeguard the planet.

A lot of mitigation scenarios were developed to counter 'global warming', such as restriction of the various greenhouse gasses through regulation and the creation of the profitable cap & trade business, making pollution one of the business fields with the highest return on investment. As from 2001 more exotic scenarios were introduced in the IPCC assessment reports such as iron fertilization in oceans, chemical buffering and 'geo engineering' – large size and deliberately manipulation of Earth environment through its energy balance and reflection of additional incoming solar radiation back into space.<sup>141</sup>

However geo-engineering scenarios for reduction of global warming on a large scale already appear in much older documents, such as U.S. patent 5,003,186 of March 26<sup>th</sup> 1991, held by Hughes Aircraft Company. It contains 18 claims to reduce global warming through stratospheric seeding with Aluminum Oxide (claim 3 and 12), Thorium Oxide (claim 4 and 13) and refractory Welsbach material for reflection of incoming solar radiation (claims 7 and 10) with a particle size of 10 to 100 Microns (claims 6 and 16) and dispersed at altitudes between 7 to 13 kilometers (claims 5 and 14).<sup>142</sup> Refer to appendix 14 for the full outline of patent 5,003,186.

So far government sources systematically deny the existence of operational atmospheric spraying schemes in order to cut 'global warming', but one must bear in mind that the proposed scenario by the IPCC in 2001 is identical to the claims contained in the Welsbach patent. Moreover Hughes Aircraft Company has been acquired by Raytheon in 1997, which is exact the same company that acquired E-systems and the HAARP contract.<sup>143</sup>

The exact method of spraying of the mix that comprises one of more of the oxides of metals (claims 1 and 11) is not firmly specified in patent 5,003,186, although one possible method of delivery is briefly described in the section 'background of the invention': 'one proposed solution to the problem of global warming involves the seeding of the atmosphere with metallic particles. One technique proposed to seed the metallic particles was to add the tiny particles to the fuel of jet airlines, so that the tiny particles would be emitted from the jet engine while the airline was as it cruising altitude. While this method would increase the reflection of visible light incident from space, the metallic particles would trap the long wavelength blackbody radiation released from the earth. This could result in the net increase in global warming. It is therefore an object of the present invention to provide a method for reduction in global warming due to the greenhouse effect which permits heat to escape through the atmosphere.'<sup>144</sup>

<sup>139</sup> Doubled length of Western European Summer Heat Waves since 1880, Della-Marta, P.M., M. R. Haylock, J. Lutherbach, and H. Wanner 2007, Journal of Geophysical research, volume 112, D15103, doi:10.1029/2007JD008510 – published August, 3rd 2007, Federal Office of Meteorology and Climatology Meteoswiss, Zürich

<sup>140</sup> Press Therm Climat, 142:25-30. Data for Dijon-Longvic Airbase, Centre Météorologique Départemental de la Côte d'Or, Dijon, 2005.

<sup>141</sup> IPCC Third Assessment Report, Climate Change 2001, working group III: mitigation, section 4.7 Biological uptake in oceans and freshwater reservoirs, and geo-engineering, GRID-Arendal, 2003.

<sup>142</sup> U.S. patent 5,003,186, Stratospheric Welsbach seeding for reduction of global warming, March 26<sup>th</sup> 1991.

<sup>143</sup> Raytheon Company and Hughes Electronic Defense Business (Hughes Aircraft) to merge, creating \$21 billion enterprise – combination creates a world leader in defense electronics, Raytheon press release, Raytheon Company Corporate Communication, New York, January 16th, 1997

<sup>144</sup> Idem as footnote 142, page 1.


However a recent research paper by David L. Mitchell and William Finnegan dated October 30<sup>th</sup> 2009 shines a new light on atmospheric seeding by aircraft, with two possible methods of delivery:<sup>145</sup>

- The seeding material, comprised of a pressed composite of reagent Bismuth metal, Aluminum and Gilsonite (natural Hydrocarbon) could be either dissolved or suspended in the jet fuel of commercial airliners and later burned with the fuel to create seeding aerosol.
- Alternatively the mix could be directly injected into the hot engine exhaust, which should vaporize the seeding material, allowing it to condense as aerosol in the jet contrail. In this respect it is noteworthy that the Secretary of the U.S. navy is in possession of patent 3,899,144, dated August 12<sup>th</sup> 1975, claiming the invention of specific contrail generation apparatus for producing a powder contrail having maximum radiation scattering ability for a given weight material.<sup>146</sup> The seeding material in this document again consists of 85% metallic particles and 15% colloidal Silica and Silica gel in order to produce a stable contrail that has a residence period of 1 up to 2 weeks as the Mitchell and Finnegan survey claims.<sup>147</sup> Refer to appendix 15 for the full text of patent 3,899,144.

