



Oliver XO-121

Building a modern tribute tractor to the XO-121

Oliver XO-121 History

- Created in 1954
- Experimental high compression (12-1) engine.
- Hercules DOOB diesel block and experimental high compression gasoline head.
- 100 octane fuel was developed by the Eythl Corporation.
- 92% more horsepower than the Oliver 70.
- 85% fuel economy increase over the 70
- Resides in the Floyd County Museum— Charles City, IA





Engine Acquisition

- Several miscellaneous pieces were acquired from Floyd County Museum of the #3 original XO-121 motor that was suspected to have been seized at some point in testing. No specifications or detailed information existed for this engine which consisted of a Hercules DOOB diesel block with a custom experimental high compression (12-1) gasoline head.
- Engine was 199 CID with 3.75" bore and 4.5" stroke. The block was rusted and pitted badly. Intake, exhaust, head, block, cam, front cover and oil pan were the only usable parts.
- This Original XO-121 (#3 of 3) motor was acquired in 2013 from the Floyd County Museum.
- I have never found another DOOB engine or what it was in.



Donor Tractor

- A 'restored' 1952 Oliver 88 was purchased at auction in Kentucky for the base of the XO-121 Tribute Tractor build.
- It was stripped down to begin the long process. It became apparent over time that this tractor had several mechanical major issues and lived a very difficult life.
- Almost every mechanical part on the tractor was replaced or repaired.





Modern Design

- Early on, we decided to remove all access holes from the hood and create a unique look.
- Custom fenders were fabricated to hide inner supports and wiring for the fender lights.
- Several attempts were made to get the correct look of the side as well as make them look very clean. Ultimately, we made new custom side panels without hinges.
- We were very optimistic test fitting an empty block and head into a very rough build. I did not know the struggles that lie ahead.



Front Axle

- The adjustable front axle was welded up and smooth transitions were welded into place
- We thought it added some lines and character to the adjustable front end.

Finding Issues

- Several transmission/rear end gears had to be replaced due to missing teeth.
- New brakes installed
- New wheel bearings
- New clutch and custom clutch linkage and brackets since no Oliver bell housing could be used.



Iconic Grill – Part 1

- Many models of the grill were created and several people attempted to build it.
- I think I have about 8 full examples of someone trying to build the grill. Everyone had a different take on how to build it or over estimate their skill.
- Several Oliver experts along the way told me that all Oliver's grills went horizontal, not vertical
- In the end, I found someone who used a vintage pullmax with a buck to make it. He split the grill and had to drill many holes to secure it to a buck and stretch the material. Then he welded up all the holes and get the grill back smooth. Tons of hours went into getting the grill right.



Engine Restoration

- Several engine builders and machinists looked at the pile of parts saying it could not be used or rebuilt.
- The engine block was cleaned and expected. It was badly pitted but useable
- The head was cleaned and tested fine.
- Finally found Jeremy Coker of Marionville, MO who understood that we had 1 shot to get it right!



12-1 Compression

- The original box for the head is hand labeled “OX-121 High Compression head #3 Good”.
- It is not known when the label was written or why it said OX not XO. Is it a typo or maybe they floated the idea of naming the tractor OX-121 for Oliver Experimental vs Experimental Oliver?
- It is unlikely that someone would have labels ‘Good’ unless they had working knowledge of the head. Maybe other heads were ‘Not Good’ after testing.





