Fluid Optics™' Letter

La lettre des Syzygies

2002, December

EDITORIAL

We have the pleasure to present you the letter of the Sizygies of the winter solstice 2002.

In the column products, you will find an article on the development of a new type of beaconing for flying club.

A second article deal with the parameters managing the choice of the Fluid Optics®' illuminators.

The inventors of the Fluid Optics

THEORY

PARAMETERS MANAGING THE CHOICE OF THE FLUID OPTICS' ILLUMINATORS

The application of the concept of the Fluid Optics permit to design and manufacture illuminators for fibre optics which some characteristics are unreached today. This first chapter, presented in this letter, treats possible parameters being able to lead the creation of such generators.

So, it is possible to create illuminators perfectly adapted to the ne-

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SUMMARY

PRODUCTS

AIR BEACONING OF THE AERODROME

Night piloting, IN VFR (1), is more and more appreciated by the pilots of leisure activities of our flying clubs.

This activity requires an expensive beaconing of the flight platform. So, the exploitation and the hour flight costs are inevitably raised.

Today, the near totality of these VFR night flights is made from platforms equipped in fixed beaconing for the essential need of the commercial planes. The VFR use this infrastructure by paying sometimes heavy royalties of landing and beaconing.

The small flying clubs often work on small platforms in grass and so are practically excluded from this activity, so as to organize movements on nearby aerodromes.

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(1) Visual Flying Rule : Flight according to the rules of flight at sight, which mean the use of visual external references (the natural horizon); in opposition IFR uses an instrumental reference of "artificial horizon". The IFR requires a specific qualification of the pilot and a plane equipped consequently. The VFR, it is a flight in condition of good visibility whereas IFR can be executed in condition of flight without visibility.

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The necessity of a light beaconing for leisure is so necessary.

This activity is regulated and the used material has to be approved by the technical official services of the DGAC (2).

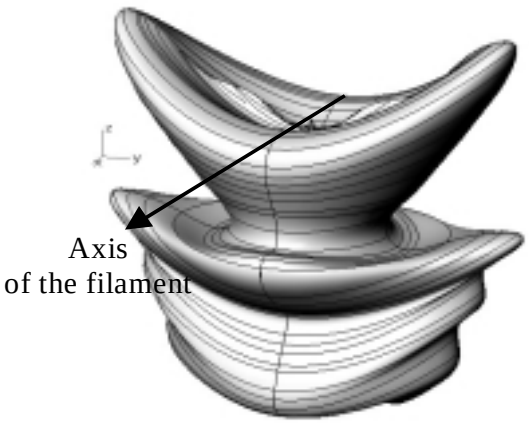
Flying clubs wait so for a system of simple beaconing of use with a weak cost of purchase and exploitation.

MEGALUX, office of research and development in Fluid Optics, was dreaded on this problem. A development of this product had been already realized from traditional optical solutions, but the optical efficiency of the device was not sufficient for the brilliant power delivered with the light bulb. In this project, the use of the concept of the Fluid Optics, by the geometrical properties, allowed to get back a maximum of light, better to distribute hit, spatially, to answer in closer of the need.

Two versions of the new optical system were declined. First solution is a dioptric solution, based on the refraction of the light in a simple monolithic optic, while second solution is purely reflexive, and brings in several reflectors. In both cases, an initial reflector gets back all the light emitted by the light bulb and send it towards the optical system of diffusion.

LIGHT BULB

The source, chosen as its big reliability and its weak price, delivers a luminous power of 200 lm.



Photometric solid of the lamp

The observation of several lamps of series reveals that position and shape of the filament vary enormously. The conception of an optical system is delicate because the variations of the luminous distribution are considerable due to the tolerance on the glass bulb. The picture shows the photometric solid of the light bulb obtain from the average of laboratory photometric measurements. We can notice that this photometry created by the glass-bulb and the filament seems very complex.

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(2) Head office of the Civil aviation.

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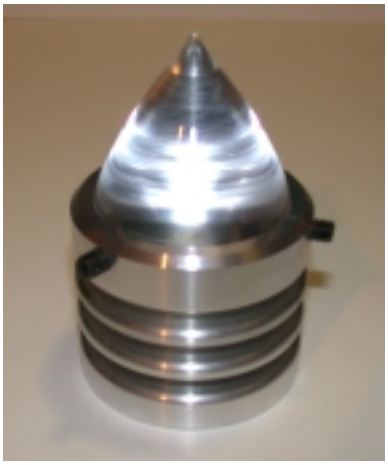
REFLECTOR

Fortunately, the concept of Fluid Optics is much less sensitive to the location of the filament and to the brilliant distribution of the light bulb. This property of the concept permits the development of a reflector which gets back near totality of the light. The generator of this reflector is a parametric curve, not polynomial, deducted from the concept of the Fluid Optics.

The prototype of the reflector is turned in a rod of aluminium using a numeric turning machine. Fins were created to provide maximum cooling to the system.