As discussed in the case study in paragraph 3.3.2 the KC135 and possible the AWACS aircraft are already equipped with pods to enable spraying operations. The question arises if the higher gas emission ratios than those in civil aviation are not part of this type of delivery mechanism for geo-engineering.

Thus basically the first method with direct injection through jet fuel is primarily designed for civil aviation, since delivery of the mixture through pods would involve direct co-operation of airline staff, management, crews, maintenance personnel and generally attract media attention. This is also the basic argument that is being used by websites that deny the existence of 'chemtrails', such as 'contrail science'.<sup>148</sup> This is very true, since the very nature of such an operation would involve intense co-operation at all levels. However, the Dutch Airport Portal website, supposed to be a platform for professional pilots, contains a lot of postings referring to spraying schemes with product 'X-432' (a Barium derivate).<sup>149</sup> It contains even excerpts from a company's operating manual and suggestions that KLM, the national Dutch carrier, is a partner in the spraying program. Some consider this portal as a hoax, but one can only wonder why so much energy is used to generate such 'rubbish' that has 'no purpose'. Furthermore the nomenclature is similar to standard operating procedures (SOP) and airplane checklists as used in commercial aviation. Refer to appendix 16 for a printout of some of the postings on this website.

*As additional evidence has shown up that confirms the fact that European ministries of defense have bought great amounts of Barium or Barytine C14. The concrete documents (appendix 17) have been removed from this ~~document~~ report for security reasons and kept in a safe place.*

 10/05/2010  
Taking into account that Barytine C14 is used as a tracer for measurement of sea currents as part of global climate modeling<sup>151</sup> it

<sup>145</sup> Michell D.L. & Finnegan W., Modification of Cirrus clouds to reduce global warming, Desert Research Institute, Reno, USA, October 30th 2009.

<sup>146</sup> U.S. patent 3,899,144, Powder Contrail Generation, August 12th 1975.

<sup>147</sup> Idem as footnote 145.

<sup>148</sup> Contrail science, chemtrail plausibility study, <http://contrailscience.com/chemtrail-plausibility-study/>

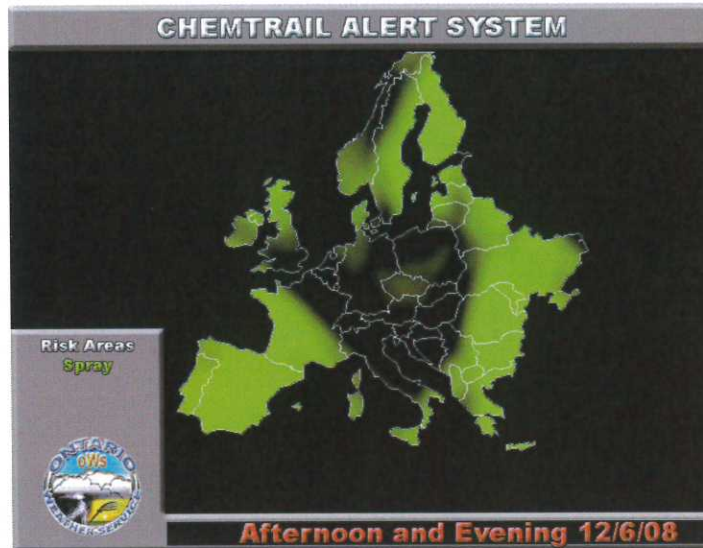
<sup>149</sup> <http://www.airwork.nl/bulletinboard/showthread.php?t=6001&page=3>

<sup>150</sup>

<sup>151</sup> Modelisation Climatique Globale, PNEDC, page 60, Institut National des Sciences de l'Univers, Centre National de la Recherche Scientifique. 2005.