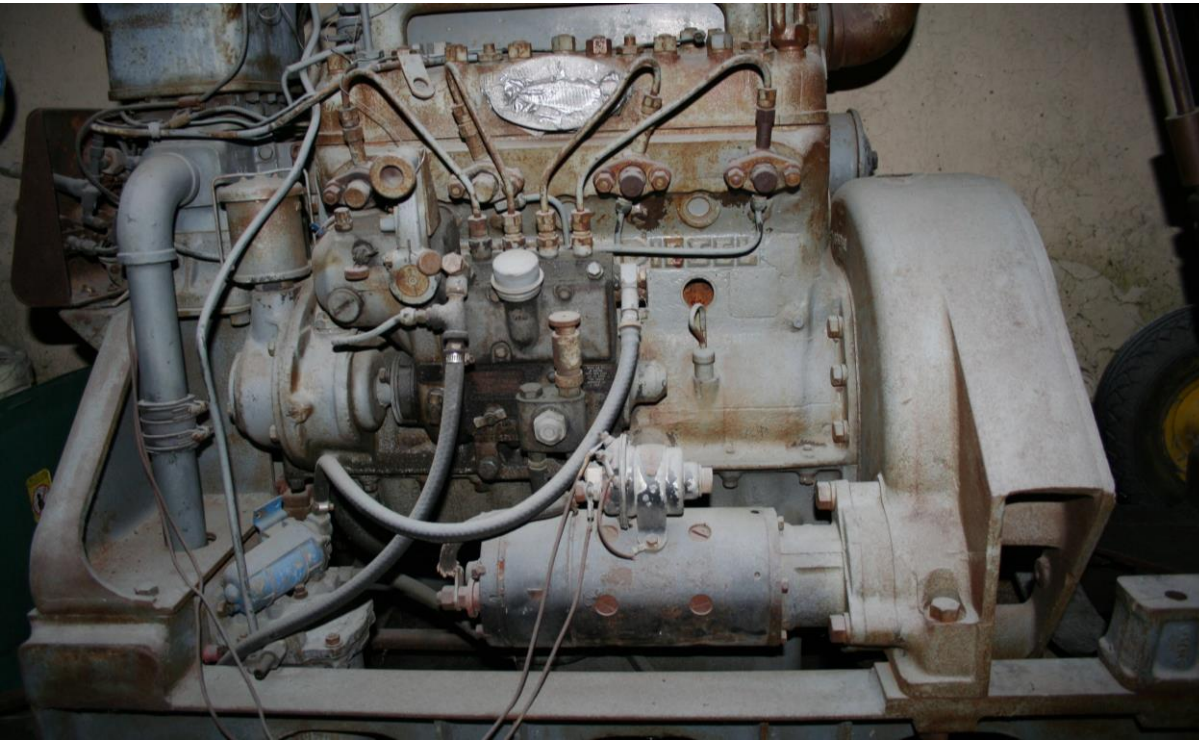
Pistons / Rods

- No pistons or rods were available.
- A hand fabricated rod was constructed and sent off to Carrillo who designed & machined an amazing one of kind billet piston/rod combo.
- Corvette style pistons with Ford 460 rod journals. Works of Art!



Crankshaft

- No crankshaft was available
- Another Hercules motor (DOOD) was purchased in CA to source a crankshaft and main bearings.
- The heavily pitted original block was decked and bored .030 over. A shorter piston was also utilized which increased the stroke over the stock 4.5".
- Bored & Stroked from 199ci to approx. 225ci
- The motor has a rotating lower for the first time in 60+ years!



Valvetrain

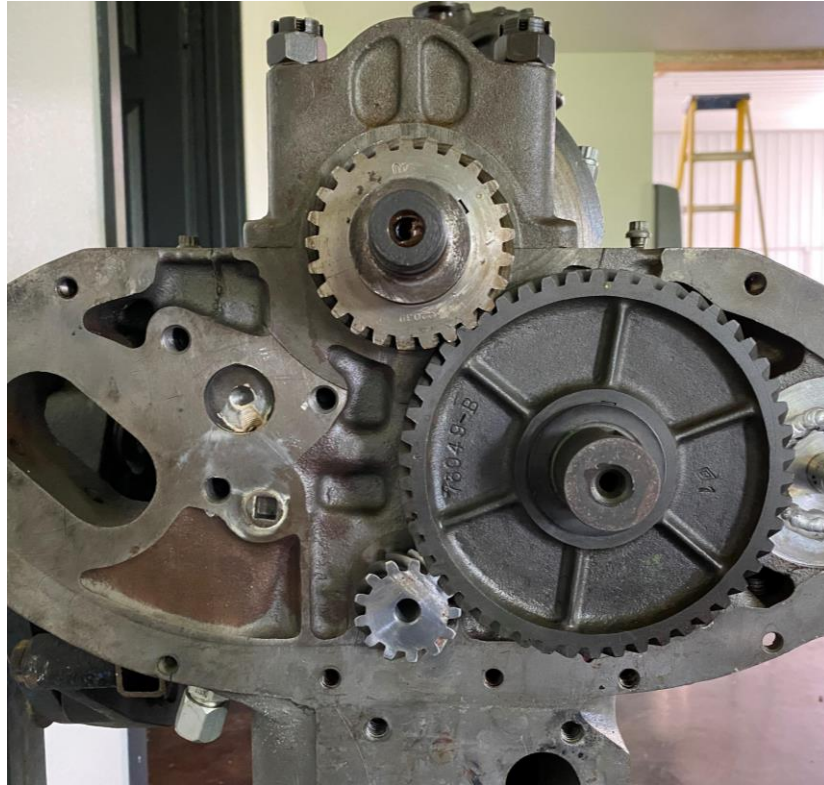
- No upper valve train was present, so engine builder hand built the valve train structure, pushrods and utilized race car roller rockers with a custom oiling rail.
- This ensures proper oiling since the original block only had 1 oil galley way. Big block Chrysler shaft and roller rockers were used!
- It was great to have an engine coming together.