DIOPTRIC SOLUTION



This optics which comes to put on the reflector collects the totality of the flux of light and diffuses it in a narrow horizontal beam defined by the standards of the aeronautics. This optic of revolution can be made easily with classic turning in a piece of plastic (PMMA). PMMA is used because it has an excellent transparency and is very easy to model with the conventional numeric tools of manufacture.

NUMERIC SIMULATION

Obviously, our software packages of research Horus and Khnoum have permit to calculate the reflector and the dioptric optic. Horus allowed to research good profiles depending on the concept of the Fluid Optics whereas Khnoum allowed to realize photometric 3D simulations close to the reality.

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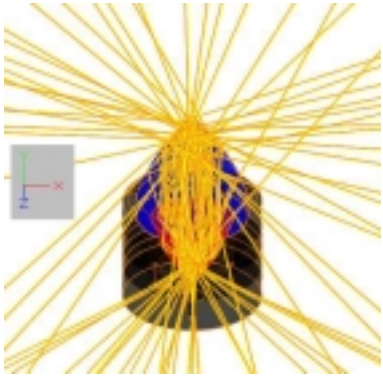
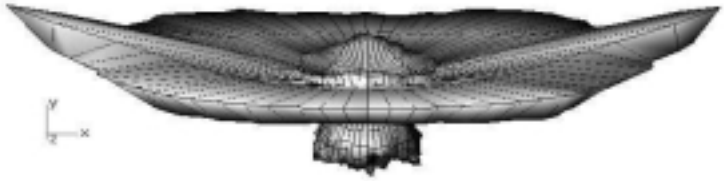
Here, we present the final result of 3D simulation.



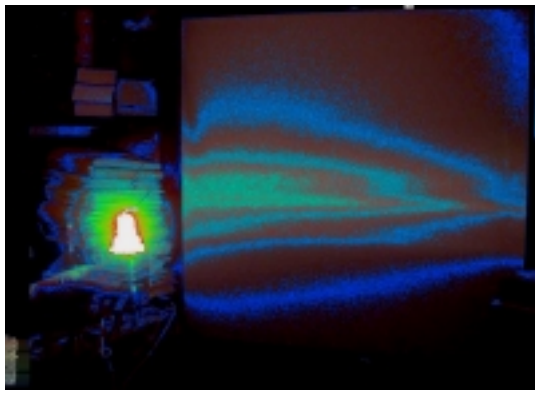


Photometric solid of the simulation of the beaconning

These theoretical results, considered satisfactory for this project, allowed us to decide on the launch of the prototype which was presented to you on the previous images.

ATTEMPT OF THE PROTOTYPE

Prototype functioning in front of a screen presented us relatively tightened horizontal beams. Photos were taken with a digital camera.



These photos, analyzed numerically, allow to reveal lines of same intensity. This allows us to notice the luminous emission of the beacon before making more pushed photometric attempts.

CONCLUSION

This new beaconing seems to meet the needs of the project, however, the light bulb placed in a very stuffy space emits a lot of heat and the plastic optic would not well support these thermal constraints in the long term. Furthermore, the lifetime of the light bulb shall be lowered. It would have been possible to finalize the product by realizing some ventilation and by making the plastic optic in glass but the cost price of the optical system would have exceeded economic objectives.

As a consequence, we turned to another reflexive solution always based on the concept of the Fluid Optics but also by integrating these new thermal and economic constraints.

This other solution will be presented to you in the next letter of Sizygies.

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cessities of the user. All these generators, even the most powerful can generate a flux of light devoid of useless energies for the required use.

The new illuminators will so be able to be imagined and created for their performances, for their power or for their physical characteristics.

Performances required with illuminators

-Possible uses - the main uses of these illuminators are:

-a) the feed of light into the plastic optical fibres (or another) in longitudinal transmission of light or in lateral distribution of light, or the set of the two types of fibers at the same moment.

-b) The slide or movie projection on very big screens located at remote distances, can be used for advertisement.

-The power of the exit flux - current range of the available luminous powers are from a few ml to 100 000 ml (for the lower limit of our powerful illuminator using a source of 1 800 watts). Product developments are foreseen to increase considerably these first results.

- The profile of the exit flux - the profile of the exit flux is defined by three parameters at the level of.
- a) the beam diameter Æ,
- b) the beam aperture q, and
- c) the distribution of luminous intensities with regard to the optical axis of the system.

- Colour temperatures - The flexibility of the sources' choice permits to obtain the needed colour temperature. The total absence of infra-red and ultraviolet energy at the exit involves a total absence of heat due to these useless energies and allows to place the necessary filters to modify the needed colour temperature.

-The exit accessories and the main possible uses - the exit accessories directly depend on the use of illuminators. One can imagine different solutions:

-a) An exit with a transmission using fibre optics then a distribution into a lot of sideglow-optical fibres. To resolve this case, it will be necessary to use a CONCOL connected to a harness of optical fibres placed at the window exit.