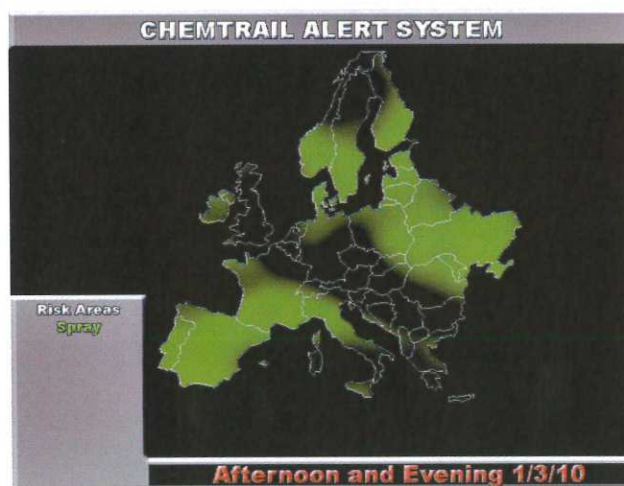
comes at no surprise why such large quantities are ordered. Refer to appendix 17 for different screenshots of the order confirmation.

On top of this comes a map with spraying schemes in Europe, which has been released by Kevin Martin, a meteorologist working for the Ontario Weather Service in 2008. Later on such maps displaying intended spraying schemes for Europe, Australia and the United States appeared on the Southern California Authority website. Currently this section of the website has been shut down since January 6<sup>th</sup> 2010 for unknown reasons.



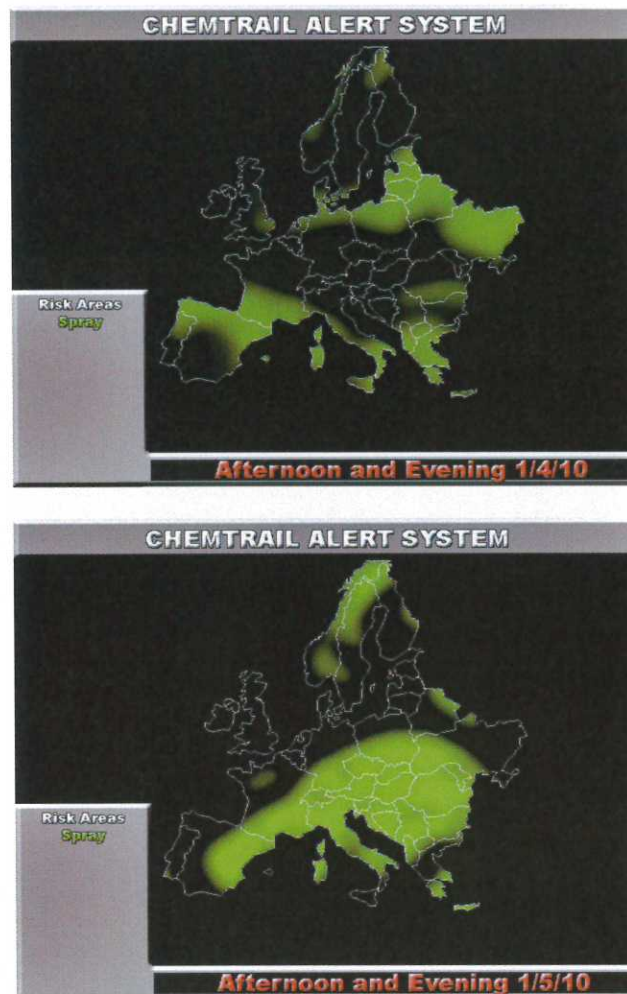
This map shows the European spraying scheme for June 6<sup>th</sup> 2008.<sup>152</sup>

The spraying schemes seem to be organized in a logical pattern so that the whole of Europe is covered in a 3-day period:



<sup>152</sup> By courtesy of Kevin Martin, meteorologist.





