THE "DEFINITION" OF THE MOTORSEGLER

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INTRODUCTION

The Motorsegler - in Germany a well-known, accepted, and certificated catagory - has in different countries and organizations several names such as

powered auxiliary powered self launching motorized motor	glider or sailplane

Some other names are moto(r) soarer, motorplaneur, avion-planeur, motoaliante, motorzweefer, etc., also bromzweetvliegtuig (Dutch "growling sailplane").

The trouble is that in many cases the name has to "define" the motorsegler or has to include some of its limitations (e.g. self launching sailplane SLS).

My first proposal: let us say all over the world "motorsegler" or "moto(r) soarer" (MS).

Technically, the motorsegler seems to be difficult to define: there must be a separation from the light aeroplane and there should be a good connection with the sailplane. Many definitions include recommendations or requirements for a certain glide ratio L/D, a minimum sinking speed W_s, or some other performance values which can only be known accurately after a series of flight tests and careful measurements (because the calculated performances are often very optimistic) (1), (2), (3). But even measurements in a so-called smooth atmosphere can suffer from a lot of scatter (4) which makes it difficult to say with certainty: this is a motorsegler.

It would be helpful for the aviation authority as well as for the designer to know the correct category of the aircraft before the beginning of the certification. Also, the jury of a motorsegler competition needs a definition or a formula for the class or handicap evaluation which is simple to understand and easy to calculate.

Theoretical considerations

The determining characteristics of a sailplane and also of a motorsegler are, above all, in my opinion

the high aspect ratio $\frac{b^2}{S}$

the low wing loading $\frac{W}{S}$

upon which the special performance qualities (high L/D and low W_s, respectively) depend.

If we say

$$\frac{W}{S} \cdot \frac{S}{b^2} = \frac{W}{b^2}$$

then we have a value which could be limited as we explain in the following paragraph.

Statistical Diagrams

In the figures 1, 2 and 3 are plotted (without any manipulation) the weights and spans of sailplanes

