

# Thoughts on 2020 Naviga rules

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## Introduction

At the Naviga Technical Committee Meeting in Italy on 7<sup>th</sup> Aug 2019, there were the following proposals that were voted on that related to limiters and batteries.

- 1) It was voted that only limiters would be permitted for all except the mini classes. The decision on mini classes was deferred till later. YES – 11, NO – 4.
- 2) Only ONE type of limiter will be used that will be picked out of a hat before each race. YES – 7, NO – 7, Casting vote YES by M Section Leader. (It would have been interesting to know how the French would have voted had they been present.)
- 3) Allow any voltage up to 43V for all classes. YES – 5, NO – 8.
- 4) Increase the minimum LiPo voltage to 3.5V. YES – 6, NO – 8
- 5) The minimum weight for batteries to be 350gm for M1,H1,ECO Expert. 700gm for M2,H2. YES – 7, NO 6.

These changes will therefore apply for all Naviga events in 2020. However, other none resolved matters can be voted on by electronic voting by the country section leaders and so additional rule changes may occur before 2020.

The purpose of this document is therefore to stimulate discussion about these potential changes that may occur before 2020.

## Thoughts

Please note that these thoughts are my own opinions and do not necessarily reflect those of the MPBA.

### Limiters

As most of you will be aware, the use of limiters only was proposed (and now mandatory) for two main reasons:-

- 1) To level the playing field by giving everyone the same amount of energy.
- 2) To reduce the cost of racing by allowing heavier, higher capacity batteries that would not be damaged by being discharged too far. Some racers have used the same battery over 100 times with no ill effects.

Point 1 - This goal has been achieved and so will not be discussed further here.

Point 2 – This has not yet been fully resolved as it is still possible for racers to choose a battery which contains only marginally more energy than the limit allowed and thus discharge the battery too far and risk damaging the battery. They do this because they perceive that the lower weight of this pack gives them some advantage and prefer to give priority to this despite the higher cost of batteries as they can either afford to do so or are sponsored by a supplier.

There are two main methods by which Point 2 can be addressed (that I am aware of).

**Method 1** - limit the minimum voltage of the LiPo battery after the race to some value which would guarantee that the LiPo would not be damaged. A voltage of 3.4 or 3.5V would achieve this.

**Method 2** - limit the minimum weight of the LiPo pack on the assumption that this particular weight would guarantee that the pack contained sufficient safety margin of energy above the current energy limit.

I will now consider the advantages and disadvantages of the two methods. **(Please note that I am fully aware that the decision has already been taken to use the second method for 2020 at least but I am setting out my case for a future rule change).**

#### Method 1 advantages

- Keeping the minimum voltage per cell to (say) 3.5V almost guarantees that the pack will not be damaged as this is very closely linked to battery life.
- The minimum pack voltage is already measured at the end of every race and therefore would require no extra checks.
- This single rule would require no future changes and this single value would apply equally to all LiPo batteries no matter what capacity they are.

#### Method 1 disadvantages

- None that I can think of.

#### Method 2 advantages

- None that I can think of.

#### Method 2 disadvantages

- The weight of a LiPo pack is only loosely connected to the amount of energy that it contains and so if the goal is to ensure that the pack contains sufficient safety margin of energy above the current limit (approximately 15%) then careful consideration will need to be given to the weight limit so that cheap heavy packs that do not have sufficient energy are not used.
- It requires an extra check to be performed after every race.
- Any time that the energy limit is changed, the weight value would also need to be changed.

As you can gather from the above, no weight limit and a minimum voltage per cell of 3.5V would have been my choice.

## Limiter Energy Limits

Given that for 2020 at least, limiters will be mandatory and a minimum weight of 350/700/1050gms will be in place, it was left for further discussion, proposal and electronic voting by country section leaders to decide whether to change the existing energy limits and if so, to what.

For simplicity I will just discuss a 3S pack in the following

For ease of discussion, I have included a table below which shows the energy limit in column 1 and the approximate required AmpHr pack to give a 15% safety margin in column 5.