The last maps with spraying schemes on the Southern California Authority website, January 6<sup>th</sup> 2010.<sup>153</sup>

The existence of such documents highlights the discrete but heavy involvement of governments at top level in climate control projects, which are hidden for the public for the obvious reason that the actual state of the planet is much worse than admitted through media channels. Indeed, scientists are seeking to counter with an ever louder sounding voice of climate engineering the scenario of a 3°C-increase in surface temperature, coupled with a more than doubled CO<sub>2</sub> output by the year 2100 – data that has been transmitted to the IPCC in 2005.<sup>154</sup> According to Mark Lynas, author of the book 'six degrees', the critical mass to induce cataclysms on planet Earth is a temperature increase of 2.5°C. Once beyond this point very volatile and unstable weather conditions on a global scale are expected, triggering unseen social unrest and martial law, chronic shortages of water and food and widespread destruction – especially in low lying areas.<sup>155</sup> This is exact the type of scenarios that various governments are trying to prevent by means of geo-engineering though production of artificial Cirrus clouds in order to keep the temperature increase within limits, thus enabling continuation of business on the planet 'as usual'.

A press statement, released on September 4<sup>th</sup> 2009 by 5 top economists including 3 Nobel laureates just before the opening of the later (deliberately) torpedoed Copenhagen top climate summit, in which climate engineering is considered as the 'most cheap and

<sup>153</sup> <http://www.scwxa.org>

<sup>154</sup> Idem as footnote 151, page 63.

<sup>155</sup> Lynas Mark, Zes graden, onze toekomst op een warmere planeet, pages 129-193, Uitgeverij Jan Van Arkel, Utrecht, 2008.

rapid response' to global warming, confirms this point of view.<sup>156</sup> Stratospheric aerosol insertion receives a rating 'very good' in the list of possible options. All carbon taxes, which are now at the political negotiation tables, are considered as poor and useless for the safeguard of the planet – although they are a pretty good business. The full press statement is included in appendix 18.

At the time of public release of this research paper in May 2010 our investigation team comes to the conclusion that climate control programs, controlled by the military but approved by governments are silently implemented in order to avoid the worst case scenarios they obviously do not want. The two basic instruments are temperature control through generation of artificial clouds and manipulation of the ionosphere through ionosphere heaters. Both remain basically military combat systems with the option to go into the offensive if deemed necessary. However since several ionospheric heaters are installed on various places around the globe one can assume that there is wide co-operation between governments in order to reach the climate targets by 2025: controlling the weather and thus the planet.

Last but not least one can ask why staff of the university of East Anglia has deliberately manipulated climate data for the sake of the IPCC? Accidentally or not the beginning of the falsification of data series starts at the beginning of atmospheric seeding and the operational cycle of HAARP... It is also an interesting path to investigate if 'Climate Gate' is not an accident, but a well planned maneuver to gradually prepare the global population for their future on the planet.

### **5.3. MODUS OPERANDI FOR CLIMATE MODELLING THROUGH MODIFICATION OF CIRRUS CLOUDS:**

#### **5.3.1. Technique of modification of Cirrus clouds:**

It has been adequately illustrated that Cirrus clouds do have a significant impact on temperature and precipitation on a specific spot on Earth. If one combines this knowledge with strategic plans and scientific studies as described in previous chapter it is only a matter of time before climate modeling through modification of Cirrus clouds will be used on a large scale, whether for peaceful or military purposes.

As explained in paragraph 4.2.2 aircraft engine emissions that develop into contrails, which form man made Cirrus under specific conditions, possess a global warming potential. Although they reflect incoming sunlight they also trap the long wavelength blackbody radiation released by the Earth, thus resulting in a net increase of global warming.<sup>157</sup> Therefore it is imperative to develop a reliable technique that permits heat escape through the atmosphere, taking into account the albedo characteristics of the planet.

Both U.S patents 5,003,186 for stratospheric seeding and 3,899,144 claiming a powder contrail generator for radiation scattering, as well as the research work of David L. Mitchell and William Finnegan claim that global warming can be reduced by seeding the upper atmosphere by the following combination of metallic particles:

<sup>156</sup> Top economists recommend climate engineering, Press statement, September 4th 2009, Copenhagen Consensus Centre.

<sup>157</sup> U.S. patent 5,003,186, Stratospheric Welsbach seeding for reduction of global warming, Background of the invention, March 26th 1991.

