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Layman's Library

Contrails - Contrails, or condensation trails, are "streaks of condensed water vapor created in the air by an airplane or rocket at high altitudes."(Webster's Dictionary). Contrails are the result of normal emissions of water vapor from jet engines. At high altitudes, water vapor condenses and turns into a visible cloud. Contrails form when hot humid air from jet engines mixes with the surrounding air in the atmosphere which is drier and colder. The mixing is a result of turbulence generated by the jet engine exhaust. The water vapor in the jet exhaust then condenses and forms a cloud. The rate at which contrails dissipate is entirely dependent upon weather conditions and altitude. If the atmosphere is near saturation, the contrail may exist for some time. Conversely, if the atmosphere is dry, the contrail will dissipate quickly.

Contrail Grid Patterns - Numerous contrails are usually over "air routes", or highways in the sky. Aircraft fly in all different directions at any time, and numerous contrails may seem to "crisscross". Although contrails may appear to cross, the trails can actually be from planes separated by significant altitude and time.

Chaff - Chaff are small bundles of aluminum coated fibers that create a large radar reflection. A radar seeking missile is unable to distinguish an aircraft from the chaff and loses the lock on the aircraft.

Chemtrails - Chemtrails is a term coined to suggest contrails are formed by something other than a natural process of engine exhaust hitting the cold air in the atmosphere.

Ethylene dibromide - Ethylene dibromide, or EDB, is a pesticide that was used commercially before being banned by the Environmental Protection Agency in 1983.

During WW II, EDB was used as an additive in aviation gasoline to help stop lead in the aviation gasoline from plating out on valves. Jet fuels, including JP-8 have never contained EDB. Soil samples showing the presence of EDB are most likely residuals from previous use as a pesticide. Webster's dictionary definition of EDB: ": a colorless toxic liquid compound C2H4Br2 that is used chiefly as a fuel additive in leaded gasolines, that has been found to be strongly carcinogenic in laboratory animals, and that was used formerly in the U.S. as an agricultural pesticide -- abbreviation EDB."

JP-8 Jet Fuel - JP-8 jet fuel consists of kerosene, a petroleum distillate fraction purchased to specification. The specification requires that the fuel producer meet a range of chemical and physical properties to ensure proper aircraft operation. Fuel additives are allowed, but are highly controlled. Additives include antioxidants, metal deactivators, corrosion inhibitors, fuel system icing inhibitor, and a static dissipater additive.

Rocket Exhaust - The exhaust plume generated by solid or liquid fueled rockets. Solid rocket motors are usually made of ammonium perchlorate and typically create light colored exhaust emissions. The exhaust is mainly carbon dioxide and water, but may also have high levels of hydrochloric acid formed, but which disperses rapidly. Liquid fuel rockets are generally kerosene and Liquid Oxygen (LOX) and produce an exhaust, which is darker and similar to aircraft exhaust. The exhaust is primarily carbon dioxide and water, but may contain nitrous oxides, sulfides, and soot particles.

Stratospheric Ozone - The ozone formed in the upper atmosphere through the interaction of the sun's energy and oxygen and which provides the natural shielding effect for the earth from UV rays. This ozone layer is susceptible to destruction by chlorinated compounds and is generally associated with the ozone hole over the Antarctic. Ozone in the lower atmosphere and ground level is generally a by-product of motor vehicle fuel combustion that forms NOx as a precursor which then forms ozone. This ozone is often seen as smog in most major cities.

Vapor Trails - The trail formed behind an aircraft as result of air flowing over a surface which creates a cavity in the air, similar to a boat propeller in water.

• References
• Layman's Library Comment

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http://www.af.mil/environment/enviro_contrails.asp

http://www.af.mil/environment/contrails_chemtrail.asp

http://www.af.mil/environment/contrails_flares.asp

Chaff and Flares

Chaff and flares are defensive counter measures used on aircraft to confuse radar and heat seeking missiles. Chaff is used as a decoy for radar seeking missiles and is made of glass silicate fibers with an aluminum coating. The fibers are approximately 60% glass fiber and 40% aluminum by weight. The typical Air Force RR-188 chaff bundle contains about 150 g of chaff or about 5 million fibers. The fibers are 25 microns in diameter and typically 1 to 2 cm in length. In 1997, the Air Force used about 1.8 million bundles worldwide.

The amount of chaff released worldwide by all of the services is approximately 500 tons per year. Chaff falls to the earth at a settling velocity of approximately 30 cm per second. Atmospheric residence times range from 10 minutes for the majority of chaff released at 100 m to approximately 10 hours for chaff released at 10,000 feet. Chaff fibers experience little breakup before reaching the ground.

