CCBANTA

THE MAKING OF THE "MARIMBA SPORT"

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“MARIMBA SPORT” (PENTATONIC SCALE)

Concept / Inspiration

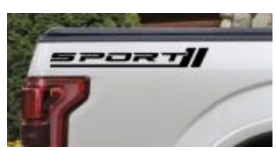
One day, while driving on the freeway, I noticed a truck, buzzing past me, had the word “SPORT” on the side of itsbody near the rear end. SPORT?? Well, I became curious and started looking for the word SPORT on the bodies of other vehicles and trucks.

So, in this case, what did that particular term imply?

Note: The dictionary defines ‘sports car’ as a low small usually 2-passenger automobile designed for quick response, easy maneuverability, and high-speed driving. On the other hand, the larger footprint of a truck would perhaps it appear to be a bit more sluggish. Although “powerful” would certainly fit into the insinuation that it was indeed a “sport” vehicle

It was also an obvious advertising ploy/that the auto manufacturers wanted to send a message out to the public. A sport version of their truck obviously equated with high-end phenomenon, e.g. amazing performance, speed, coolness, and most importantly and perhaps a justification to add dollars to the sticker price. Hmmm…well, why not create a “Marimba Sport” to imply the same coolness/features…musically?

Now, my wife ridiculed me on the idea and asked why would there need to be a *sport version* marimba. Fair enough. My answer was simple and what else; I wanted to make a marimba that was not only playable, but stylish, had a sporty look, and of course, be cool…by design!



Now there might be a difficulty in equating a percussion musical instrument to that of a high-performance vehicle with “sporty” features. Nevertheless, as with all my projects, it was primarily experimental and, in this case, what~~a challenge in what~~ features a *sporty musical instrument might employ.*

So, what might those features be in a bar percussion musical instrument?

Function
- Stylistic Looks
- Scale
- Pitches
- Frequency Range
- Layout and Playability
- ~~Design, Looks, and Styling~~
- Color
- ~~Scale~~
- ~~Pitches~~
- ~~Frequency Range~~
- ~~Layout and Playability~~
- Materials for Durability
- Mobility
- Practicality

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Color

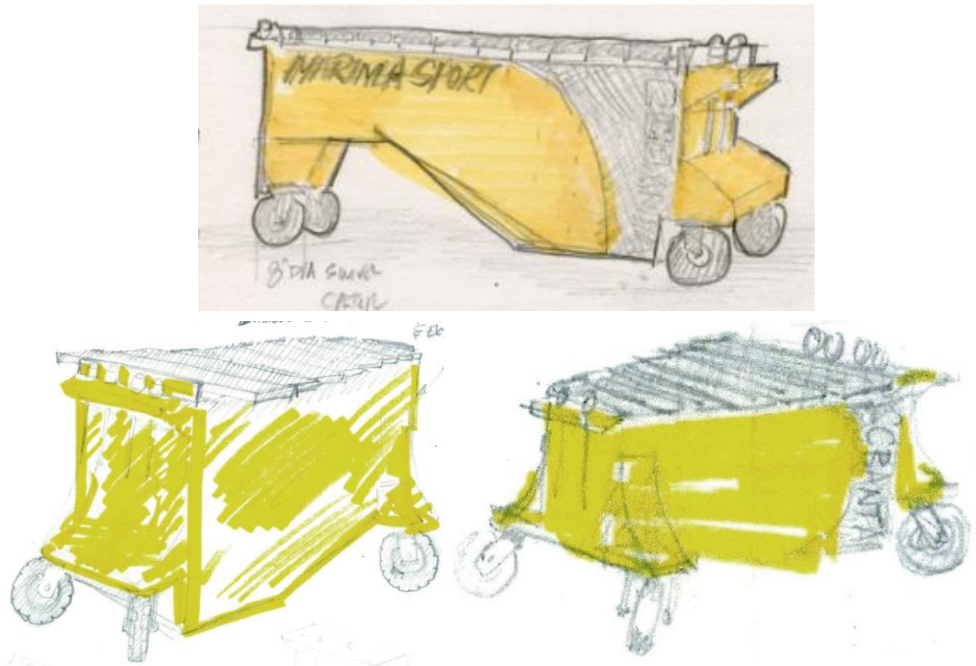
Hmmm?...well it has to be able to stand out, perhap with some sort of yellow…and with~~-~~ black! …Yeah!