U.S. patent 5,003,186, Stratospheric Welsbach seeding <sup>158</sup>	U.S. patent 3,899,144 Powder contrail generation <sup>159</sup>	D. Mitchell and W. Finnegan research paper: modification of Cirrus clouds <sup>160</sup>
One of more oxides of metals (not specified), particle size 10 to 100 $\mu$ Aluminum oxide Thorium oxide Welsbach material	85% TiO <sub>2</sub> (e.g. Dupont R-931, median particle size 0,3 $\mu$ ) 15% colloidal Silica (e.g. Cabot S-101 Silanox, median particle size 0,007 $\mu$ ) Silica gel (e.g. Syloid 65, average particle size 4,5 $\mu$ )	A pressed composite mixture of Bismuth tri- iodide (BiI <sub>3</sub> ), potassium perchlorate (KClO <sub>4</sub> ), Aluminum (Al) and gilsonite (a natural hydrocarbon)

As explained in the previous chapter the delivery mechanism is aviation. The stratospheric Welsbach patent suggests particle seeding by dispersal from aircraft at an altitude on the order of 10 km, but this is within the troposphere where airliners routinely cruise - except at polar latitudes.<sup>161</sup> D. Mitchell and W. Finnegan are even more specific about this: "with the delivery process already existing, this geo-engineering approach may be less expensive than other proposed approaches."<sup>162</sup> This implies that the mechanism for widespread spraying of metallic particles through commercial aviation is already in place since a considerable long time. The 'other proposed approaches' may be the technology as claimed in patent 3,899,144, iron ocean fertilization of 1975 or even HAARP (1991). Refer to appendix 19 for the full text of this research paper.

Adding tiny metallic particles to aviation fuel Jet A-1 or the military JP-8 or JP8+100 have a specific purpose. They are characterized by wavelength dependent emissivity or reflectivity, in that said materials have high emissivity in the visible and infrared wavelength region and low emissivity in the near infrared region. Such metals are also referred to as Welsbach material in the 5,003,186 patent. By seeding these metals in the upper troposphere and stratosphere the particles remain suspended for some time in the air and provide by their nature a mechanism for converting the blackbody radiation in the near infrared region into radiation in the visible and infrared wavelength so that the heat energy may be reradiated out into space, thus reducing global warming due to the greenhouse effect.<sup>163</sup>

On the question if this technique is adequate for reduction of global warming one can only state that the primary examiner of the patent bureau only delivers U.S patents if the inventors can sufficiently demonstrate that the invention effectively works. Moreover secrecy orders may be issued if they are deemed detrimental or vital to national security. In some cases the government can even confiscate a patent ('John Doe'). A list of military patents, secrecy orders and John Doe's for the period 1988-2009, as well as an example of secrecy order letter, are contained in appendix 20.

A last consideration is that the metal particles must remain suspended in the atmosphere for a considerable long time in order to be effective. Patent 5,003,186 claims that the particles may remain in suspension for up to one year.<sup>164</sup> D. Mitchell and W. Finnegan use the same logic with a much shorter residence time (1 up to 2 weeks) but far sufficient to produce 'artificial' Cirrus clouds that enable climate modeling with temperature and precipitation as instruments.

<sup>158</sup> Idem as footnote 157

<sup>159</sup> U.S. patent 3,899,144, Powder Contrail Generation, August 12th 1975.

<sup>160</sup> Michell D.L. & Finnegan W., Modification of Cirrus clouds to reduce global warming, Desert Research Institute, Reno, USA, October 30th 2009.

<sup>161</sup> Idem as footnote 157.

<sup>162</sup> Idem as footnote 160.

<sup>163</sup> Idem as footnote 157.

<sup>164</sup> Idem as footnote 157, page 5.



An argument that is used in almost all these publications is cost effectiveness hence atmospheric seeding through aviation seems to be the cheapest option for geo-engineering. It comes at no surprise that the number of complaints of civilians about persistent Cirrus clouds and conspiracy theories such as 'chemtrails' are on the increase. In the scope of the extensive U.S. weather modification project through history it is clear that Hughes Aircraft Company must have performed extensive testing before the patent was awarded and implementation of this technology is already finalized – cost effective, efficient on short term, with or without active co-operation of air crews, in short 'perfect'.

