Front Wing Internal Structures 2025-26

This page is dedicated to exploring new FW Internal Structures.

These structures should be able to withstand:

- Inertial loading
- Cone strike
- Aero loading
- Wear and tear from misuse, moving car out of truck, things like that.

These structures should also be:

- Lightweight
- Manufacturable

Each concept we create should be analyzed in these different situations.

Foam Research

Gurit

Rohacell

General Plastics

Union Stru-cell (chinese so idk if we can use)

ERG (fancy metal/carbon foam, way overkill but cool)

Michigan Foam

Other Gurit info

	Rohacell 31 A	Rohacell 51 A	Rohacell 71 A	Kerdyn 65	Corecell M-60	Corecell M-80	Corecell I-40	Corecell I-60	Gurit PVC40	Gurit PVC48	Gurit PVC60	Last a Foam RF-2203	Michigan Foam Standard EPS
Density (kg /m^3)	32	52	75	70	65	85	45	65	40	48	60	48	16
Compressive Strength (MPa)	0.4	0.9	1.5	0.61	0.69	1.16	0.36	0.95	0.52	0.62	0.98	0.45	0.08 lol
Tensile Strength (MPa)	1	1.9	2.8	1.15	1.21	1.74	0.75	1.16	0.71	0.98	1.82	0.34	0.15
Tensile Modulus (MPa)	36	70	92	65	67	98	34	74	68	71	100		
Elongation at Break (%)	3 (Tensile Elongation)	3 (Tensile Elongation)	3 (Tensile Elongation)	24 (Shear Elongation)	57 (Shear Elongation)	57 (Shear Elongation)	40 (Shear Elongation)	34 (Shear Elongation)	6 (Shear Elongation)	7 (Shear Elongation)	18 (Shear Elongation)		
Shear Strength (MPa)	0.4	0.8	1.3	~0.5	0.78	1.15	0.46	0.78	0.47	0.52	0.79	0.34	
Shear Modulus (MPa)	13	19	29	15-12	23	34	14	28	15	16	21		
Coefficient of Thermal Expansion	3.7	3.33	3.52										

Could we just use EPS foam? Really if we only care about dissipating impact its cheap and would do it well.

Its kind of hard to decide based on this data because we don't have SEA. I like the XPS Polystyrene, its around as good as rohacell (a bit worse) but its way less expensive. Like we only need to buy I think like $40 worth of it and we're good for a while.

Overall due to the fairly low density and high elongation at break, Corecell I-40 seems like a good choice. As we kind of want it to deform a bit I feel like the low compressive force isn't a huge issue. Again the XPS is also good and I've seen it used in similar contexts a couple times when researching.

Where might we actually buy this stuff:

Rock West Composites has Rohacell (it is indeed very expensive)

IDR feedback

Structures: Slide 48: How are there Hoerner wingtips on a cascade? Not sure the terminology is correct here but double check. Also, intuition tells me a hypothetical extra ply to stiffen your elements could be lighter than a metal slot gap maintenance solution, and for fsae speeds you do not need a metal solution. (Do a weight/gains trade this needs to be data driven) I see no useful numbers on the entire FW mounting slide + if tensile modulus is being used for sizing u need a safety factor (team standard is 1.5 iirc) Aramid: Cool idea, test for a number of cycles though. It may be really good for a single impact but then fall off a cliff. Not sure how the implementation's planned but verify this. Slide 55: Spec a threadlocker for comp maybe? Once you tighten for the "final" time just slap some on. OR you can do vibration analysis but that's a little overkill. Judges HATE turnbuckles the IM rear wing kept having this pointed out and they loved the crossbrace (even though they're totally valid imo) Slide 61: Isn't the handcalc team standard 3x? I would talk to some captain n double check these. Also 2.5x for FEA overkill? Does this deflection target exist as a number…

Initial concepts:

Carbon fiber tubes are awesome and we should use them.

Foam only on leading edge to absorb impacts. Trailing edge too? Probably not needed.

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Nvm no back foam!

What if we can add slots in the back of the foam so that inserts are easier to seat?

