Electromagnetic Radiation can affect the Lift Force

Fran De Aquino
Professor Emeritus of Physics, Maranhao State University, UEMA.
Titular Researcher (R) of National Institute for Space Research, INPE

Here we show that, under certain circumstances, electromagnetic radiations can strongly reduce the lift force. An aircraft for example, can be shot down when reached by a flux of specific electromagnetic radiation. This discovery can help the aircraft pilots to avoid regions where there are electromagnetic radiations potentially dangerous. Not only the flight of the aircrafts are affected by the electromagnetic radiation, but also the flight of any flying object whose flight depends on the lift force, including birds and flying insects.

Key words: Lift Force, Aircrafts, Gravitational Mass, Microwave Radiation.

The expression of the lift force (L) is given by [1]

$$L = C_L\left(\tfrac{1}{2}\rho v^2\right)A \qquad (1)$$

where C_L is the lift coefficient, ρ is air density, v is true airspeed, A is the wing area. Equation (1) is derived from the Bernoulli equation

$$\tfrac{1}{2}\rho v^2 + \rho g h + P = C \qquad (2)$$

which is obtained starting from the variations of the potential energy (mgh), and kinetic energy $\left(\tfrac{1}{2}mv^2\right)$; the mass m is expressed by means of the following equation: $m = \rho A v \Delta t = \rho V$, ($V$ is refers to the volume).

The quantization of gravity [2] showed that the *gravitational mass* m_g and rest *inertial mass* m_{i0} are not equivalents, but correlated by means of a factor χ, which can be reduced and made negative, for example by means of absorption or emission of electromagnetic radiation. Only for $\chi = 1$, $m_g = m_{i0}$. The correlation is expressed by means of the following equation

$$m_g = \chi\ m_{i0} \qquad (3)$$

In addition, it was shown [2] that the new expressions for the kinetic energy and potential energy are respectively, given by

$$\tfrac{1}{2}m_g v^2 \qquad m_g g h \qquad (4)$$

Consequently the variable $\rho = m/V$, in the Eqs. (1) and (2) must be replaced by $\rho_g = m_g/V = \chi\ m_{i0}/V = \chi\ \rho_{i0}$. Thus, the Eq. (1) will be rewritten as follows

$$L = C_L\left(\tfrac{1}{2}\rho_g v^2\right)A = C_L\left(\tfrac{1}{2}\chi\rho_{i0} v^2\right)A \qquad (5)$$

This is the generalized expression for the lift force (See Fig. 1).

The atmospheric air contains water droplets. Thus, if a region of the Earth's atmosphere is subjected to *electromagnetic radiation* then, according to Eq. (3), the gravitational mass of the water droplets in this region will be reduced. In this particular case, the gravitational mass of the water droplets (*gravitational mass of water droplets cloud* (WDC)) will be reduced according to the following expression [3]:

$$\chi = \frac{m_{g(wdc)}}{m_{i0(wdc)}} = \left\{1 - 2\left[\sqrt{1 + \frac{n_r^2 n^6 S_\alpha^2 S_m^4 \phi_m^4 D^2}{\rho_{i0(wdc)}^2 c^4 f^2}} - 1\right]\right\} \qquad (6)$$

where f and D are respectively the frequency and the power density of the electromagnetic radiation; ϕ_m is the average "diameter" of the molecules of water, $S_m = \frac{1}{4}\pi\phi_m^2$ is the cross section area; $\rho_{i0(wdc)}$ is the density of the *water droplets cloud* inside the air, $\rho_{i0(wdc)} \cong \rho_{i0(air)}$; S_α is the *maximum area* of the cross-section of the *water droplets cloud* (perpendicular to the incident radiation); n_r is the *index of refraction* of the water droplets cloud, and n is the number of molecules per unit of volume in the water droplets cloud, which is given by *weighted arithmetic mean* $n = \left(p_1 n_{(water)} + p_2 n_{(air)}\right)/p_1 + p_2$, where $n_{(water)}$ and $n_{(air)}$ are calculated by means of the following equation:

$$n = \frac{N_0 \rho_m}{A} \qquad (7)$$

where $N_0 = 6.02 \times 10^{26} molecules/kmole$ is the Avogadro's number; ρ_m is the matter density (in $kg.m^{-3}$) and A is the molar mass of the molecules (in $kg.kmol^{-1}$). Since $\rho_{i0(water)} = 10^3 kg.m^{-3}$, $A_{water} = 18 kg.kmol^{-1}$, $A_{air} = 14 kg.kmol^{-1}$, then we get $n_{(water)} = 3.3 \times 10^{28} molecules/m^3$ and $n_{(air)} = 4.3 \times 10^{25} \rho_{i0(air)} \ molecules/m^3$. Considering a region of the Earth's atmosphere, where the percentage of water is about 4% $(p_1 = 4\%)$ and the percentage of air is about 96% $(p_2 = 96\%)$, then for water droplets cloud, we can write that

$$n = \frac{4n_{(water)} + 96n_{(air)}}{100} \cong \frac{4n_{(water)}}{100} = 1.3 \times 10^{27} molecules/m^3$$