Safety Margin ->

15%

**Approx' WattHr to AmpHr Equivalence**

WattHr	WattMins	AmpHr(3S)	AmpHr(2S)	AmpHr(3S)+Margin	AmpHr(2S)+Margin
45	2700	4.054	6.081	4.662	6.993
46	2760	4.144	6.216	4.766	7.149
47	2820	4.234	6.351	4.869	7.304
48	2880	4.324	6.486	4.973	7.459
49	2940	4.414	6.622	5.077	7.615
50	3000	4.505	6.757	5.180	7.770
51	3060	4.595	6.892	5.284	7.926
52	3120	4.685	7.027	5.387	8.081
53	3180	4.775	7.162	5.491	8.236
54	3240	4.865	7.297	5.595	8.392
55	3300	4.955	7.432	5.698	8.547
56	3360	5.045	7.568	5.802	8.703
57	3420	5.135	7.703	5.905	8.858
58	3480	5.225	7.838	6.009	9.014
59	3540	5.315	7.973	6.113	9.169
60	3600	5.405	8.108	6.216	9.324

**Specs of Possible 3S Batteries by weight (>350gm)**

Make	Type	Capacity	S	C	LxWxH	Weight	Price
EPS		5000	3	20	135x45x30	357	€ 51
Turnigy		5000	3	20	143x51x23	360	€ 25
RedZone		5800	3	30	150x44x25	365	€ 43
RoaringTop		5000	3	35	136x45x28.6	371	€ 52
RedZone		6300	3	35	150x45x28	380	€ 59
EPS		6300	3	30	152x45x25	381	€ 69
Overlander	SuperSport Pro	5800	3	35	153x46x26	398	€ 73
RoaringTop		5800	3	35	157x45.2x25.3	400	€ 66
Zippy	Compact	5800	3	25	154x45x29	400	€ 33
RoaringTop		6250	3	35	155x45x25.5	400	€ 69
EPS		5800	3	30	153x46x25.3	412	€ 58
Overlander		6250	3	35	156x44x27	426	€ 70
Turnigy	NanoTech	6000	3	25	153x48x30	468	€ 46
SLS	Quantum	5800	3	30	164x49x30	470	€ 58
SLS	Xtron	5800	3	30	160x45x28	475	€ 59

We need to consider what capacities are actually available. From the brief list I have pulled together in table 2, you can see that the standard capacities available are:-

5000, 5800, 6000 & 6250 mAh

From the above chart we can see that these would be equivalent to the following limits (assuming a 15% safety margin)

49, 56, 58 & 60 WattHr

Given that there is a 350gm limit, some people will want to push to that limit. We can see from the second table, if you didn't care about giving any safety margin, you might consider the EPS 5000mAh if a limit of less than 56WattHr was chosen as the new energy limit.

There seems to be a feeling amongst some racers that the existing limits are too high and so should be less than 60 WattHrs.

There is also a feeling that if the value were to be reduced too much then boats would have to be redesigned.

In order to balance the different considerations above, my suggestion would be an energy limit of 56WattHrs.

Of course, this value only holds true given the currently available packs. If LiPo manufactures produce other capacities which are >350gm (which they probably will), then 56WHR may no longer be my preferred value.

This is the problem with trying to use weight as a substitute for energy.

A 3.5V min would have been so much better as it would not matter what batteries the manufactures create.

## Mini Classes Limiter Energy Limits and Battery Weights.

I see no reason to change the energy limit for limiters used in the mini classes. Leave at 21WHR.

As for the minimum weight, it will be clear from my discussion above that I strongly disagree with using weight as a method of ensuring sufficiently robust batteries. Nothing was discussed at the TC related to the mini classes and so I see no reason to perpetuate this bad method.

I suggest that we propose the use of the 3.5V minimum voltage instead. (for limiter use only. Leave at 3.3V for weight limited)

If we are forced to propose a minimum weight, then I would suggest a value which just includes most of the currently used packs. i.e. 140gm

Make	Type	Capacity	S	C	LxWxH	Weight
Redzone		2200	3	25	98x34x22	146
Zippy	Compact	2200	3	25	107x34x21	163
Roaring Top		2200	3	25	102x34x22.4	165
Roaring Top		2700	3	25	101x34x26	191
EPS		2750	3	20	101x35x26	200

## Penalty for turn back in ECO and FSR-E

As we do not compete in these events we should probably abstain.

If I were forced to make a decision I would keep it simple and make it the same as the oval classes.

## Summary

My personal opinion is therefore:-

### Limiter values for 2020

21, 56, 112,168 WattHrs

### Limiters for Mini Classes

On the assumption that for the mini classes, there will still be a choice to use 113gm packs or limiters, then my opinion is that :-

For 113gm packs the minimum voltage per cell stays at 3.3V

For limiter use the minimum voltage per cell is 3.5V (Note: No minimum weight value)

### Missed Buoy Penalty for ECO and FSR-E

My personal view is to use the same as for the oval course classes.