Cam Shaft Gear / Governor

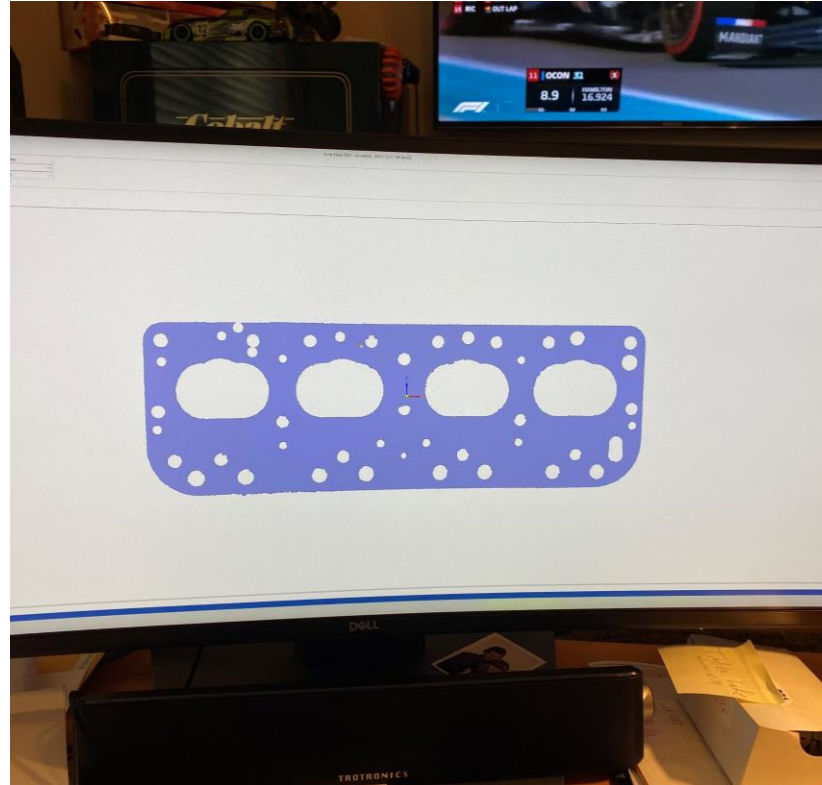
- Hercules casted these 3 special built blocks to include the word "Sample" on the timing cover.
- An appropriate camshaft was among the parts acquired.
- A custom gear was locally manufactured to allow the engine to have a working governor. Many hours went into building a custom governor mechanism.