By reducing the gravitational mass of the water droplets cloud inside the air, it is possible reduce the gravitational mass of the air, $m_{g(air)}$ and, consequently, to reduce the air density $\rho_{g(air)} = m_{g(air)}/V = \chi \ m_{i0(air)}/V = \chi \ \rho_{i0(air)}$. According to Eq. (5), this affects the intensity of the lift force.

In order to evaluate how much the lift force can be affected, we will start from Eq. (6). By substituting the values: $n_r \cong n_{r(water)} \cong 1.33$; $\rho_{i0(wdc)} \cong \rho_{i0(air)}$; $n = 1.3 \times 10^{27} molecules/m^3$, $\phi_m = 1.55 \times 10^{-10} m$, $S_m = 1.88 \times 10^{-20} m^2$, and c (speed of light) into Eq. (6), we get

$$\chi = \frac{\rho_{g(wdc)}}{\rho_{i0(wdc)}} = \left\{ 1 - 2\left[\sqrt{1 + 7.6 \times 10^{10} \frac{S_\alpha^2 D^2}{\rho_{i0(air)}^2 f^2}} - 1 \right] \right\} \qquad (8)$$

This equation shows that the gravitational density of the water droplets cloud, $\rho_{g(wdc)}$, can become *negative*, reducing the initial value of $\rho_{g(air)}^{initial} = \rho_{i0(air)} \cong \rho_{i0(wdc)}$. Under these conditions, we can write that

$$\rho_{g(air)} = \rho_{g(air)}^{initial} - \left|\rho_{g(wdc)}\right| = \rho_{i0(air)} - |\chi|\rho_{i0(wdc)} \cong (1 - |\chi|)\rho_{i0(air)} \qquad (9)$$

Then, the expression of the lift force will be given by

$$L = \tfrac{1}{2} C_L \rho_{g(air)} v^2 A = \tfrac{1}{2} C_L (1 - |\chi|) \rho_{i0(air)} v^2 A \qquad (10)$$

Note that for

$$|\chi| > 1$$

The *lift force becomes negative*.

According to Eq. (8), for $|\chi| > 1$, we must have

$$\frac{S_\alpha D}{f} > 2.5 \times 10^{-6} \qquad (11)$$

Now consider a maser beam with an initial diameter of ϕ_0. If it is directed to an aircraft flying at height h, then the cross-section area of the maser beam at the height h (focus area) is given by

$$S_\alpha = \pi(\phi_\alpha)^2/4 = \pi(\phi_0 + 2htg\alpha)^2/4 \qquad (12)$$

where α is the divergence angle of the maser beam. Assuming $\phi_0 = 0.8m$, $h = 10km$ * and $\alpha \cong 0.1^0$ †, we obtain: $S_\alpha \cong 1000 m^2$. This is the focus area of the maser beam, containing the aircraft. Note that this area is sufficient to contain the most known aircrafts.

The power density in the area S_α is

$$D_\alpha = \eta(\phi_0/\phi_\alpha)^2 D_0 = \eta\left(\frac{\phi_0}{\phi_0 + 2htg\alpha}\right)^2 D_0 \qquad (13)$$

where η is the absorption factor.

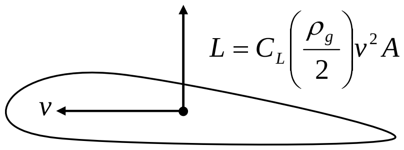
Substitution of S_α and $D = D_\alpha$ into Eq. 11, gives

$$D_0 > \left(\frac{10^{-5}}{\pi\eta}\right)\frac{f}{\phi_0^2} \qquad (14)$$

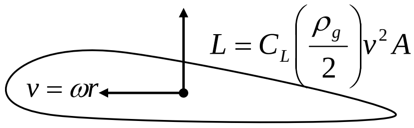
---

* Usual height of most aircraft flights.