-b) Several powerful exits of light should assure the feeding of several slide projectors or video projectors, or two kinds at the same moment. In that case, a special CONCOL will be necessary to adjust and drive the flux of light at the window exit into one or several guides (fixed or supple).

-c) One or several outputs for the feeding in light of a ceiling of a surgical operation table. The system will assure a good illumination of all the sensitive places. One will note a possible total absence of electricity in the surgical unit, and a possibility of cleaning with perfect disinfection.

-d) All the lighting places sensitive to the heat or the pyrotechnics.

The global electric power of the illuminator depends on the electric power of one or several sources and on the electric power of the cooling system

-The electric power of one or several sources - The range of the electric power of the light sources begins with milli-watts and ends with 12 500 watts.

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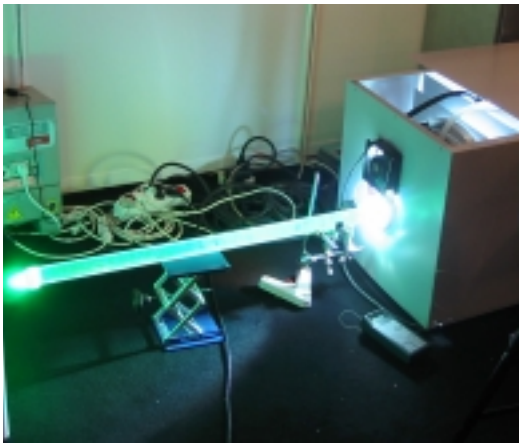


Powerfull Fluid Optics' illuminator

-The choice of sources - the choice of sources is totally free. Sources are chosen according to their quality: life expectancy - electric power - brilliant efficiency or other parameters. The choice of sources can extend from the most powerful sources to the lowest.

-a) the most powerful sources are, doubtless, plasma sources followed by discharge lamps,

-B) The most miniaturized sources are electoluminescentes diodes.

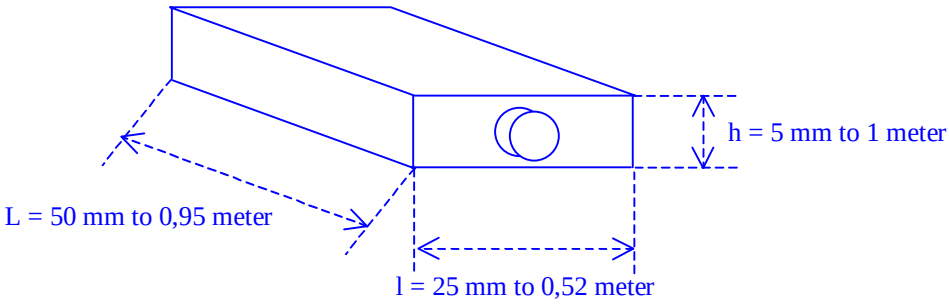
- The possible cooling systems

- A) Radiators
- B) Electric fan
- c) cold groups
- d) Pelletier components

Illuminators characteristics

-Reliability - reliability of the powerful illuminators prototypes n°1 and n°2 is excellent – Since, we did not observe any breakdown of the optical system, of the fluid system of these qualification illuminators after several months of functioning.

-Dimensions - Various dimensions (Length L, width l and height h) of the various illuminators extend from millimetres to a metre and a half aside.



This plan gives us an idea of the smallest dimensions and the biggest dimensions; It is evident that the corresponding powers of the illuminators are also different.

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-Weight - The weights of the various illuminators extend from some grams to more than 150 kilograms.

-Produced noise - Noise is produced by electric fans and the cold group when this one is provided with a compressor. In the case of a Peletier cooling system, only the electric fans produce a little of noise.

-Maintenance - Maintenance depends on the life expectancy of the sources and on the reasonable life expectancy of the optical fluid.
Fluid is foreseen to be replaced once a year.
Sources used in prototypes n°1 and n°2 have a life expectancy of 9 000 hours.

Conclusion :

All these illuminators, based on the concept of the Fluid Optics and protected by national and international patents, are conceived and developed by MEGALUX and can be extended according to the needs, or to the imagination of the Architects and the Designers.

The SIBYLUX company, which has just been created to manufacture and distribute the powerful illuminators, is located in Auvergne.

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mail: info@sibylux.com

The SIBYLUX company has just been declared prize winner to the competition of the new business start-up of the innovative technologies of the French Ministry of the research.

NEWS

From the next letter of Sizygies, this letter will not be referenced any more with the month of every sizygy but rather by the name of the season.

The web site of the letter of Syzygies is at the address : http://www.syzygies.optique-fluide.org.

In this site, you can consult all the previous letters of Syzygies. If there is a subject you wish to see treated in this letter, you can directly contact us by email at the address:

redaction@syzygies.optique-fluide.org

On the internet site of MEGALUX (http://www.megalux.com), you can consult, directly in line, all the documentations of the company as well as articles.

NEXT LETTER

The next Letter of Syzygies will appear for spring equinox.