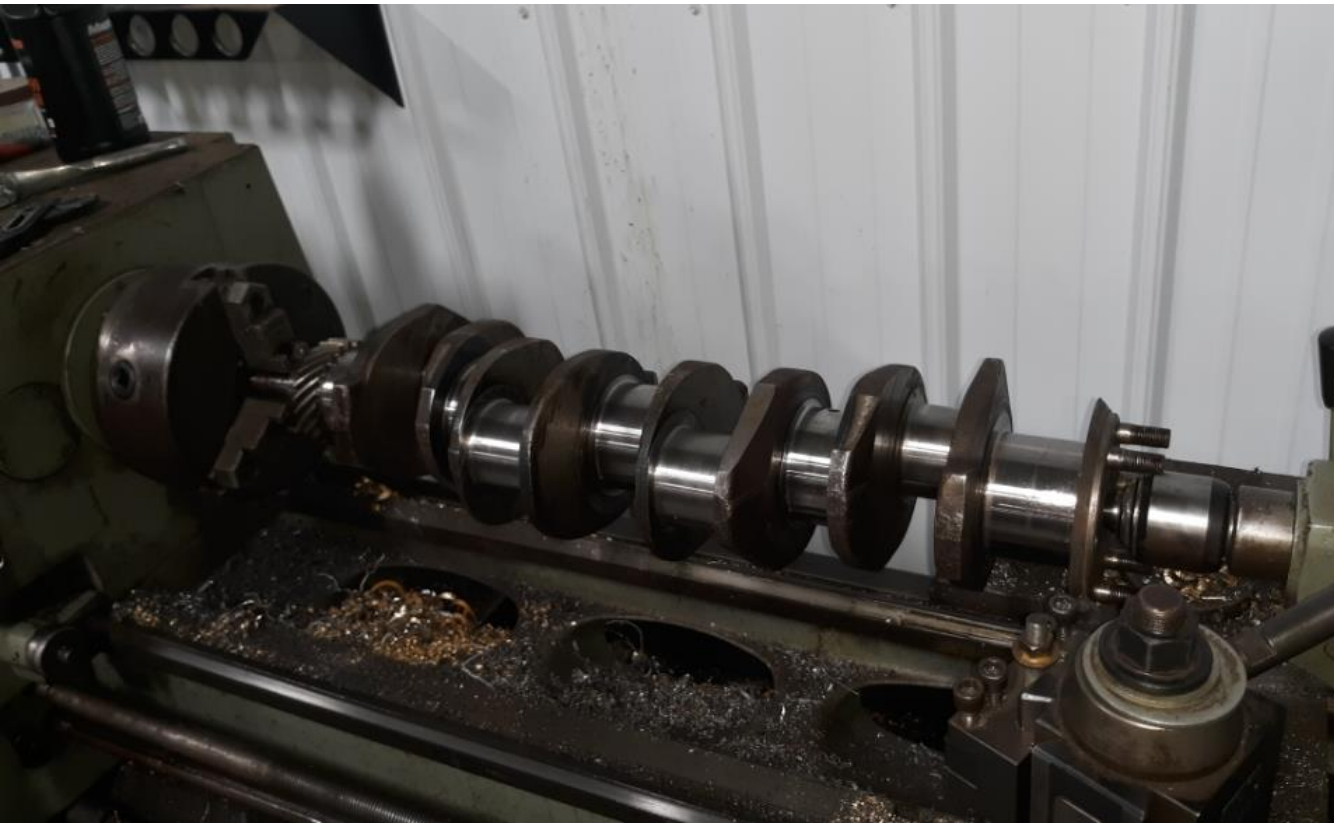
Head Gasket

- A paper model was built of the block for the head gasket.
- The head was 3D scanned. Both pieces were utilized to create a CAD file for the head gasket. This file was given to the waterjet company to create the copper head gasket.



Oil Testing

- The crank was machined to fit a modern day 1 piece rear main seal
- Proper oil pressure and reach was critical. Even a pressure relief valve from a corvette. Several dry run tests helped us to find problem areas prior to first startup. We found 2 issues after startup that could have resulted in catastrophic failure but close eye on oiling saved us. One original internal oil plug failed but was caught in time.



Flywheel / Water pump / Oil Filter

- 7.25" was machined off the very large donor DOOD flywheel to fit within the Oliver tractor! A very skilled procedure to machine this off and get clutch housing bolts perfectly centered and balanced.
- A custom starter (gm starter with Ford 5.4 ring gear) & water pump were also fabricated.
- Much work and detail to get a part machined to match a spin on oil filter to the original block.
- Aluminum side plates allow for external oil lines to spray the cam and lower end.
- A custom aluminum valve cover was also fabricated.