Body

STYLISTIC LOOKS~~Design Styling~~

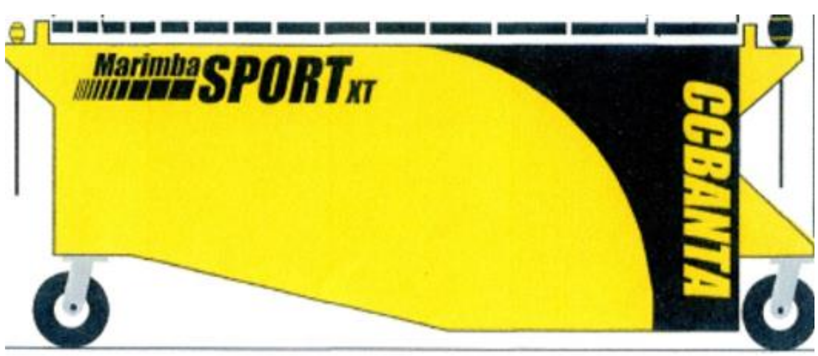
Rough Sketches



Early concept sketches

Body Styling Refinement

At the time, the color style of many cars was yellow in some variation or another. So, yellow it had to be. Styling had to suggest more vehicle than marimba.



~~[STEP 1]~~ SCALE, PITCHES, AND RANGE~~Scale, Pitches and Range~~

Q: What should the be range and what scale should be employed?

Ideal Criteria:

1) Should not require a great deal of knowledge in musical scales
2) Should be able to sound good even with novice players
3) Should have a desirable range of pitches – especially in low notes
4) Should be easy to move around
5)

Constructing such a beast was challenging not only for its size, but for its weight and ability to move around the shop.

xxxxxx

SCALE TYPE

Pentatonic (5-notes) to the octave – but without numbers 3 and 7

C, D, E, F, G, A, B, C

1, 2, 3, 4, 5, 6, 7 ,1

Diatonic Scale (without numbers 3 and 7) = Pentatonic Scale

1, 2, 3, 4, 5, 1

F, G, A, C, D, F (F Major)

Enharmonic Equivalent:

D, F, G, A, C, D (D Minor)

No wrong notes

PENTATONIC SCALE NOTES

	1	2	3	4	5	1		
F MAJ	F	G	A	C	D	F		
D min	D	F	G	A	C	D		

PENTATONIC SCALE FREQUENCIES

	1	2	3	4	5	1		
F MAJ	F	G	A	C	D	F		
D min	D	F	G	A	C	D		

~~**SCALE TYPE**~~

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~~F, G, A, C, D, F (F Major)~~

~~Enharmonic Equivalent:~~

~~D, F, G, A, C, D (D Minor)~~

~~No wrong notes~~

~~PENTATONIC SCALE NOTES~~

	~~1~~	~~2~~	~~3~~	~~4~~	~~5~~	~~1~~		
~~F MAJ~~	~~F~~	~~G~~	~~A~~	~~C~~	~~D~~	~~F~~		
~~D min~~	~~D~~	~~F~~	~~G~~	~~A~~	~~C~~	~~D~~		