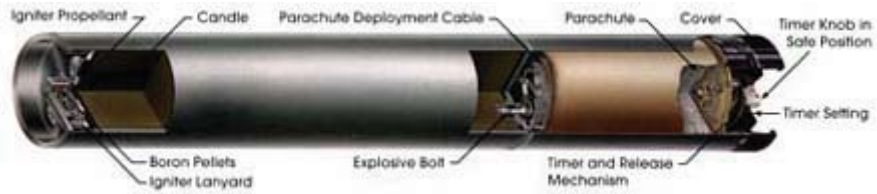
After the chaff is ejected from the aircraft and into the aircraft slipstream, the chaff packages burst open and the fibers scatter to form a radar-reflective cloud called a chaff corridor. Each chaff package is designed to simulate an aircraft. Several aircraft can create a chaff curtain, consisting of thousands of false targets, which confuse the radar guidance package on a missile so they are unable to locate the real targets within the chaff cloud.

Virtually all chaff fibers are 10-100 times larger than PM10 and PM2.5, the air particulates of concern for public health. The primary fiber size is usually too large to be inhaled by livestock, but if they are inhaled they do not penetrate far into the respiratory system and can be easily cleared out. The possible nutritional effects due to chaff ingestion and the risk is minimal to nil for both humans and livestock, considering the chemical composition of chaff (essentially identical to soil) and low chaff loading on the environment. Chaff decomposing in water has no adverse impacts on water chemistry or aquatic life.

Flares are of two types: decoy flares that protect aircraft from infrared missiles, and ground

illumination flares. Decoy flares are typically made of magnesium that burns white-hot and are designed to defeat a missile's infrared (IR) tracking capability. The intense heat of the pyrotechnic candle consumes the flare housing. Common aerial flares are: ALA-17/B, M-206, MJU-2, MJU-7 A/B, MJU-10/B, MJU-23/B, and RR-119.

Ground illumination flares, are designed to descend by parachute and provide up to 30 minutes of illumination of ground targets or activities. Typical flares are the LUU-1, LLU-5, and LLU-2B. A typical LLU-2B sectional is shown below.



The ground illumination flare enhances a pilot's ability to see targets while using Night Vision Goggles (NVGs). Flares burn at uneven rates and fluctuate in brightness and are not used as frequently as in the past as the intense light interferes with the newer NVGs more sensitive sensors.

The composition and materials of flares used by the military are similar to standard flares used for aerial, highway and marine purposes. (Skyline). While unburned decoy flares falling from high altitude could be dangerous, flares are designed to burn up during the descent (even the aluminum casing is burned).

Chaff and flares are deployed on most Air Force aircraft from a common MJU-11 Chaff/Flare magazine that is integrated with the warning receiver (a device that alerts the aircraft a missile has locked onto the aircraft). The magazine has a capacity of 30 RR-188 or 30 M-206 flares.

A very thorough independent description of military systems, equipment, and capabilities is published by the American Federation of Scientists.

Typical chaff and flare deployments and patterns are shown in the following pictures.

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Documents 1 - 1 of 1 matches.

Electronic Warfare Systems Apprentice ****
. . . Apprentice, you will be trained to maintain and repair this state-of-the-art equipment intercept receivers,

jamming devices, homing devices, **chaff** dispensers, panoramic receivers, direction finders, digital computer

subsystems and special purpose equipment. Your job will include troubleshooting aircraft . . .

http://www.af.mil/news/airman/0105/attack.shtml

Contrails - An Introduction

The Air Force operates many aircraft and space systems that are constantly interacting with the environment. Atmospheric interactions such as exhaust gases forming contrails, chaff and flares deployment that produce smoke, aerial pest or weed control spraying, or in-flight emergency fuel releases usually have very minor environmental impacts over a very limited geographical area. This site provides

basic information and links about contrails, aircraft and space launch exhaust emissions, chaff and flares, aerial spraying, in-flight emergency procedures, and related topics.

Aircraft, engines, chaff, and flares can produce a variety of condensation patterns (or contrails), exhaust plumes, vapor trails, or smoke patterns. The exhaust emissions produced by aircraft and space launch vehicles can produce contrails that look very similar to clouds which can last for only a few seconds or as long as several hours. Vapor trails are formed only under certain atmospheric conditions and create a visible atmospheric wake similar to a boat propeller in water and usually dissipate very rapidly. Chaff and flares produce unique smoke patterns that are visibly different than a contrail but have the same color and appearance as a cloud but which also typically dissipates very quickly. Aerial spraying for pest or weed control and fire suppression are the only Air Force activities which involve aircraft intentionally spraying chemical compounds (insecticides, herbicides, fire retardants, oil dispersants). In the case of an in-flight emergency, jet fuel may be released to lighten the landing weight and minimize the risk of fire if the aircraft should crash.

Reference Sites
Contrails Facts
• Introduction
• Background
• Contrail
• Wingtip Condensation Trails
• Exhaust Gases
• Chaff and Flares
• Aerial Spraying
• Cloud Seeding and Fire Suppression
• In-flight Emergency Fuel Release
• The "Chemtrail" Hoax
• Link to Related Sites
• References
• Layman's Library
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