Engine Install

- After a successful engine startup, the motor had to be fitted into a stock Oliver Row Crop 88.
- Custom motor mounts, clutch linkage, clutch housing, exhaust, wiring, fuel cell, radiator cooling system had to be fabricated to get the XO-121 engine in harmony with the chassis.
- To keep the hood free of holes, the stainless-steel exhaust is tightly fitted near the clutch and exists as dual exhaust through stock holes in the belly pan



Carb / Testing

- Several carburetor setups were experimented with until the tractor was running smoothly on E85. The motor builder and expert tuner felt this was the best option to keep engine cool and have a long life
- We decided to run an electric fan to make sure the engine stays cool at all times and reduce stress off of the custom water pump.
- The original area for the battery is where the CDI box and ignition timing box reside. The timing is retarded 12-15 degrees upon startup. This aids in high compression starting and then is returned to full timing approximately 5 seconds after startup. The engine went through about 10 hours of run time while testing and fixing of mechanical issues of the tractor.



Covid

- I had to purchase a new front end because the front bolster had been broken and poorly rewelded. We drove to Michigan during COVID lockdown to purchase a new wide front end. It is clear that this tractor had a very rough life.

- After not being satisfied with current build, the decision to find a new shop which took a few years. You can see the amount of body filler that was discovered on the hood. Over a .25" thick in places and the body fitment was not good.

- The years were not kind to the grill or the tractor.



Enter New Shop

- Received a call that I had been waiting for, new shop is ready for me.
- After driving around tractor for about 10 hours, it was time to disassemble again.
- Pulled motor and loaded it on the trailer. Didn't fit well on the trailer but I didn't need to haul it too far.
- Time to focus again on the finish line.



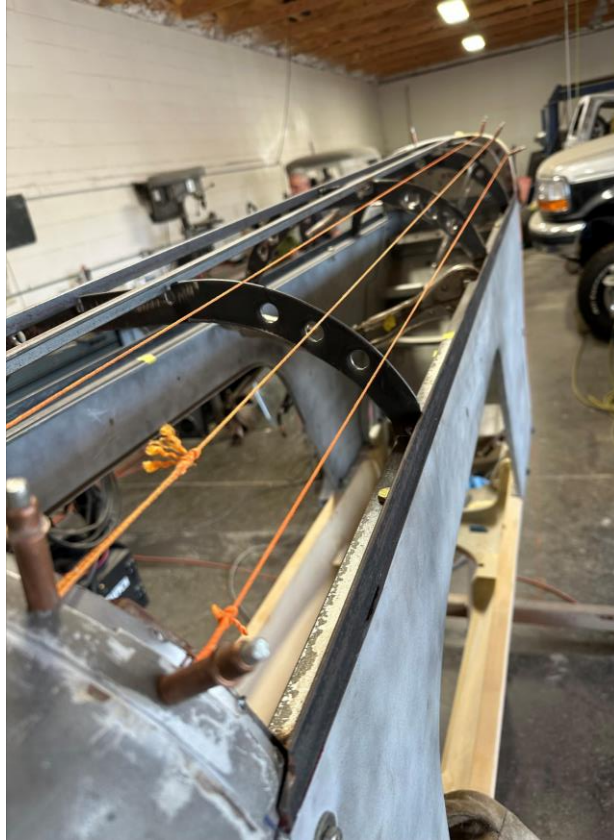
New Shop!

- I was fortunate to be introduced to Chris Rude – Marionville, MO who accepted the large challenge of getting this tractor back to paint again.

- New shop broke the tractor down again.

- All pieces were ground down to metal, shot with Z-chrome and blocked multiple times for a mirror finish.





Hood..again

•We decided to remake the hood once again. The hood was built in 4 pieces—a skeleton frame, left & right skin and the molded center raised piece. We changed the center rib slightly vs the stock hood. The hood skins were 3D modeled from the skeleton and computer formed. Many hours of precision forming took place after that for a perfect fit.