### 5.3.2. Legal aspects of climate modeling through aviation:

The question arises about the legal aspect of these spraying actions, especially in Europe since it may be an infringement of the sovereignty of the airspace of different countries. For example the Belgian airspace (FIR and UIR EBBU) consists of the national territory, part of the North Sea and Luxemburg.<sup>165</sup> Although all aircraft that emit a mixture of exhaust gases and metallic particles legally operate in controlled airspace on a prior approved flight plan the consideration has to be made if formation of man made Cirrus clouds over France that drift within Belgian airspace would present a violation of the law. However, as long the existence of the technique of cloud generation through contrails is officially denied this is not an issue.

In the United States things are quite simple since it is a vast country and spraying is considered legal according public law.<sup>166</sup> Rather intriguing is the space preservation act proposal of 2001, which was rejected on April 19<sup>th</sup> 2002 after an unfavorable executive comment received from the DOD. As a result of this seeding the atmosphere through aviation can be considered as legal in this country. The unrevised proposal included a permanent ban on 'exotic space weapons', which included ultra low frequency weapons, environmental & climate weapons and chemtrails – the only existing document where this phenomenon is explicitly mentioned.<sup>167</sup> The bill was re-written in less unusual language with omission of these 'exotic weapons' before submission to the committee. Websites that systematically deny the existence of climate manipulation programs state that congressman and sponsor Dennis Kucinich did not even write the bill or read a document written by 'UFO-enthusiasts' until too late.<sup>168</sup> However it shines some light on the professionalism that reigns in some government circles. A copy of the unrevised Space Preservation Act is included in appendix 21.

Spraying programs in Russia and the People's Republic of China are legal since they are standard procedure for major political rallies and parades.

Some interest groups however do put the legality of geo-engineering as a solution for global warming into question. One of them is the ETC-group, a technology watchdog with HQ in Canada. They warn against the rollout of geo-engineering as plan B after the failure of the Copenhagen climate summit in 2009 and point out that Bill Gates and Richard Branson are very keen to experiment with 'fast, cheap and imperfect' geo-engineering technologies – 'no matter what happens to this planet'. According to the ETC-group the very fast developing geo-engineering lobby has no mandate and no right to manage solar radiation on behalf of anyone.<sup>169</sup> That is very much true. Refer to appendix 22 for the full text of the ETC Group news release.

<sup>165</sup> Aeronautical Information Publication Belgium and Luxemburg CD-rom, AIP section ENR, issued by Belgocontrol, 2010.

<sup>166</sup> U.S. Public law 95-79, title VIII, Sec. 808, July 30<sup>th</sup> 1977.

<sup>167</sup> HR2977: Space preservation act of 2001, 107<sup>th</sup> congress 2001-2002.

<sup>168</sup> <http://contrailscience.com/kucinich-chemtrails-and-hr-2977/>

<sup>169</sup> Top-down planet hackers call for bottom-up governance, ETC Group news release, February 11<sup>th</sup>, 2010.

### 5.3.3. Safety and health aspects of climate modeling through aviation:

According to D. Mitchell and W. Finnegan seeding the atmosphere with aerosols containing oxides of metals as part of a geo-engineering project have some drawbacks:<sup>170</sup>

- Increase of the rates of strategic ozone destruction.
- Higher costs of injecting sulfur compounds into the atmosphere.
- Decrease in solar radiation altering the hydrological cycle with more frequent droughts.
- Change in sky color from blue to white.
- Less solar power.

Change in precipitation patterns have already been covered in paragraph 4.3, confirming that climate modeling projects through aviation should be approached in a much more cautious way. Ozone depletion is a fact, which could effectively be countered if HAARP was to be used for more peaceful purposes. The change of color is probably the more frequent appearance of a milky sky, which is a totally unacceptable prospect if geo-engineering is to be used on a global scale.

According to official government sources, such as the U.S. Agency for Toxic Substances & Disease Registry (ATSDR), materials such as Aluminum that is used in the aerosol mix are always present in virtually all food, air, water and soil and therefore exposure is usually not harmful and there are no known carcinogenic effects.<sup>171</sup> The same logic applies when researching the effects of Barium.<sup>172</sup> The questions arises how extremely high concentrations of Aluminum and in a lesser extend Barium, measured in the center of Paris (for example PTE = Paris Tour Eiffel) in November 2008 and included in appendix 23 should be interpreted as there are no fixed standards to determine an alarm level for this type of contamination.