~~PENTATONIC SCALE FREQUENCIES~~

	~~1~~	~~2~~	~~3~~	~~4~~	~~5~~	~~1~~		

~~F MAJ~~	~~F~~	~~G~~	~~A~~	~~C~~	~~D~~	~~F~~		
~~D min~~	~~D~~	~~F~~	~~G~~	~~A~~	~~C~~	~~D~~		

LIST OF FREQUENCIES

CONTRA BASS	C1	32.70
	C#1	34.65
	D1	36.71
	D#1	38.89
	E1	41.20
	F1	43.65
	F#1	46.25
	G1	49.00
	G#1	51.91
	A1	55.00
	A#1	58.27
	B1	61.74
BASS (CELLO)	C2	65.41
	C#2	69.30
	D2	73.42
	D#2	77.78
	E2	82.41
	F2	87.31
	F#2	92.50
	G2	98.00
	G#2	103.83
	A2	110.00
	A#2	116.54
	B2	123.47
TENOR	C3	130.81
	C#3	138.59
	D3	146.83
	D#3	155.56
	E3	164.81
	F3	174.61
	F#3	185.00
	G3	196.00
	G#3	207.65
	A3	220.00
	A#3	233.08
	B3	246.94
MIDDLE	C4	261.63
	C#4	277.18
	D4	293.66
	D#3	311.13
	E4	329.63
	F4	349.23
	F#4	369.99
	G4	392.00
	G#4	415.30
	A4	440.00
	A#4	466.16
	B4	493.88
TREBLE	C5	523.25
	C#4	554.37
	D4	587.33
	D#3	622.25
	E4	659.26
	F4	698.46
	F#4	739.99
	G4	783.99
	G#4	830.61
	A4	880.00
	A#4	932.33
	B4	987.77
HIGH	C6	1046.50

BAR LAYOUT~~Mobility~~

As with most melodic bar percussion instruments the low end is typicall on the left-side and the high end on the right-side with the player standing in the middle between the ends of the instrument.

All marimbas, vibes, and xylophones have casters to make them mobile for easier handling and positioning in the musical environment. In this instrument, the wheels needed to be large not only to look cool and possibly overwhelming, but to support its weight.

Constructing such a beast was challenging not only for its size, but for its weight and ability to move around the shop.

Bar Material

Strength: Since the bars drive the size and sound of the overall instrument, the bars in this instrument had to be strong and break-resistant from heavy-handed pounding. Slightly oversized lengths and widths would help in this regard. ******resume here******

bar layout

why this →At first thinking, African Padauk should be the ideal wood because it is very vibrant, has brilliant overtones, and good sustain time. However, a *sport* model must have more in the terms of durability and strength.

The wood I used was *Hard Maple*. As the name implies, this is extreme hard and structural. It does not easily break, even with a lot of pressure. Also, its strength was a slight deficit in sound. ??

Bar layouts are critical in providing a clean gradually tapered look.

View of the bars from both ends easily show the tapered angle that perfectly aligned bar lengths create. This alignment will create a secondary line in the node points – which is where the individual bar stand-offs will be placed to support the bars on the larger instrument frame.

Laying the bars out to create a straight-line profile

When lined-up, the longest to the shortest bar creates the classic

marimba *trapezoidal* shape. Resonators (Upper Range)

Resonators (Lower Range)

BODY MECHANICS

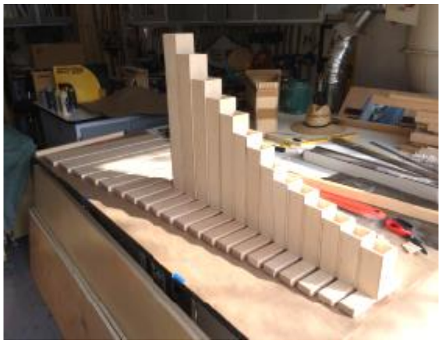
Body Outer-Frame

Made out of ¾-inch baltic birch plywood, two long side walls were necessary to contain the *resonator components* of the instrument as well as supporting the entire bar system of the instrument.

Side panels assembled to create the outer envelope of the instrument.

A view of the inside side walls which will eventually provide two-walls of each resonator.