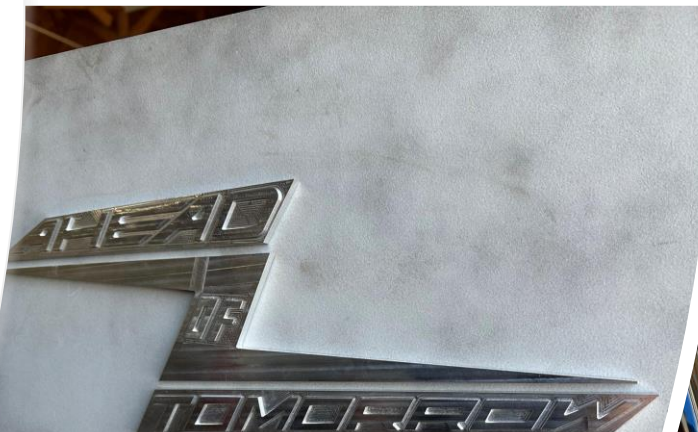
Every Part

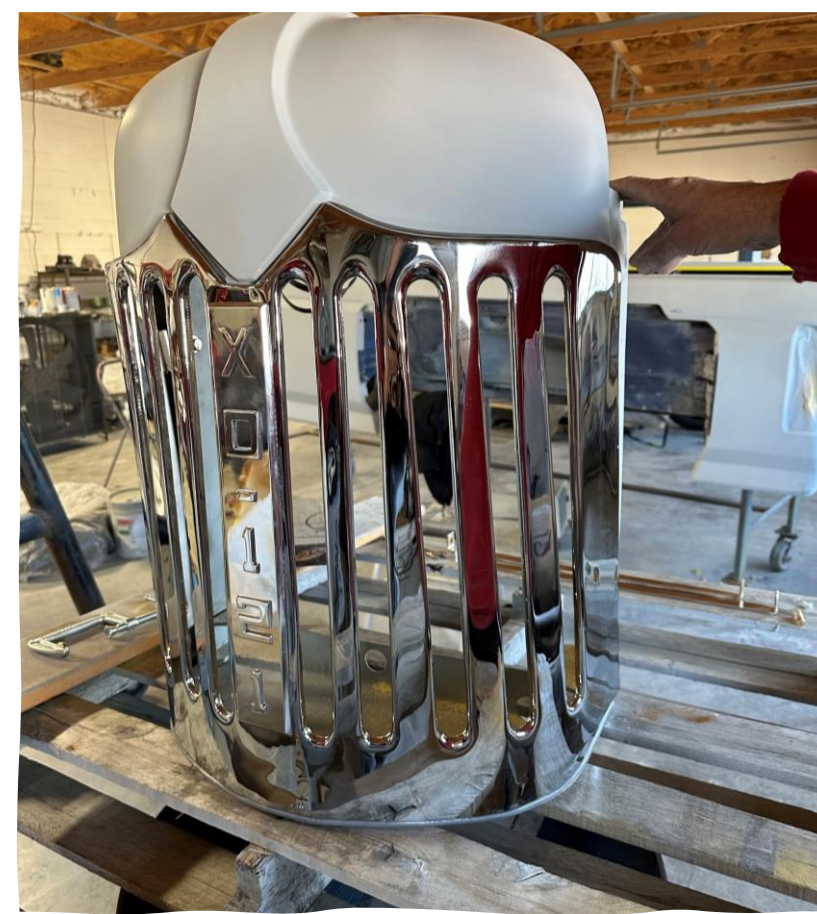
- Endless hours were invested at the shop sanding and priming parts for a very smooth finish. A young man at the shop spent a week sanding the steering box and hubs. Guaranteed the smoothest in the land.
- It was great to witness people taking such pride in their dedicated work.
- Every single part of the tractor was taken apart and smoothed out.



XO-121 Emblems

- The badging on the XO-121 is unique and hand built back in 1954.
- I took photos of the original and imported them into cad drawings to scale.
- Emblems were modified slightly so that machining would be easier and more cost effective.
- I struggled with changing the font style but thought it was important to retain the original intent.
- Drawings were sent off to Emachineshop.com to be milled out of billet aluminum.
- The emblems came out great and add important original styling.