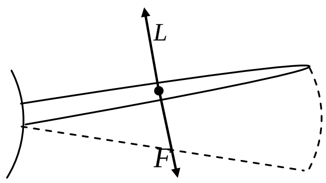
† Most of laser beams has $1.26mrad < \alpha < 6.3mrad$; then $\overline{\alpha} = \sqrt{1.26mrad.6.3mrad} \cong 2.8mrad \cong 0.1^0$ [4].



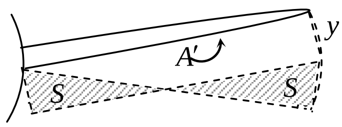
Aircraft wings



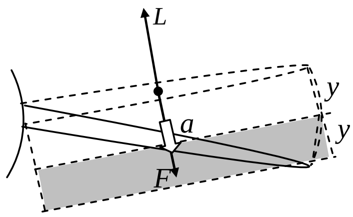
Helicopter helices



Wings of birds, mosquitoes, etc.



$V = A'y$



$v = \sqrt{2ay}$

The wings push the air with a force F , and it reacts with a force $L = F$. Then,

$$L = F = m_g a = \left(\frac{m_g}{V}\right)Va = \rho_g\left(A'y\right)a = \rho_g A'\left(ay\right) =$$

$$= \rho_g A'\left(\frac{v^2}{2}\right) = \qquad\qquad (Since\quad v = \sqrt{2ay}\ )$$

$$= \rho_g\left(C_F A\right)\left(\frac{v^2}{2}\right) \qquad\qquad (Since\quad A' = C_F A\ )$$

$$L = C_F\left(\frac{\rho_g}{2}\right)v^2A$$

Fig. 1 – The Lift Force

Assuming $\eta \cong 0.9$, $f = 1.4GHz$ and $\phi_0 = 0.8m$ then Eq. (14) gives

$$D_0 > 7736.7 \quad watts/m^2$$

This is therefore, the necessary power density at the level of diameter ϕ_0 of the maser beam, in order to make *negative the lift force* and *shooting down the aircraft*.

Masers with the $f = 1.4GHz$ and $D_0 \cong 10^4 W/m^2$ already can be produced [5].

Note that, if a radiation with a suitable ratio D/f hits an *airstrip*, then none aircraft will able to take-off from this airstrip, because the *negative lift force* makes impossible the take-off.

Consider for example, an airstrip with area $S_\alpha \cong 1000m^2$, and *nearby the sea level* ($\rho_{i0(air)} = 1.2kg.m^{-3}$). If it is subjected to an electromagnetic radiation with frequency $f = 1.4GHz$, then according to Eq. (8), we have

$$\chi = \frac{\rho_{g(wdc)}}{\rho_{i0(wdc)}} = \left\{1 - 2\left[\sqrt{1 + 0.027D^2} - 1\right]\right\} \qquad (15)$$

In order to obtain $|\chi| > 1$, we must have

$$D > 10.5 watts/m^2$$

Note that the maximum output from a GSM850/900 mobile phone is ~2W at ~1GHz. Thus, the power density nearby the head (~8cm) is greater than $25W/m^2$.

On the other hand, if $S_\alpha \cong 450m^2$ (a house, for example) and $f = 50MHz$, the result is

$$\chi = \frac{\rho_{g(wdc)}}{\rho_{i0(wdc)}} = \left\{1 - 2\left[\sqrt{1 + 4.2D^2} - 1\right]\right\} \qquad (16)$$

In order to obtain $|\chi| > 1$, we must have

$$D > 0.85 watts/m^2$$

This is sufficient to shot down *any bird or flying insect that penetrates the house* ‡. This can be very useful in the combat to the mosquitoes, which are responsible by the transmission of several diseases.

Now consider the following: nearby of the water surface of the oceans, rivers, lakes, etc., there is a range of water that is rich in *air droplets* due to the pressure of the atmospheric air, temperature, etc. If an electromagnetic radiation strikes a part of this range, then according to Eq. (6), the gravitational mass of the air droplet cloud (*adc*) existing at this region will be reduced, reducing therefore the gravitational mass, $m_{g(water)}$, of the water in this region, and also the water density ($\rho_{g(water)} = m_{g(water)}/V$). This affects the lift force (*buoyant force, B*) at mentioned region, because it is expressed by §

$$B = \rho_{g(water)} V_c g \qquad (17)$$

where V_c is the volume in contact with the fluid, that is the volume of the submerged part of the body; g is the local gravity acceleration.