Middle and High Pitch - Resonators



Low-Frequency Pitches: Test Resonators

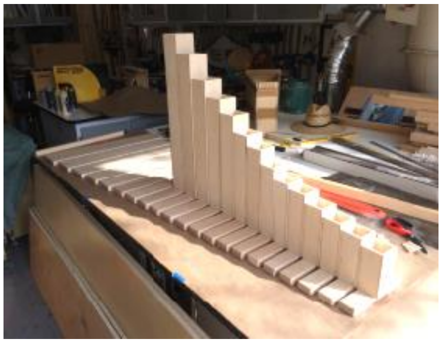
The lowest frequency notes are always the most difficult to achieve a fully resonant tone while making them just large enough to do the job. -The goal is to use the smallest resonator that will provide to most substantial resonance. But, you need to take the guess work out of it. The answer is test resonators.

To the right is two cavity resonators designed to resonate at F1 (43.65Hz). The one on the left has much less volume than the one on the right. When slapping the side of the box, the ring tone of the one on the left is not as loud as the ring tone on the larger one.

The better test is to use an actual tuned marimba bar as the energy source. The bar is then placed on foam blocks and struck with a mallet. Listening to the combined bar-resonator tone provides proof of the size of the function. The larger (volume) resonator will have a stronger resonant than the smaller volume version.

There is a trade-off. When using the larger volume resonator, this adds length to the overall instrument. So, the decision is simple – stronger resonance in a longer instrument is better in performance than weaker resonance in a shorter instrument.

Resonator Layout



This instrument uses column resonator for the upper notes and cavity resonators for the lower notes.

Columns

Columns are simply straight tubes each having a moveable stopper for tuning.

Cavities

Cavities are simply a six-sided box with an opening on the top panel placed directly beneath the bar's center.

The side walls provide two of the six "edge" boundaries in the cavity resonator. The other four boundaries are the two front and back and the two top and bottom boundaries which is basically a six-sided box.

[Far Right] The bottom right photo shows how the side walls create the partitioning between each resonator. It also shows where the transition from cavity to column starts.

[Right] The lowest resonator is in place and has a barrier wall between the resonator and the instrument's trunk space.

Prior to final installation of the resonators, it is important to make sure they all fit in their allotted space.

Cutting out the side panels of the instrument.

Resonator Tuning Control

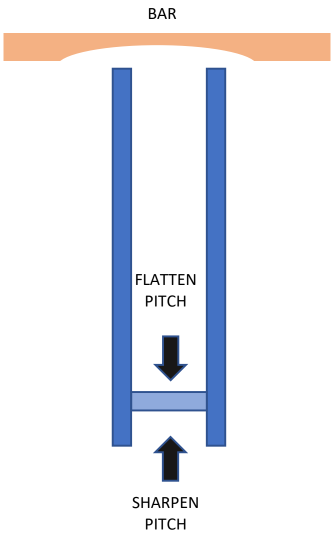
Once the resonators have been fitted and attached to the body, then comes the process of achieving the precise tuning of each column and cavity resonator.

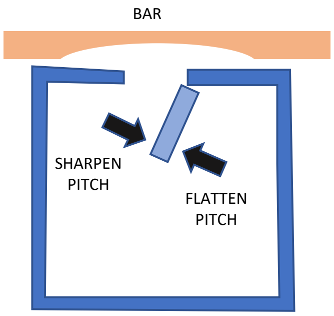
Column Resonator

(Middle to High Frequencies)

Cavity Resonator

(Low Frequencies)





Resonator Tuning Check

A view of the inside partition walls between each "cavity" resonator.

By standing the resonator frame on end, this allows for stacking all the column resonator so they're not affected by gravity when placed in the [normal] horizontal position.

Testing for fit within the instrument body - while stacking all the column resonators.
To ensure all resonators would fit the spanning distance, some of the column sides required a slight amount of sanding to "slim" the height of the stack so it would fit within the internal span. down.
The photo on the right shows how they all stack on one-another.

During construction, it was advisable to start testing the resonance of the quality of each resonator – while having open access to the walls and interiors. Below is the test station and loudspeaker for sending a tone burst into the resonator opening. Two things are key at this point:

1) Tuneability of the resonator and
2) quality of the final resonance within the resonator

Both are essential for the success of the instrument's tone.