Iconic Grill Part 2

- Polishing the grill didn't hold up over time.
- Found Whitworx metal that chromed the grill so that the finish would hold up.
- We did a test fit of the grill on the modified grill/radiator shell and it fit amazing and looks great.

What color?

- Documentation of paint codes were unable to be located to find the original color of the XO-121. To my knowledge no color photographs existed unless held privately. The original tractor had been repainted by Living Farms in Des Moines, IA then repainted again to its current color. 2 pieces were discovered that I believe document the original color of the XO-121.
- The air cleaner has red paint inside and out that had been covered by tubing and black paint. This makes sense that Living Farms would have covered the red air intake in black paint to blend in with the radiator. Under the rubber air intake hose was perfect bright red paint! It was easy to chip off some black paint to expose the red underneath on other parts of the intake.



Paint..cont

•The second piece is the dust shield under tractor. One side (presumably the engine side) has burnt red paint from the engine getting hot. The other side (ground side) again has red paint with some green overspray on top of the red paint. Is it possible that when Living Farms repainted the tractor that this area was hard to reach, and they didn't really try to cover the bottom of the tractor well? Anyway, we picked a higher quality of paint that closer matched this newly discovered paint. The green is also of higher quality which removes some of the black tint which can 'muddy' the color a bit. The green very closely matches the FFA XO-121 toy tractor. Our red will be brighter than the current state of the original tractor, but we feel better matches the discovery of what we believe is the original paint color of the Oliver XO-121



Paint Selection



- Paint samples with Oliver Paint codes sprayed over different base colors show how much colors can vary. You can see how black tint can 'muddy' the color and is cheaper to produce.
- The green is a very close match to the green used on the FFA toy XO-121.
- I do think the factory used the period correct Oliver Green but I believe they did not use the standard Oliver Red.

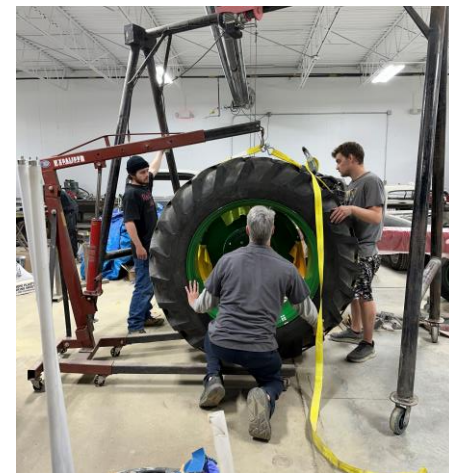
We have Color

- Great to see some paint going on!
The wheel hubs almost look plastic.
- New rear rims and larger tires mounted and painted.



Wheels On

- All hands on deck to assemble the tractor to protect paint as much as possible.
- It take 2 lifts and lots of patience to mate the wheel weight and rim to not scratch the paint.
- The tractor sits on painted wheels and is a roller after a long wait.





Sheet Metal Paint

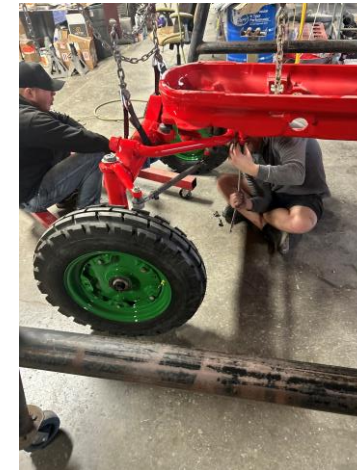
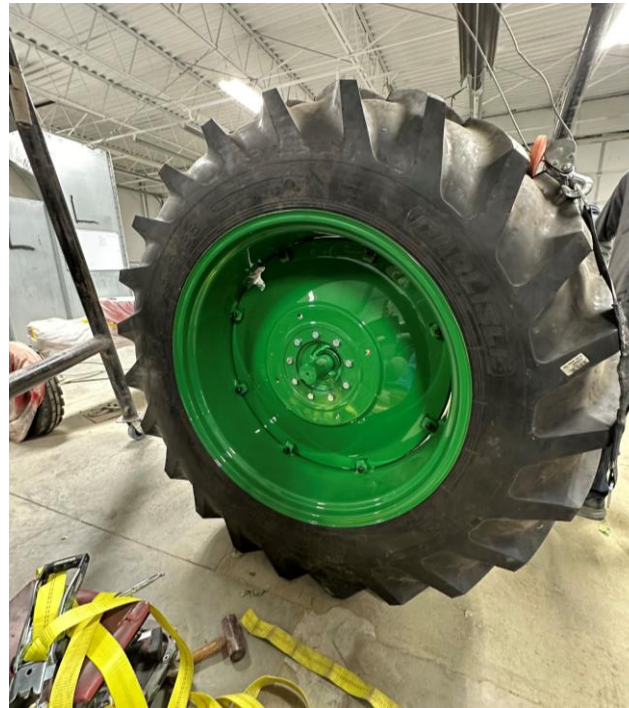
- All parts are painted white prior to the red being sprayed, then clear coated.