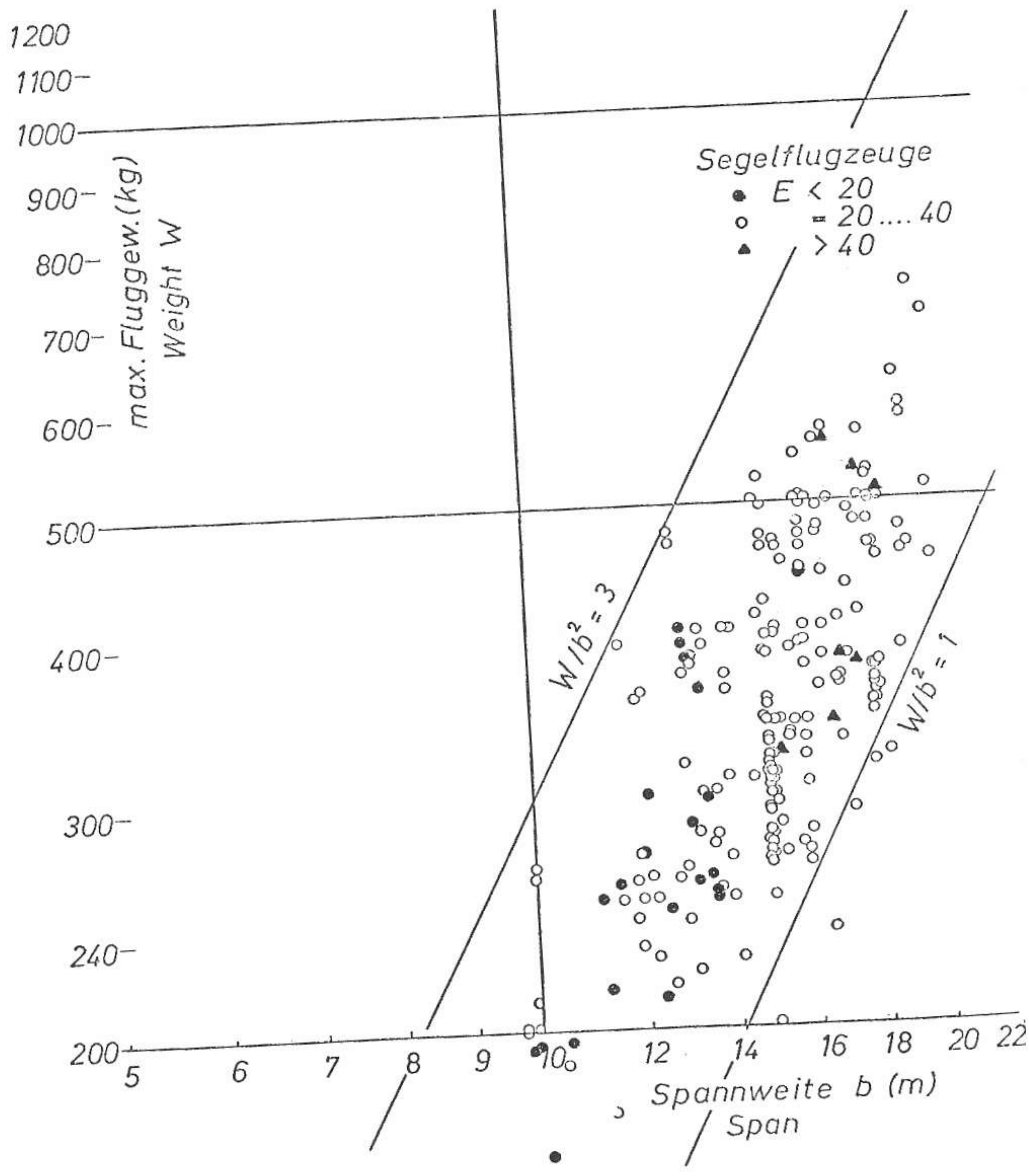

FIGURE 1. $\frac{W}{b^2}$ for Sailplanes (Segelflugzeuge). E stands for L/D.