In order to evaluate how much the buoyant force can be affected, we will start from Eq. (6), replacing $\rho_{i0(wdc)}$ by $\rho_{i0(adc)}$, where *adc* means *air droplets cloud*. Then, by substituting the values: $n_r \cong n_{r(water)} \cong 1.33$; $\rho_{i0(adc)} \cong \rho_{i0(air)} \cong 1.2kg.m^{-3}$; $n \cong n_{(water)} = 3.3 \times 10^{28}\ molecules/m^3$, $\phi_m = 1.55 \times 10^{-10}m$ and $S_m = 1.88 \times 10^{-20}m^2$, into Eq. (6), we get

‡ Lift forces caused by moving air keep aloft aircrafts, *as well as birds and flying insects* [6].

§ The general expression of the buoyant force (for any fluid) is $B = \rho_f V_c g$, where ρ_f is the density of the fluid.

$$\chi = \frac{\rho_{g(adc)}}{\rho_{i0(adc)}} = \left\{1 - 2\left[\sqrt{1 + 1.4\times10^{19}\frac{S_\alpha^2 D^2}{f^2}} - 1\right]\right\} \qquad (18)$$

This equation shows that the gravitational density of the air droplets cloud, $\rho_{g(adc)}$, can become *negative*, reducing the initial value of $\rho_{g(water)}^{initial} = \rho_{i0(water)}$. Under these conditions, we can write that

$$\rho_{g(water)} = \rho_{g(water)}^{initial} - \left|\rho_{g(adc)}\right| = \rho_{i0(water)} - |\chi|\rho_{i0(adc)} \qquad (19)$$

Then, the expression of the buoyant force is now

$$B = \rho_{g(water)} V_c g = \left(\rho_{i0(water)} - |\chi|\rho_{i0(adc)}\right) V_c g \qquad (20)$$

Note that for

$$|\chi| > \frac{\rho_{i0(water)}}{\rho_{i0(adc)}} \cong 833.3$$

the *buoyant force becomes negative*. Under these conditions, the fishes in the mentioned water range will be subjected to a negative buoyant force, and so they can not stay in this more oxygenated region, and consequently they may even die if the radiation to remain for a long time.

Equation (18) shows that, in order to obtain $|\chi| > 833.3$, we must have

$$\frac{S_\alpha D}{f} > 1.1\times10^{-7} \qquad (21)$$

Consider a region in the Earth's surface, with area $S_\alpha = \pi\left(10^4\right)^2/4 \cong 10^8 m^2$, recovered with a large water range (a part of ocean, lake, etc). If an electromagnetic radiation with frequency of the order of 1GHz strikes on this region, then, according to Eq. (21), the power density necessary to make *negative* the *buoyant force*, in the water range below the surface, is given by

$$D \cong 1\times10^{-6} \quad watts/m^2$$

Considering that the microwave power density emanating from the Earth's surface at 300K, with frequency of the order of 1GHz is $9.62\times10^{-7}\, watts/m^2$ [7]. Then, we can conclude that an increase of few *degrees in the temperature of the Earth's surface* can make negative the *buoyant force* in the mentioned water range.

This may already be happening in some regions of the Earth**, producing the death of hundreds of fishes. In fact, something strange is happening in the world. It was recently announced that hundreds of fishes have been were found dead on the surface of oceans, lakes, etc., and that hundreds of birds fell from the sky and died [8]. It is not cold which was killing the birds and the fish, it is not pollution either. No explanation for these phenomena has been found so far.

** As consequence of the global warming.

References

[1] Anderson, J. D. (2004), *Introduction to Flight* (5th ed.), McGraw-Hill, pp. 257–261.

[2] De Aquino, F. (2010) Mathematical Foundations of *the Relativistic Theory of Quantum Gravity*, Pacific Journal of Science and Technology, **11** (1), pp. 173-232.

[3] De Aquino, F. (2011) *Scattering of Sunlight in Lunar Exosphere Caused by Gravitational Microclusters of Lunar Dust*, p.2. Available at: https://hal.archives-ouvertes.fr/hal-01078052

[4] Gan, F. (1995) *Laser Materials*, World Scientific, p.311.

[5] Oxborrow, M., et al., (2012). *Room-temperature Solid-state maser*. *Nature*; 488 (7411): 353 DOI: 10.1038/nature11339.

[6] Rosen, J., (2004) *Encyclopedia of Physics*, Ed. Facts on File, Inc., p.189.

[7] Richards, J. A. (2009) *Remote Sensing with Imaging Radar*, Springer, p.18.

[8] http://www.eutimes.net/2011/01/birds-and-fish-are-now-dying-all-around-the-world/ ; http://www.mirror.co.uk/news/weird-news/dead-birds-falling-from-the-sky-dead-102882