However there is ample evidence that aircraft engine emissions – even without the addition of an aerosol mix - pose a threat to public health, although its effects are minimized by the industry as a result of corporate profit, conflicts on interests and ineffective control by government and regulating authorities.<sup>173</sup> The aerotoxic syndrom, which has first been recognized in 1999, affects an increasing number of flight crews and cabin personnel. It is a term that encompasses the following symptoms observed by crews who have been exposed to hydraulic fluid, engine oils or mists as a result of the circulation of bleed air in the pressurized cabin:<sup>174</sup>

- Symptoms of dysfunction in neurological function, immediately after intense exposure, including loss of positional awareness, vertigo and loss of consciousness. If these symptoms occur to a pilot there is a significant aviation safety problem.
- Symptoms of skin, eyes, nose and respiratory irritation immediately after exposure. Further exposures exacerbate the symptoms, often leading to other respiratory and cardiovascular effects.
- Symptoms of gastrointestinal discomfort immediately after exposure. While these recede with cessation of exposure there is a suggestion that nausea and diarrhea can persist.

<sup>170</sup> Michell D.L. & Finnegan W., Modification of Cirrus clouds to reduce global warming, Desert Research Institute, Reno, USA, October 30th 2009.

<sup>171</sup> ToxFAQ for Aluminum, Agency for Toxic Substances & Disease Registry, September 2008.

<sup>172</sup> ToxFAQ for Barium, Agency for Toxic Substances & Disease Registry, August 2007.

<sup>173</sup> [www.aerotoxic.org/index.php/about-aerotoxic-syndrome](http://www.aerotoxic.org/index.php/about-aerotoxic-syndrome), Is the aviation industry adressing the issue.

<sup>174</sup> Winder C., Fonteyn P. And Balouet J-C, Aerotoxic syndrome, a descriptive epidemiological survey of aircrew exposed to in-cabin contaminants., J Occup Health Safety – Australia & New Zealand 2002, 18(4) 321-338.

- Some symptoms of impairment of neurophysiologic function immediately after exposure, such as headache, dizziness, disorientation and intoxication. These symptoms become more debilitating after time with loss of cognitive function and memory problems emerging.
- General symptoms of exhaustion to chronic fatigue, with suppression of the immunity system with food intolerance, allergies and chemical sensitivities (MCS or Multiple Chemical Sensitivity) some time after exposure.

The aircrews in this survey had incidences of symptoms at much higher rates than population backgrounds, suggesting that they were unhealthier than the general population. However, since pilots and cabin crew undergo routine medical checks the level of fitness and health in such individuals should be better than population norms.<sup>175</sup> Various governments and regulating authorities have commissioned research on this subject, but so far have not been 'able to conclusively prove a link between contaminated cabin air and chronic health problems'.<sup>176</sup> The full text of this research paper is included in appendix 24.

As the aerotoxic syndrome is a joint result of leakage of hydraulic fuels and engine oils there is other evidence that jet fuel itself is detrimental to health. Extensive animal testing on monkeys, rats, mice and dogs by the U.S. air force in 1993 – exposing them to then now obsolete JP-4 and JP-7 jet fuels showed decreased liver weights, red blood cell fragility, depressed activity, infertility and an increase in inflammations that sometimes resulted in cancer and subsequent death.<sup>177</sup> Refer to appendix 25 for an excerpt of this survey. There are no research papers released on the health effects of JP-8 or JP-8+100 military jet fuels but one can assume they are identical to those described in the 1993 paper.

These research papers illustrate that aircraft engine emissions, whether combined with aerosols or not, are a concern for public health and action should be taken by the scientific society to perform additional research on the effects of nano sized particles on humans and in general our eco-systems.

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<sup>175</sup> Idem as footnote 174, page 336.

<sup>176</sup> Idem as footnote 174.

<sup>177</sup> TP76-c2 Fuels on animals, Jet fuels JP-4 and JP-7, Health effects, 1993.