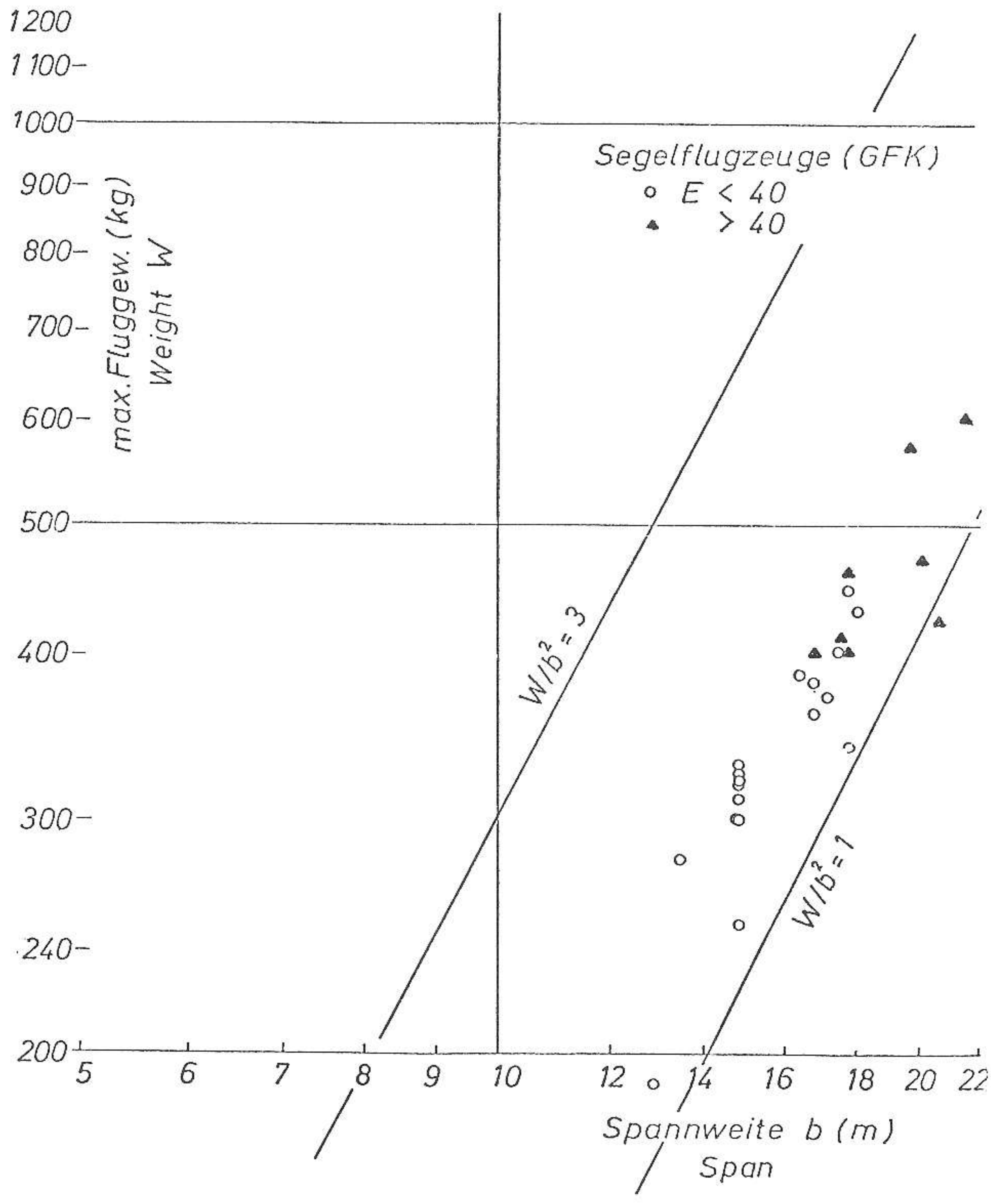

FIGURE 2. $\frac{W}{b^2}$ for Glass Fibre Sailplanes (GFK-Segelflugzeuge).

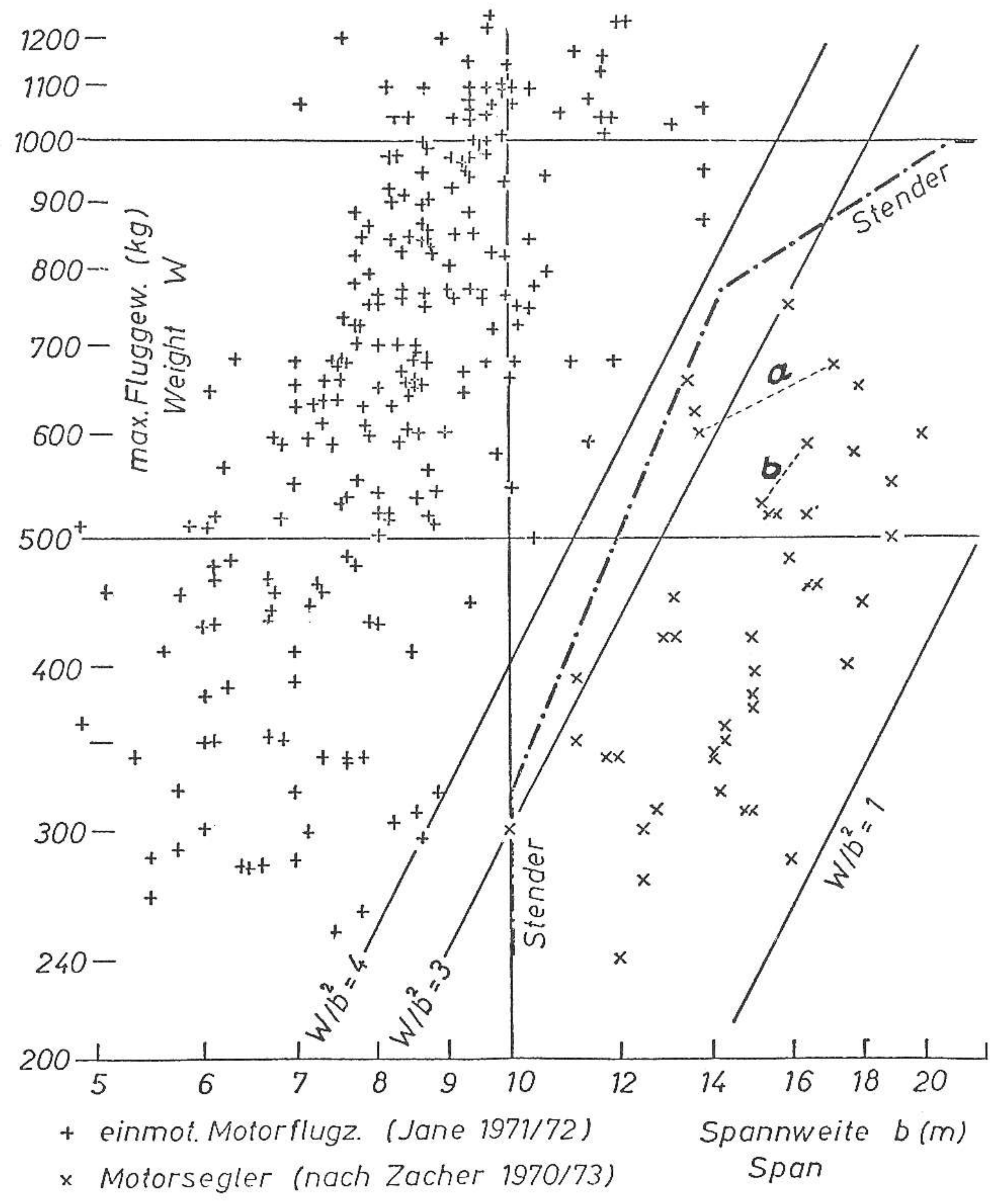

FIGURE 3. $\frac{W}{b^2}$ for Light Aeroplanes (einmot. Motorflugzeuge) und Motorsegler.
a. RF RF5B
b. SF25B 2F28