I was able to stand the overall frame on its low end. This allowed for all the resonators to be stacked on top of each other, without having to fight gravity or use a ton of clamps with the instrument in its on-ground position.

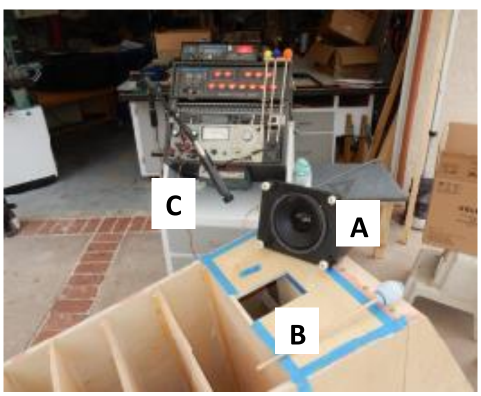
Partitions and Openings

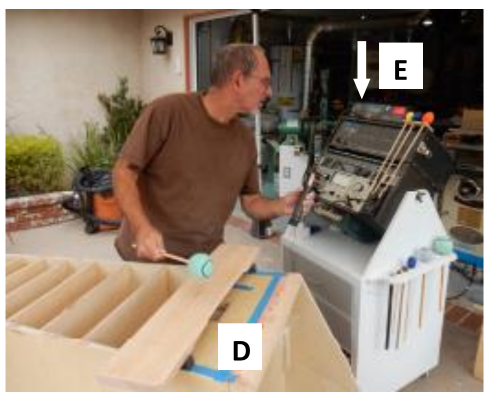
A view of the low F1 resonator
Note: Blue masking tape is used to temporarily create an airtight seal at all the joints. Resonance is compromised if the joints aren't airtight.

A view of the low F1 resonator

Preliminary Resonance Check – Using a Loudspeaker and Test Tone

Resonance and acoustical loudness are the name of the game in marimba design and construction. This requires on-going testing during the construction process to ensure sonic function is maximized. To make this happen, the following steps are necessary.





Check for quality of resonance

STEP 1 - Speaker [A] is aimed into the resonator opening [B] and a test tone, tuned on-or around the resonator's frequency, is triggered.

Microphone [C] , connected to the strobe tuner, will allow the strobe to visually show the resonant frequency ring tone. Once the resonator has been tuned using tone burst from the speaker into the resonator opening, the tuned bar is placed over the opening, then struck with the mallet

[D]. Strobe tuner [E] will display the bar-resonator pitch.

Preliminary Tuning and Resonance Check – Using the Strobe Tuner

While everything is readily accessible, the resonator's internal louver can be moved to further refine the adjustment of the resonator's tuning.

RESONATOR ASSEMBLY

Little-by-little, the resonator pieces are put in place to complete the assembly of all resonators. The process is repeated over and over until every resonator can be tuned and checked.

The same routine is applied to all the remaining resonators.

Once the remaining resonators have been installed and tuned, then all bars are put in place, resting on foam strips, directly over their corresponding resonator.

This becomes an exciting moment… to give us a preview into how this marimba will sound. And, as difficult and time consuming as it was, it makes all the effort up to this point well worth it!

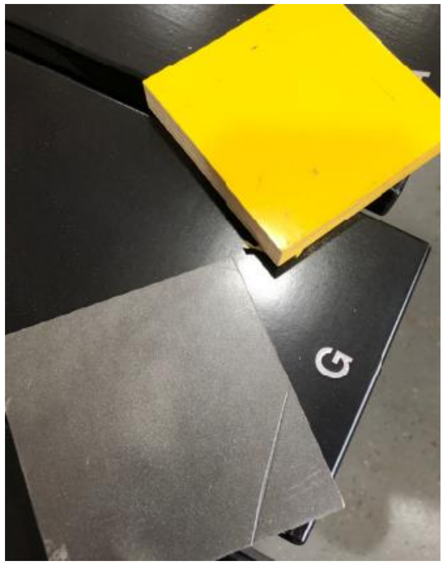
Ah…Listen to those resonant tones!! …and time for a break

