

OSTIV DEFINITIONS OF LIGHT AND ULTRALIGHT SAILPLANES A PROPOSAL TO FAI-IGC

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1. Introduction

This paper summarizes considerations and concepts developed by the OSTIV SDP Working Group on LS and ULS (*) since the 1999 SDP meeting in Bayreuth. The following documents have been produced by the Working Group on the subject:

(a) "The Development of Ultralight and Light Sailplanes," P. Morelli - SDP meeting in Bayreuth, Aug. 1999.

(b) "Ultra Light (ULS) and Light Sailplanes (LS) - Report No. 1 SDP meeting in Prague, Oct. 2000.

(c) "Ultra Light Sailplanes - Considerations on their Definition and Development - Report No. 2" - SDP meeting in Aalen-Elchingen, Aug. 2001.

(d) "Definition of Light and Ultralight Sailplanes: Background for the Use of OSTIV and FAI," P. Morelli - presented by Prof. L.M.M. Boermans on behalf of the author at the OSTIV Seminar, Mafikeng, South Africa, Dec. 2001; a later version, including a chapter co-authored with Tor Johannessen, was circulated at the FAI-IGC meeting, Lausanne, March 2002.

(e) "Ultralight Sailplane Design and Regulations," P. Morelli - SDP meeting in Tehachapi, CA, USA, Aug. 2002; SHA Workshop, Tehachapi, CA, USA, Aug./Sept. 2002.

At the Tehachapi meeting of the SDP Working Group the proposals contained in document (e) were slightly modified, resulting in the definitions reported in the following para. 2. These definitions were subsequently unanimously approved by the SDP plenum, the OSTIV Board and the OSTIV President.

2. OSTIV approved definitions

Light sailplane: a sailplane with a maximum take off mass not exceeding 220 kg.

Ultralight sailplane: a sailplane with a maximum take off mass not exceeding 220 kg and a maximum wing loading not exceeding 18 kg/m^2 (Note: Ultralight Sailplanes are intended for utilizing very weak atmospheric lift conditions, hardly usable for conventional sailplanes).

3. Considerations underlying the new definitions

The word ultralight referred to sailplanes is used with different meanings in different parts of the world. In the USA in particular, FAR 103, originally intended for hang

gliders, specifies that an ultralight sailplane must have an empty mass not exceeding 70 kg.

Under this specification, the development of hang gliders towards higher and higher performance has produced machines more and more resembling conventional sailplanes, but extremely light. A typical example among others is the well known Carbon Dragon, the prototype of which featured an empty mass of less than 70 kg and, with a pilot of 90 kg, a wing loading of about 12 kg/m^2 .

Memorable flights made by Gary Osoba have demonstrated that the Carbon Dragon, combining a low rate of sink with a small circling radius and a very safe behaviour at low speed, was capable of staying aloft in weak soaring conditions at very low altitude for hours, a possibility practically denied to conventional sailplanes (too large circling radius) and to conventional hang gliders (too high rate of sink).

The exploitation of microlift, as Gary Osoba named the weak, narrow, unsteady upcurrents he was able to exploit even at very low altitude, is likely to open a new scenario to soaring flight. To stimulate such a development, however, adequate and careful promotional action is needed.

Nowadays not all designs called ultralight possess the performance characteristics required for the exploitation of microlift. If the wing loading is relatively high the rate of sink and/or the circling radius may be excessive. If the take-off mass, combined with a low wing loading, is too large, the size of the machine may be incompatible with the requirement of a small circling radius.

It is therefore necessary, or at least advisable, to define a design environment by limiting both the max. take off mass and the wing loading. This is what the OSTIV definition of ULS does.

What about those sailplanes, a number of which already exists, which are light, as far as the take off mass is concerned, but the wing loading of which is relatively high, as appropriate for machines designed as racers rather than floaters, or for low cost? These we call Light Sailplanes (LS). To distinguish them from conventional sailplanes (i.e., those of the six FAI Classes and more) it is therefore necessary and sufficient to set an upper limit to the maximum take-off mass. This is what the OSTIV definition of LS does.

4. Is the microlift exploitation capability a possible discrimination criterion?

The answer is: no.

It has been shown and widely reported that low mass

(*) Dan Armstrong (USA), Bruce Carmichael (USA), Eric de Boer (The Netherlands), Helmut Fendt (Germany), Daniel Howell (USA), Piero Morelli (Italy, coordinator), Gary Osoba (USA), Dieter Reich (Germany).

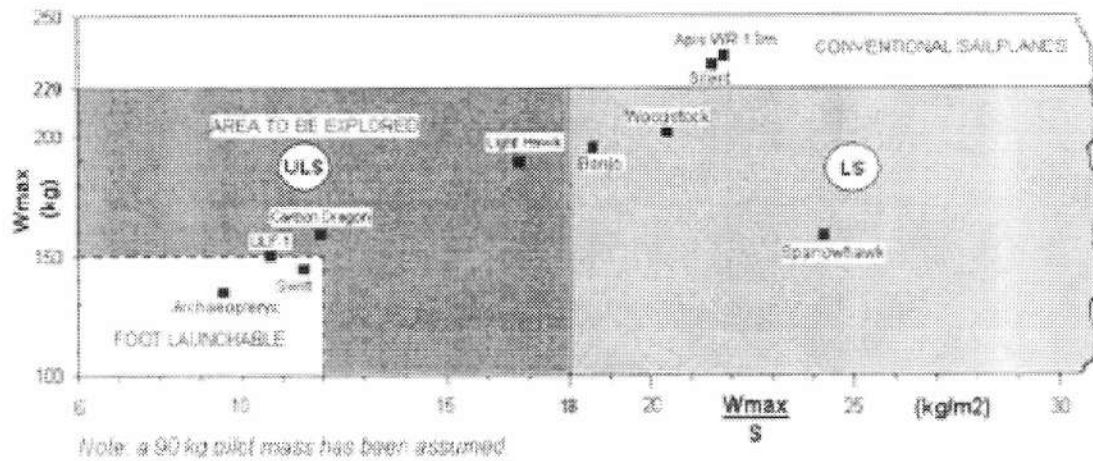
and wing loading (or, more precisely, low minimum speed in steady straight flight) are required for the exploitation of microlift (**).