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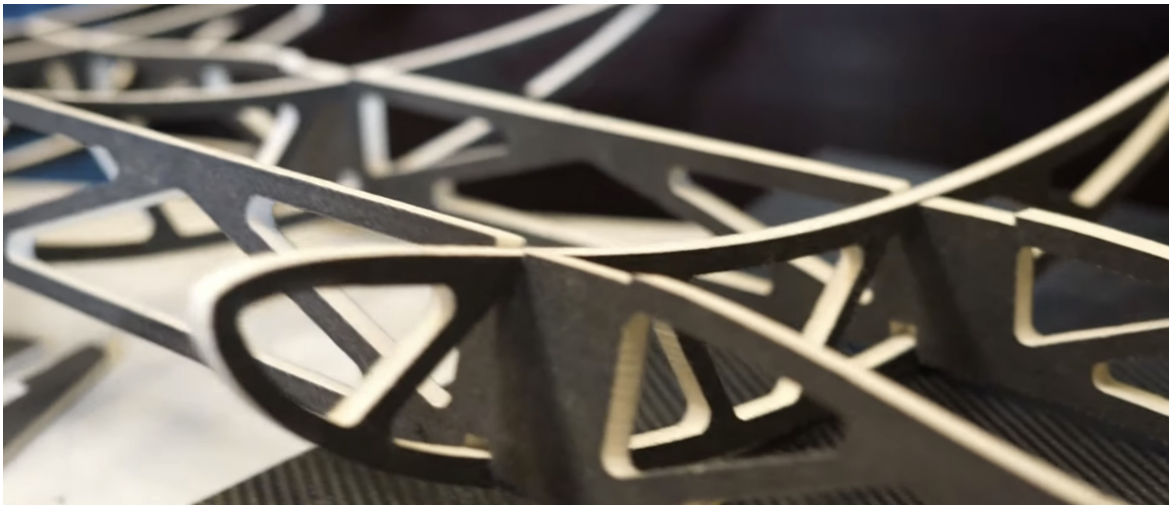
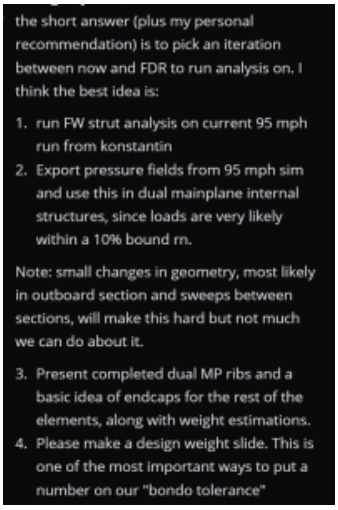


struts could definitely be 90% there until loads are finalized

actual endcaps should be made, but with a copy geom to easily change shape when the wing does

and a preliminary design of ribs and spars is necessary, tbh I want to see one by monday



Other useful links I will keep referencing:

https://www.instagram.com/reel/DQZbqD6Edsf/?igsh=a3R2NDNrYnF2dWph

3) Final Design Review (11/23/24)