REVIEWED BY: AO

APPROVED BY:

10/05/10

PV

## 6. CONCLUSIONS AND RECOMMENDATIONS

The secretary of defense may conduct tests and experiments involving the use of chemical and biological agents on civilian populations.

Public law of the United States, Law 95-79, title VIII, Sec.808, July 30<sup>th</sup> 1977.

## 6.1. CONCLUSIONS AND RECOMMENDATIONS:

When combining the knowledge of the formation of contrails, the effects of Cirrus clouds on climate, the historical records of weather manipulation programs, the scientific studies on geo-engineering through modification of Cirrus clouds, the available and patented technology coupled with reactions of pilots on the internet one can only come to the following conclusions:

1. Manipulation of climate through modification of Cirrus clouds is neither a hoax nor a conspiracy theory, but currently the best option in geo-engineering considered by decision makers to counter global warming. The impact of production of artificial Cirrus clouds on temperature and precipitation patterns is supported by adequate hard scientific evidence.
2. The ambition of the United States is to control the weather by the year 2025, both for civil and military purposes (offensive and defensive strategies). This research paper contains a proven track record to support that statement.
3. The technology to organize spraying actions on a global scale is widely available. Both civil and military aviation is used for that purpose. The mix, containing oxides of metals and chemical components, can either be dispersed through special designed pods or directly incorporated into the jet fuel. This research paper is well documented in this respect.
4. Since the patents are owned by the main defense contractor for the U.S. armed forces (Raytheon) or the U.S. department of defense itself and given the history record it is obvious that current climate manipulation programs are organized and directed by the United States government.
5. The spraying actions in Europe are only possible with prior approval and intense co-ordination on top government level and industry on executive level. The general public is intentionally kept unaware of the existence of such projects.
6. Although the spraying actions may be considered legal these actions may have a potential detrimental effect on health. There is sufficient scientific evidence available in this research paper to support this thesis.

It is not the purpose of this research paper to give a moral appreciation of these actions. Nevertheless the investigation team unanimously comes to the following recommendations for the future:

- a) Artificial Cirrus clouds should be classified as a separate cloud genus by the WMO. Additional scientific research with the effects on nature and public health on this subject should be considered. Results –whatever the outcome- should be made public.
- b) It is unacceptable that the Awacs aircraft fleet under NATO operates under a Luxemburg civil registration without complying with civil aviation regulations. This is a flagrant violation of the law and this should be corrected in the near future. Given the very unfavorable engine emission ratios of this aircraft retrofitting of these engines should be considered as soon as practical.
- c) When considering a legal case it is better to sue an industrial group, such as Raytheon, rather than a government agency. It is clear for us that the responsibility of Raytheon in this respect is far reaching with the creation of a monopoly in climate modeling and weather as a geo-engineering or military instrument. If possible an international ban should be placed on such weapons.
- d) Although the existence of weather modification projects have been illustrated in an adequate way in this research paper it is now the duty of a serious politician on any level to make enquiries to the government for public release of these spraying schemes through aviation. It is mandatory that such statement should include the reason why such operations are conducted. It is not an option to hide behind the motive of national security.

The investigation group has performed the research meticulously with maximum integrity and we hope that our intervention will reveal the truth about climate manipulation, exposing the real reasons to the general public, which has the basic right to know. We also hope this research paper will contribute towards a more peaceful world. Last but not least we thank the Belfort group for its courage and wish them maximum success in public divulgence of this document.

In the name of our planet, Agent Orange

On behalf of the Belfort-group and of humanity as a whole  
 I congratulate this team of 'inside' experts for doing an  
 outstanding job in producing this scientific evidence based  
 and very well documented report.  
 Although for security reasons I do not know their identity  
 I thank these brave persons from the bottom of my human being.  
 I am sure that their engagement was driven by their conscience,  
 their knowledge, their desire for the truth, their sense of  
 responsibility for Mother Earth and all her creatures  
 and above all their love to love, which is definitely  
 the only engine of life itself.  
 May this document contribute to the wake-up of mankind  
 and the transformation of our species to become again  
 what we were always meant to be: god-like, spiritual beings...

Ring the bells, that still can ring  
 Forget your perfect offering  
 There is a crack in everything  
 That's how the light gets in  
 Leonard Cohen, The Anthem.

May God help us all...

Peter Vereecke

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