Everything is buffed after the clear dries.



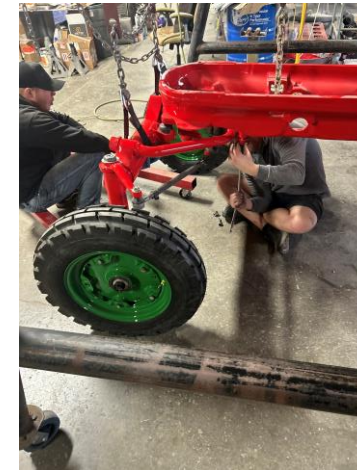
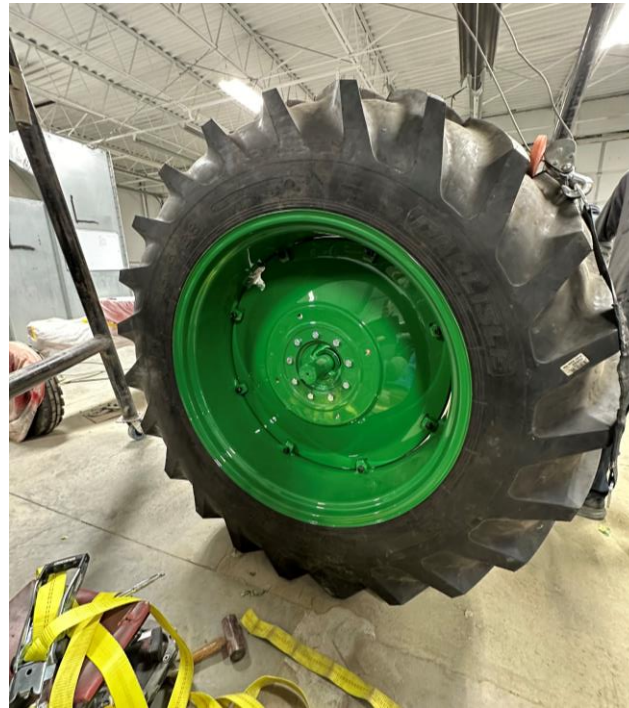
Assembly

- The floor pan has been covered with clear bed liner material to avoid scratching while driving.
- Fenders and axle step area have 3M clear protectant to avoid paint scratching while mounting tractor.



Motor Re-Install

- The motor barely fits into 88 chassis.
- Custom mounts, clutch mounting hardware are all reattached



Wiring / Operation

- Sleek wiring harness was built to be mostly hidden.
- The fuel cell is remote fill from the rear of the tractor to avoid filling from the top of the hood.
- The battery has been relocated to the rear of the tractor to avoid removing the hood to charge or service the battery
- The stock location of the battery now is home to MSD box and other electronics.



Testing

- Several hours of testing are completed prior to hood and side panels going on which is a substantial process.



Final

- A custom rollback truck was ordered to protect the tractor going down the road.

- After 11 long years of researching and building, the Tribute XO-121 is complete. A project not for the faint of heart.

- It is ready to go to a few tractor shows.