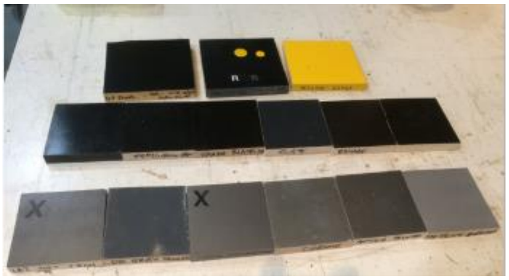
Color Scheme

Several views of cars having a yellow and black colors are used in the final decision for the marimba. (Black for the bars, and yellow for the body.) Now that the functionality of the bars and resonators have been tested and confirmed, it is time to plan for the painting process.

Color Testing

So, what does a sporty color look like? Many of the automotive manufacturers have a “yellow” version of a sport model. Color schemes come and go.





However, I did see some cars having a bright yellow finish along with some black accent colors. So, it was time to try these colors out and create some samples.

The working colors ended up being Rust-Oleum “Sunburst Yellow” and Rust-Oleum “Black Stainless Steel.”

A test panel

Bar Finish

Black was the chosen color for this instrument.

Prior to finishing each bar was sanded smooth, then a coat of black primer to applied. It is never good to spray the finish coat on un-primed wood, as it takes multiple coats to turn the wood fully black. Primer provides a sub-coating that fully adheres to the wood. Then the color coat is applied. Finally, several applications of a clear coat are applied.

There were structural locations on the marimba frame where the wheels could fit and would be bolted into mounting holes.

(Left) First Coat: Flat Black | (Middle) Second Coat: Semi-Gloss Black | (Right) Third coat Semi-Gloss Clear followed by a fourth coat of semi gloss clear. High-Gloss clear was not used because it can create a harsh reflection under bright lights.

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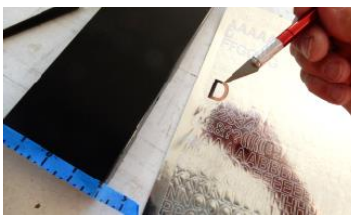
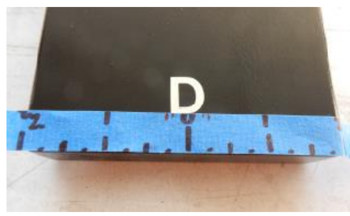
Pitch





Transfer letters are ideal for pitch identification. They're clean they're easy to apply and center on the bar. A piece of blue masking tape with a centerline and equal-distance ruler markings applied in both directions. Just line up the two distances on each edge of the bar and centerline will exactly be placed in the middle.

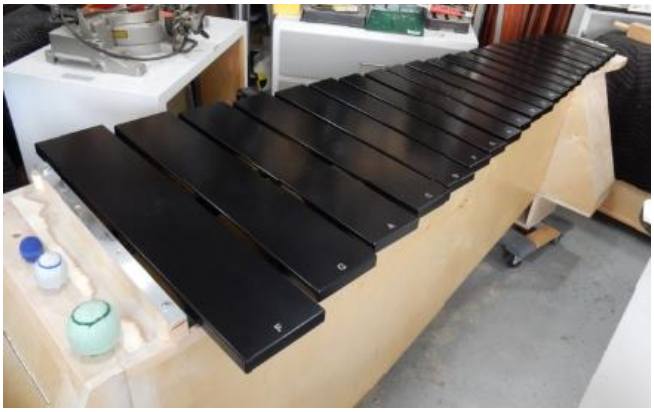
Use an exacto-blade to lift the letter of the lettering sheet, then place it just above the tape line at the center of the bar's width. Then, use a plastic burnishing tool to press the letter into the bar's surface. To protect the letter from the burnishing blade, place a piece of stiff paper over the letter, then rub vigorously with the blade in flat position. If angled, the blade might tear the paper and damage the applied letter.