(Stender (8))

(5), light aeroplanes (6), and motorseglers (7). We find that the field of sailplanes is limited by $W/b^2 = 3$ and $1\ kg/m^2$ with a modern trend to $W/b^2 = 1$ due to glass fibre (GRP, or in German, GFK) surfaces. The light aeroplanes lie in the region $W/b^2 \geq 4\ kg/m^2$, being mostly well beyond that value. Nearly all motorseglers have the same limits as the sailplanes. The very few exceptions slightly above $3\ kg/m^2$ are early designs having more the qualities of "high performance aeroplanes" like the RF3, RF4 and RF5. The well known RF5 is in our consideration a good example for the trend of the development: it has been observed that the original RF5 had insufficient "soaring performance" ($L/D, W_s$). The demand for an improvement arose and the designer developed the RF5B which is generally acknowledged to be a real motorsegler; it lies well in our field between 1 and 3 (in fig. 3 the dotted line a). Also one of the best training motorseglers, the two seater SF25B Falke (side-by-side), has in its tandem version SF28 a somewhat lower W/b^2 (in figure 3 the dotted line b).

Walter Stender (8) made the attempt to categorize motorseglers and to include also these RF-types into the area of motorseglers, establishing a more complicated formula (illustrated by the chain-dotted boundary in fig. 3) and perhaps a better limitation. But I think W/b^2 is a good and sufficient single quantity which can be measured by a balance and a tape-measure and so easily determined before the first flight for certification or, on the other hand, for handicaps in competitions, etc. In table 2 are shown those motorseglers which have been tested and measured in flight by the DFVLR. The represented data confirm our considerations.

<u>My second proposal: the "motorsegler" is "defined" by a W/b^2 not more than $3 kg/m^2$.</u>

Requirements for Motorseglers

It is obvious that motorseglers must have some additional requirements as in the case of other aircraft (e.g. take-off run, climbing speed or angle, stalling speed, weight limit, number of seats, etc.)

However, these do not "define" the motorsegler. They are simply there to provide for safety, like all other airworthiness requirements (2), (3) (maneuverability, strength, fire protection, etc.)

TABLE 1.

"Definitions"
of the FAI-CIVV Sporting Code Sect. 3 Class D 1971
OSTIV Airworthiness Requirements for Sailplanes 1971
LBA Lufttuchtigkeitsforderungen fur Segelflugzeuge und Motorsegler, Entwurf 1973

Max. all-up weight	$W \leqq 750$ kg	
Max. take-off distance to 15 m	$S_{15} \leqq 600$ m	
Min. rate of climb	r/c $\geqq 300$ m in 4 min. ($\geqq 1.25$ m/s)	
Max. stall speed	$V_{so} \leqq 75$ km/h	
Min. normal glide ratio with engine off	$L/D \geqq 20$	1
Max. sinking speed single seater	$W_s \leqq 1.0$ m/s	2
two seater	1.2	
Glide ratio airbrakes open	$L/D \leqq 7$ at $1.3V_s$	

1 FAI and OSTIV only
2 LBA only

TABLE 2. Some Performance-Measured Motorseglers

Type	Span (m)	Weight (kg)	$\frac{W}{b^2}$ (kg/m^2)	Vso (km/h)	Wsmin (m/s)	L/D (-)	Remarks
RF3	11.2	370	2.95	71.3	1.49	16.1	
RF5	13.7	650	3.45	86	1.52	18.0	
K8B-KM48	15.0	321	1.45	≈60	1.10	16.5	*
SF25B	15.3	540	2.30	67.2	1.02	21.1	
SF28	16.3	583	2.20	≈65	0.96	23.5	
SF27M	15.0	370	1.65	75	0.77	31	
fs26	12.6	333	2.10	75	1.00	24	
Mu23	20.0	660	1.65	≈70	0.96	21.5	
AK1	14.9	392	1.78	≈70	0.80	30.5	
D37	18.0	374	1.15	<70	0.60	37.9	*

* non selflaunching

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