25-26 IDR Feedback

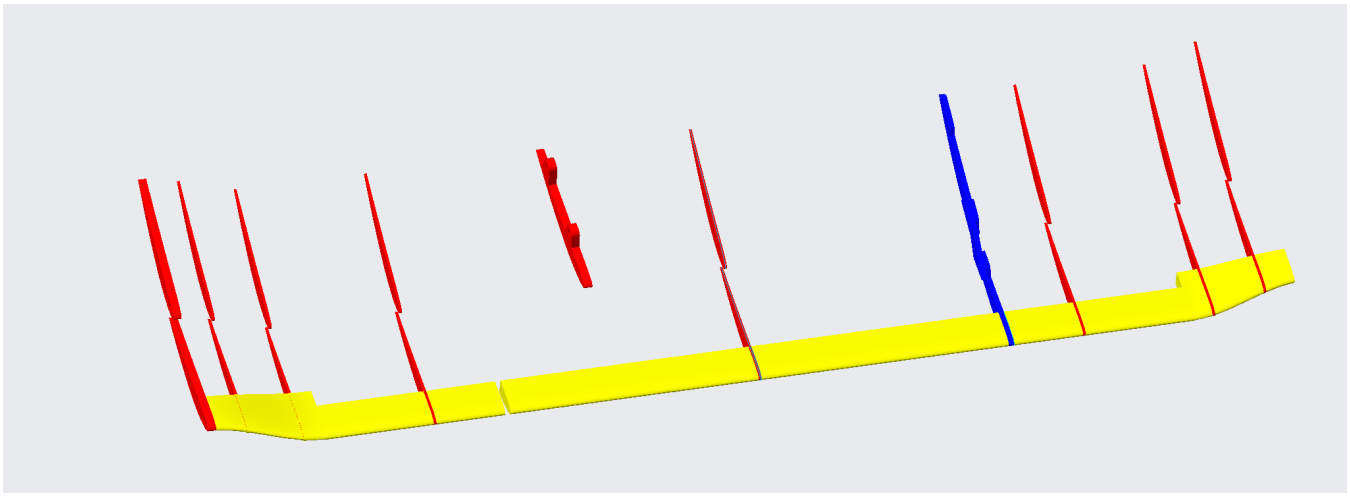
Gate 6.5 25-26 Design Season Rules Review

2023 - 2024 Front Wing Struts

How would we manufacture this?

The wing is straight now! We can easily hotwire the foam. With a guide 🙂
Not straight anymore : (

Initial CAD:



Pre FDR

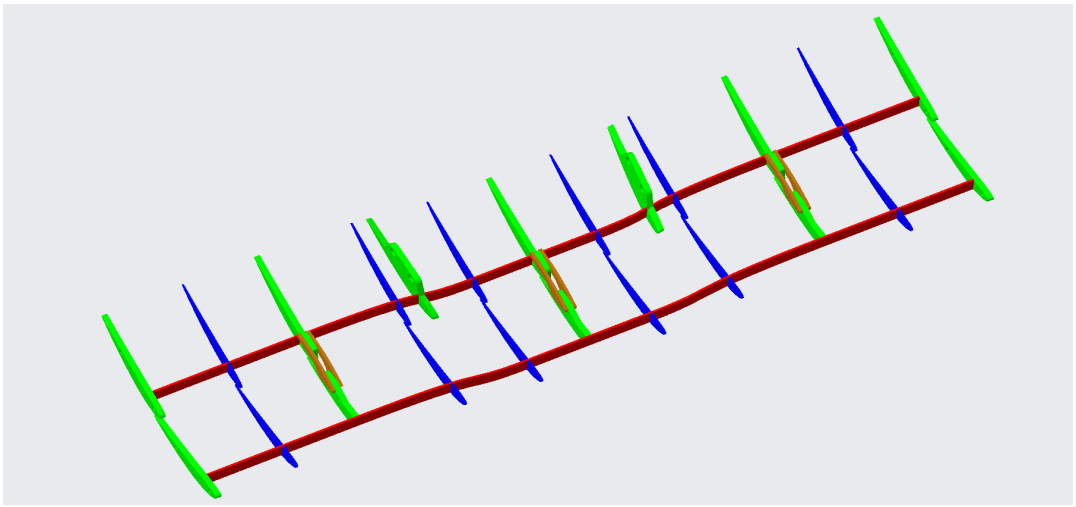
Materials for front wing foam core leading edge:
XPS vs Polyurethane?

https://marineware.com/core/corecorecell/gurit-corecell-m80-3mm-half-sheet?products%5B36419%5D%5Boptions%5D%5B3009%5D=10217&selected_option=3009&selected_option_value=10217&products%5B36419%5D%5Boptions%5D%5B23320%5D=24365948&selected_option=3009&selected_option_value=10217&without_product_list=1

THIS IS IT!!!!

Materials for spars + ribs: the goal is to be able to waterjet all of the spars and ribs from a single flat stock + that flat stock should be light and have good stiffness and compressive strength
sandwich panel options:
Corecell + carbon fiber
Balsa + carbon fiber

Flatstock some plastic (figure out what plastic) (only for ribs)



Safety Cable

Hardware:

https://www.aircraftspruce.com/catalog/hapages/shearboltsnas6203.php?clickkey=27366