At the present time, however, the upper limits of the mass and of the wing loading are more a sort of guess rather than rational knowledge. It has been largely due to casual circumstances if the exploitability of microlift has been demonstrated by a sailplane weighing less than 70 kg with a wing loading of about 12 kg/M².

Presently nobody knows if with a larger mass and wing loading the microlift exploitation is still possible. It is unknown, therefore, at which value the maximum mass and wing loading should be set in order to define a significant design environment: inside microlift exploitation is possible, out of it is not.

For this reason, the design environment of the ULS corresponding to the OSTIV definition is kept deliberately large: it is likely that a sailplane with a mass of 220 kg and a wing loading of 18 kg/m², although complying with the OSTIV specification, is unable to exploit microlift, or far from the optimum in this respect. On the other hand, however, much freedom is given to the designer to make his choices.

The figure clearly illustrates the design environment and how well known ULS and LS fit in (***). The data of the Light Hawk have been provided by the designer recently (Nov. 2002). Note that for W_{max} the value $W_e + 90$ has been assumed.



(**) It would have been more precise to adopt the minimum speed in steady straight flight (V_{min}) rather than the wing loading (W/S) as reference parameter (taking thus into account the sailplane C_{LMAX}), however the wing loading has been preferred as easier to measure.

(***) This form of graphical presentation has been suggested by Hannes Ross and Dieter Reich. A tentative design environment for foot launchable ULS can be added, as shown by the dotted lines in the figure.

It should be understood that the lower the limits of mass and wing loading, the higher the difficulty, complication and cost of the construction. It would be a most welcome result that a particular design shows the same capability of the Carbon Dragon to exploit microlift but with a higher mass and wing loading. This would simplify the structure, lower the cost of production, in addition the sailplane could be less fragile in ground handling, a detail of not secondary relevance for such light constructions.

Such benefits could be very relevant for the development and the promotion of this new scenario of soaring flight. As a matter of fact, the small number of ultralight presently existing (the Carbon Dragon being the more popular) are homebuilt, starting from drawings, by skilled builders in thousands of manhours using expensive materials.

It is evident that for the promotion of this type of soaring ultralight sailplanes should be available in the market in a completed form at a reasonable price. Moreover, considering that microlift has been exploited by a very small number of pilots so far, it is obviously necessary that the peculiar piloting technique (in conditions often requiring a sort of dynamic soaring) is understood and acquired by more pilots.

OSTIV and FAI may play a decisive role in this development.

5. The OSTIV concern

Being the recognised international scientific and technical organization for soaring flight, OSTIV is supposed to have the competence to suggest definitions. This is done here.

Once the definitions are approved within OSTIV, and this has actually been done, the necessary basis is provided upon which design guidelines can be developed for the new ULTRALIGHT category of sailplanes. The word

guidelines is used, not specifications nor requirements or standards, because in this phase of development ample freedom should be given to designers for their choices.

On the other hand the attention of designers should be called upon to consider features and characteristics of ULTRALIGHT making them differ from conventional sailplanes from the airworthiness point of view.

OSTIV could contribute to the development of simplified airworthiness standards for a now more uniform class of LIGHT sailplanes. In some countries, like the Czech Republic and Germany, this process is on the way officially already.

6. The FAI-IGC concern

For the actual version of the FAI Sporting Code, Section 3 - Gliders, an ULTRALIGHT is a glider with a maximum take off mass not exceeding 220 kg. It is evident that such a definition puts together gliders with relatively high wing loading like the Apis, Silent, Russia, Woodstock, Sparrowhawk, Banjo, etc., properly called in America Light Sailplanes (LS), with gliders with very low mass and wing loading, like the Carbon Dragon, Swift, Light Hawk, ULF-1, etc. In other words, Ultra Light Sailplanes (ULS), designed or potentially capable to exploit microlift are put together with sailplanes designed for the exploitation of the same soaring conditions as conventional sailplanes and behaving like real racers.

As far as distance and speed records are concerned (currently recognized by FAI), this gives practically no chance to ULS to prevail on LS.

The OSTIV proposal separates ULS from LS, maintaining the FAI definition of ULS, but calling LS the sailplanes complying with that definition.

Thinking of competitions for Ultralight in the future, the fact should be acknowledged that most LS are typically racers. As such the same tasks as for conventional sailplanes would fit them too.

ULS, on the other hand, can't help being typically floaters. This characteristic could suggest to adopt a different task philosophy for ULS, in addition to speed and distance. Perhaps, tasks specifically designed for ULS could be appealing to the general public, a much cherished possibility. Who knows? This is an open matter.

7. Conclusions

If the definitions proposed by OSTIV (see para. 2) were adopted by FAI several advantages would follow:

(a) due to the reputation and influence of the two international bodies, OSTIV and FAI, the actual confusion of names and definitions would probably and hopefully be gradually eliminated;

(b) the separation of the two classes, LIGHT and ULTRALIGHT, would stimulate the achievement of FAI records for ULTRALIGHT, a possibility actually denied;

(c) the design and construction of sailplanes for microlift

exploitation would be stimulated;

(d) competitions for ULTRALIGHT, and records too, could be envisaged on the basis of new task philosophies:

(e) the potential scenario of a new type of soaring flight which more people could afford and enjoy, would come closer.