Bars - Final Clear Coat

Before applying the pitch letters, it is a good idea to group the bars into "pitch families." This helps to ensure that a wrong pitch identifier is not inadvertently applied to a wrong pitch.

Once the letters have been pressed into place on the black color, apply three or four coats of the clear finish to further seal the letters in place.

Once dried, the bars are temporarily placed on the instrument frame which provides a glimpse into how the keyboard will look on the completed instrument.



Casters

Casters are pneumatic, 8-inch diameter tires having a 280 lb. rating and were available through *Harbor Freight*.

The first thing was to paint the hubs to match yellow color on the marimba body. This required disassembly on the wheel from its swivel mount.

The carefully masking off the rubber part of the wheel to protect it from any over-spray. The tire had to be deflated so the masking tape could be tucked in between the wheel's rim and the rubber so overspray would not be applied to the rubber.

Next was to apply a primer coat which gives the final color coat something to grip onto. Finally, the color coat (Rust-O-lem "Sun Burst") was applied. Many very sparse coats were applied to minimize paint runs and to obtain the full essence of the color.





Wheels were then reassembled ready to fitting onto the marimba frame.

~~Caster Swap-Out~~

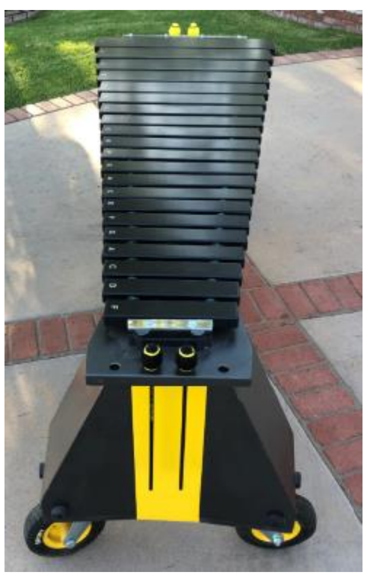
~~As nice as it was to use pneumatic tires, there was a problem with this choice. Due to the overall weight of the marimba, the casters required on-going checking of air pressure. They gradually leaked minuscule amounts of air causing them to go flat. Yuck!~~

~~Wheels were then reassembled and ready to fit onto the marimba frame.~~

Body Finish (with PHotoshopped lettering)

Photo-shopped photos with lettering overlay

Completed Instrument



Last Minute Caster Swap-Out

The original pneumatic wheels were replaced with hard-rubber wheels. Due to the weight of the instrument, the air within the pneumatic wheels would gradually leak out causing a flat. …not cool for an instrument having flat tires!

Instrument Specifications

INSTRUMENT
Model: F121P (Marimba Sport)
Type: Contra Bass Marimba
Designed and Built By: Christopher Banta
Years: 2017 - 2021

PHYSICAL CHARACTERISTICS
Height: 34”
Depth: 48”
Length: 94-1/2”
Weight: Approx 208 lbs.

MATERIALS
Bars: Hard Maple
Finish: Black with Semi-gloss clear coat

BODY
Resonator Box, Frame and Accent Pieces: Birch Harwood, Baltic-Birch plywood
Finish: Two-Tone: Sunburst Yellow (Gloss) / Metallic Stainless Steel

MUSICAL CHARACTERISTICS
Musical Scale: 5-Tone Pentatonic - Two Scales: (F-Major: F-G-A-C-D) & D-Minor: D-F-G-A-C)
Number of Notes: 21
Tuning: Equal Tempered
Pitch Standard: A-440 Hz
Pitch Range: F1 to F5
Frequency Range: A-440 Hz
Pitches: **F1**, G1, A1, C2, D2 **F2**, G2, A2, C3, D3, **F3**, G3, A3, C4, D4, **F4,** G4, A5, C4, D4, **F5**
Musical Range: