

MARKFORGED WEBINAR

# 3D PRINTING WELDING FIXTURES

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# AGENDA

Markforged Introduction

Welding Fixture Introduction

Where Does 3D Printing Fit In?

Implementation Examples

Questions

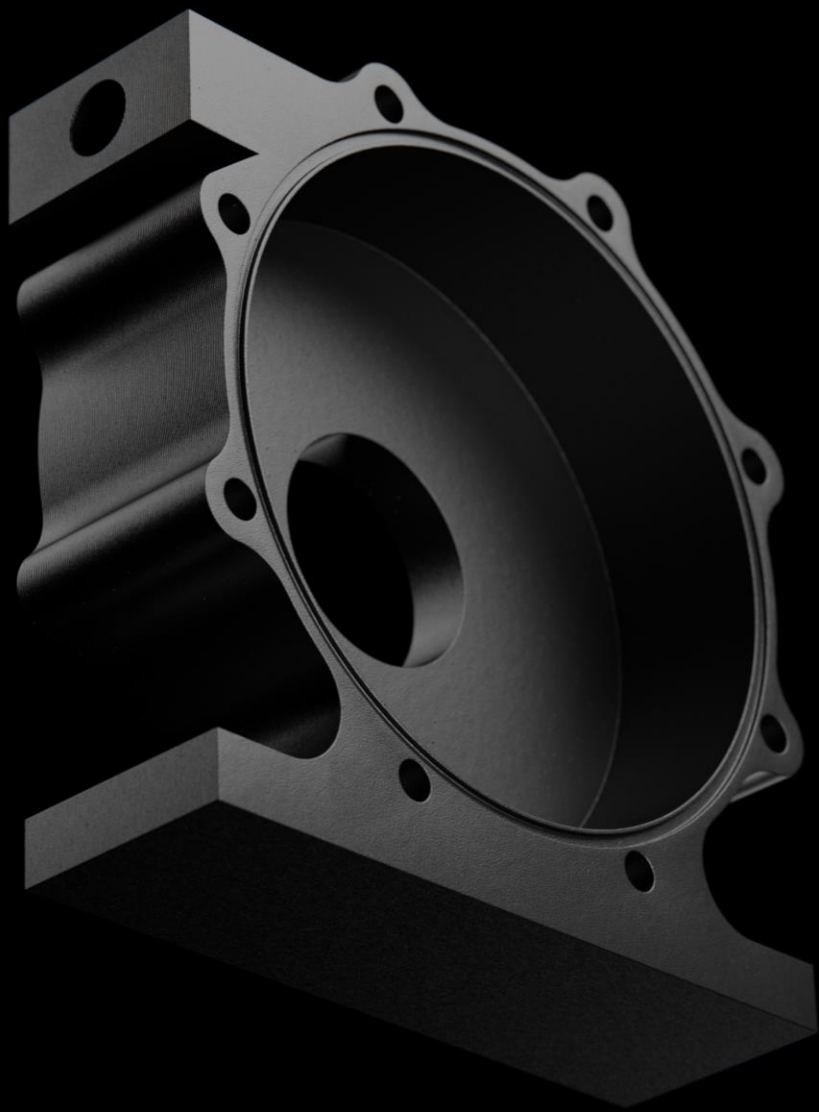
# ABOUT MARKFORGED

Founded out of MIT in 2013  
HQ – Boston, MA  
106 Employees

Shipped first printer in 2014  
300%+ YoY Growth  
Achieved Profitability Q1 2017



# FULL RANGE OF MATERIALS



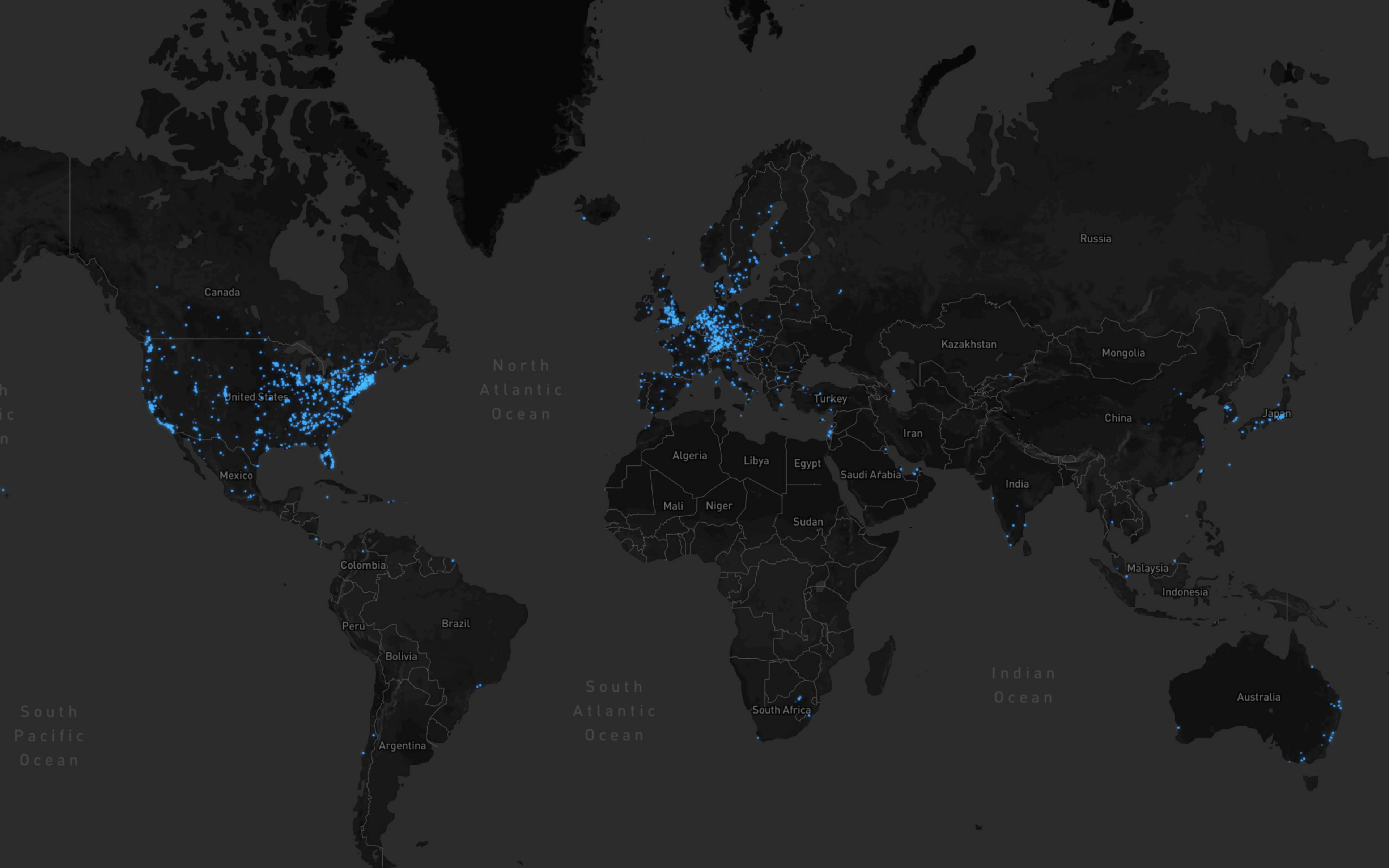
Plastics



Metals



Composites





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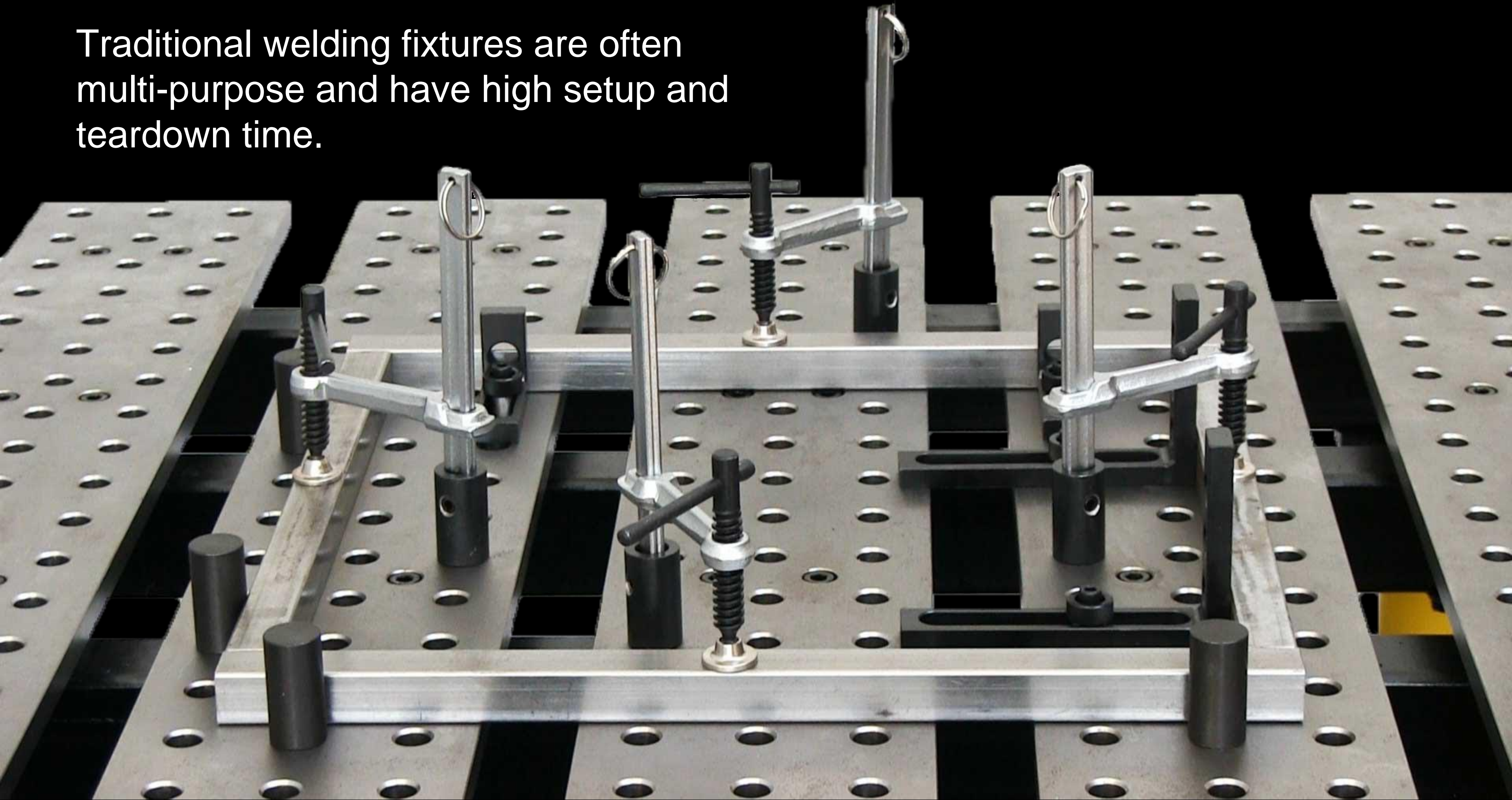
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in DESIGN and MANUFACTURING**

# WELDING FIXTURES



# STANDARD WELD FIXTURING

Traditional welding fixtures are often multi-purpose and have high setup and teardown time.

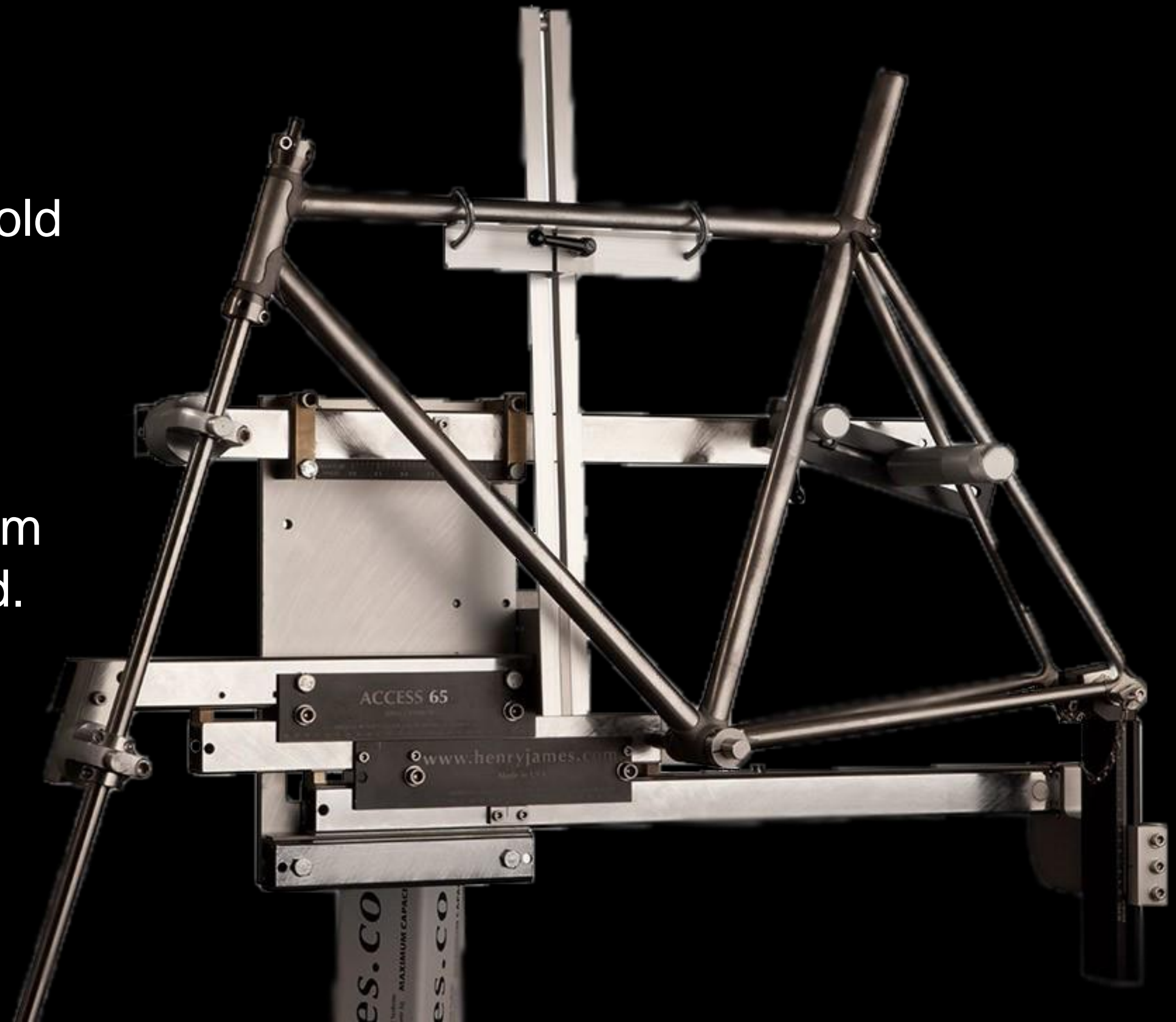




# SPECIALIZED WELD FIXTURING

Custom or specialized fixtures hold specific components in precise orientations.

These fixtures are costly if custom and single-purpose if specialized.

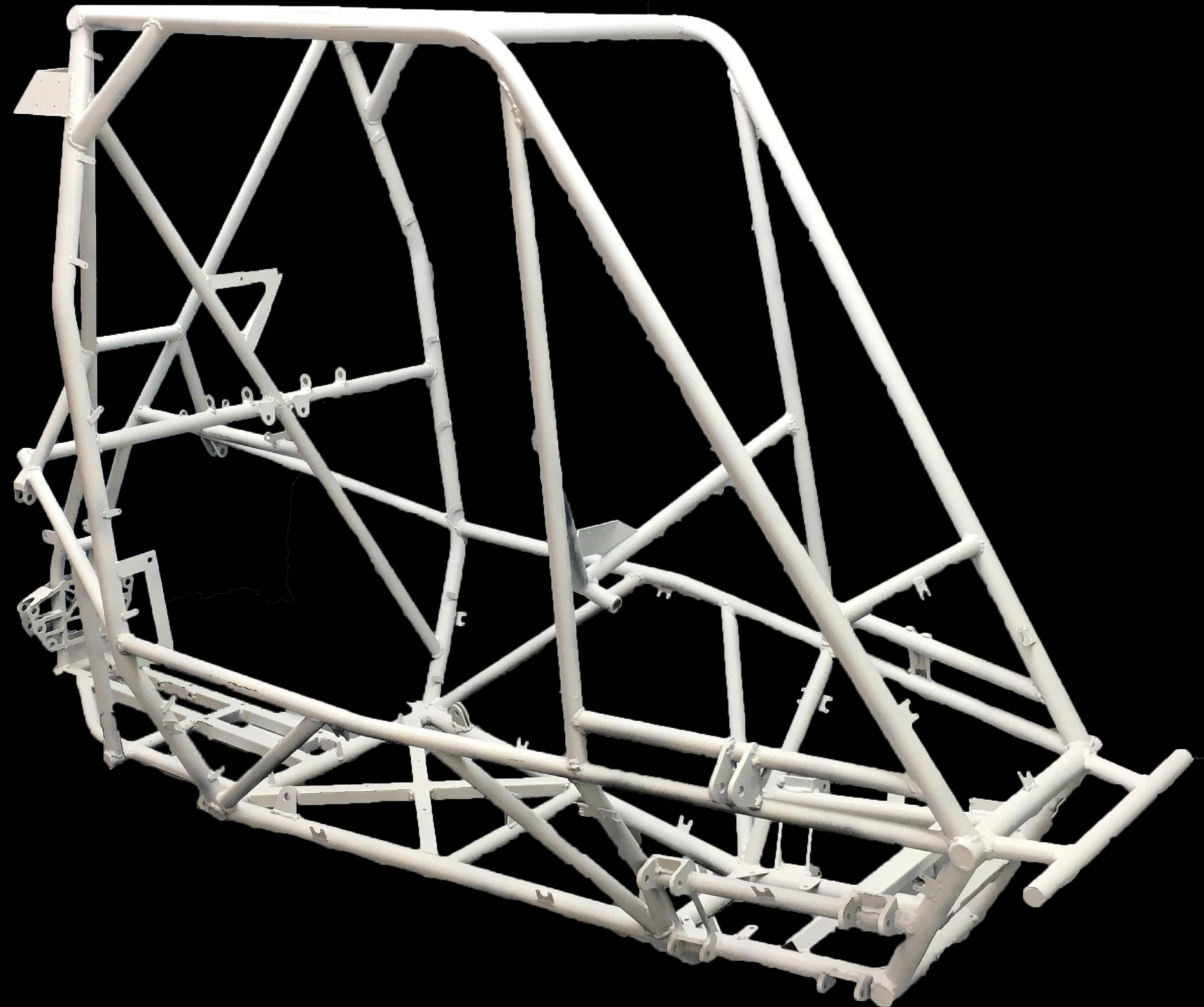


# FIXTURING CHALLENGES

As the structure gets more complicated, so does the fixturing.

Using off-the-shelf fixturing can be challenging and unwieldy.

Custom fixturing can ensure a precise and quality welding job.



**WHERE CAN 3D PRINTING HELP?**

# WHY 3D PRINT WELDING FIXTURES

Precision

Setup & Teardown

Cost

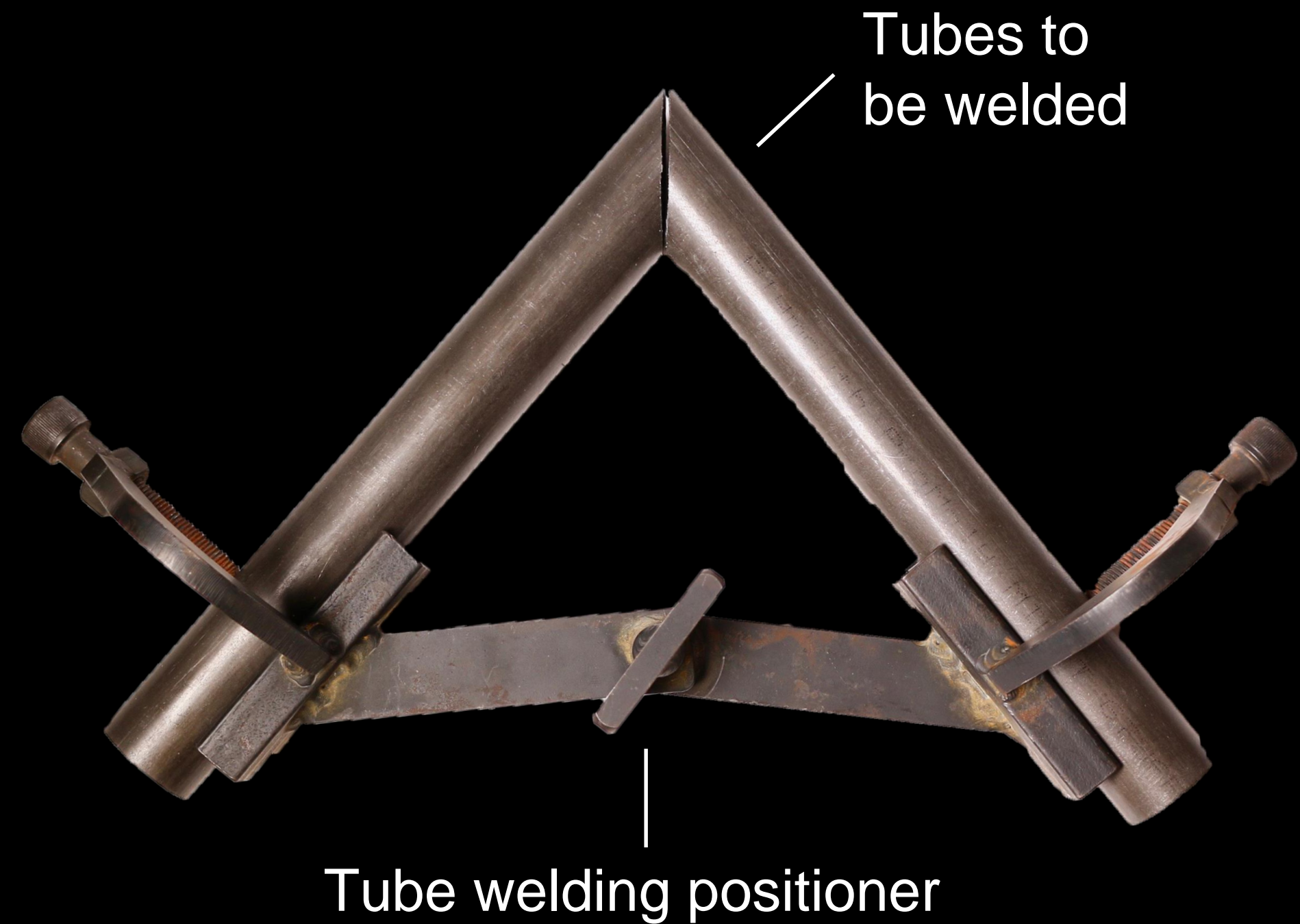


# PRECISION

Components in a welding assembly are difficult to precisely align.

Markforged printers have high precision and dimensional stability.

Fiber reinforcement delivers rigidity so fixtures won't deflect or deform.



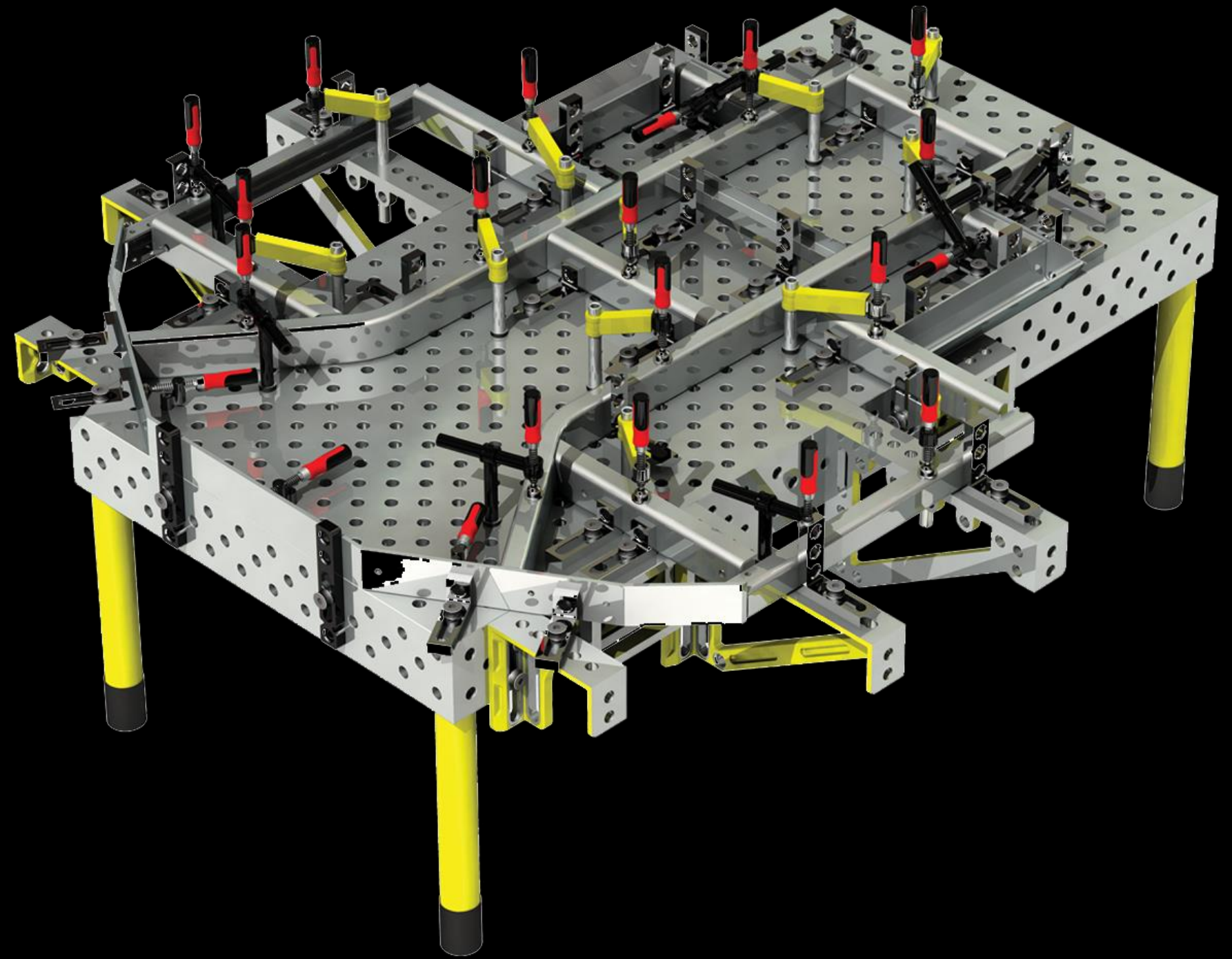


# SETUP & TEARDOWN

Both parts must be supported and aligned precisely on the welding table.

Fixtures must also be located and then aligned in conjunction with the part every setup.

Features on a custom printed fixture can allow for quick & simple alignment at a low price.

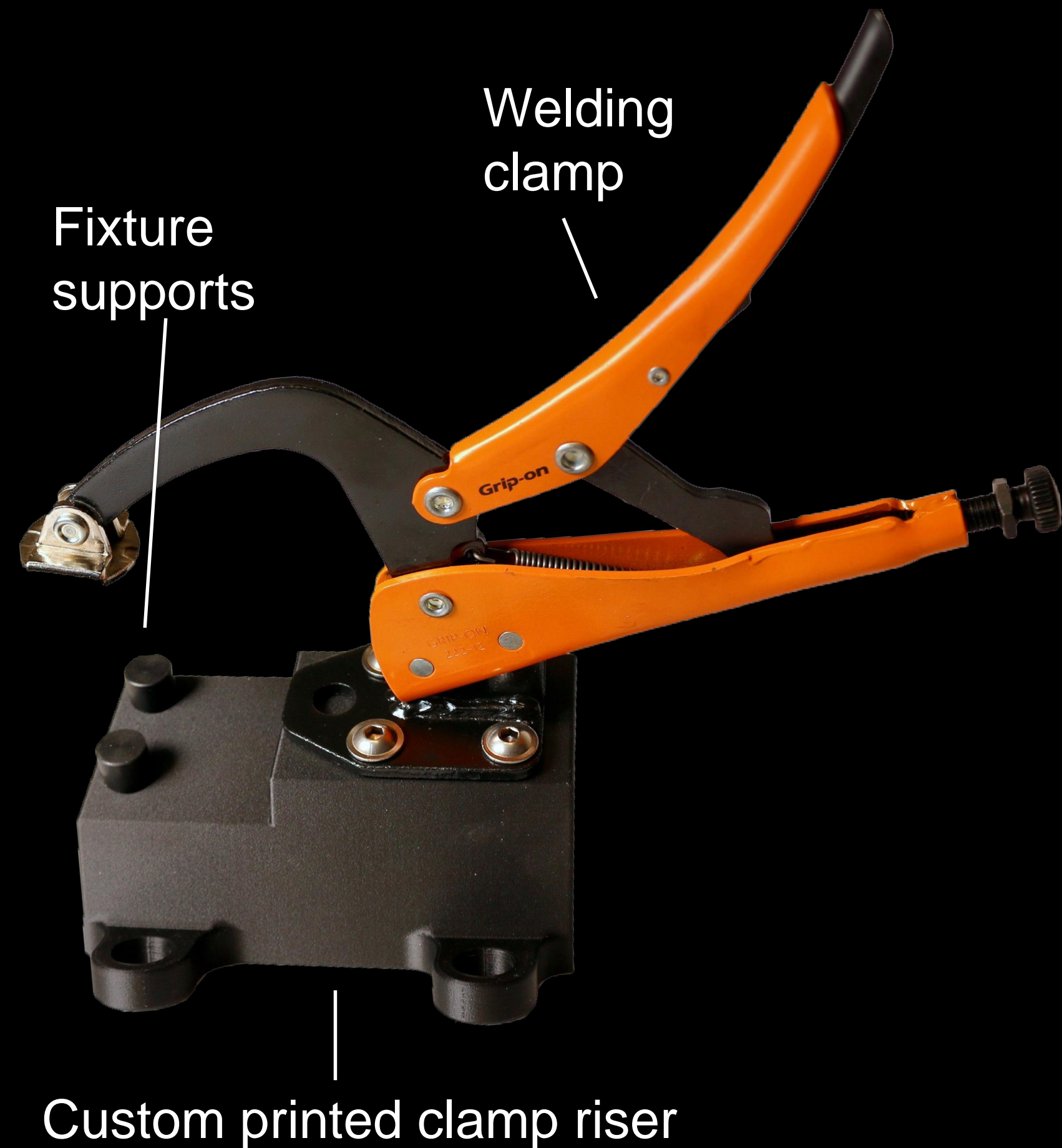


# COST

Machining custom fixtures comes with high costs and long lead times.

Custom fixturing may not be feasible for low volume production.

Markforged parts can replace machined components at a fraction of the cost and time.



# IMPLEMENTATION EXAMPLES

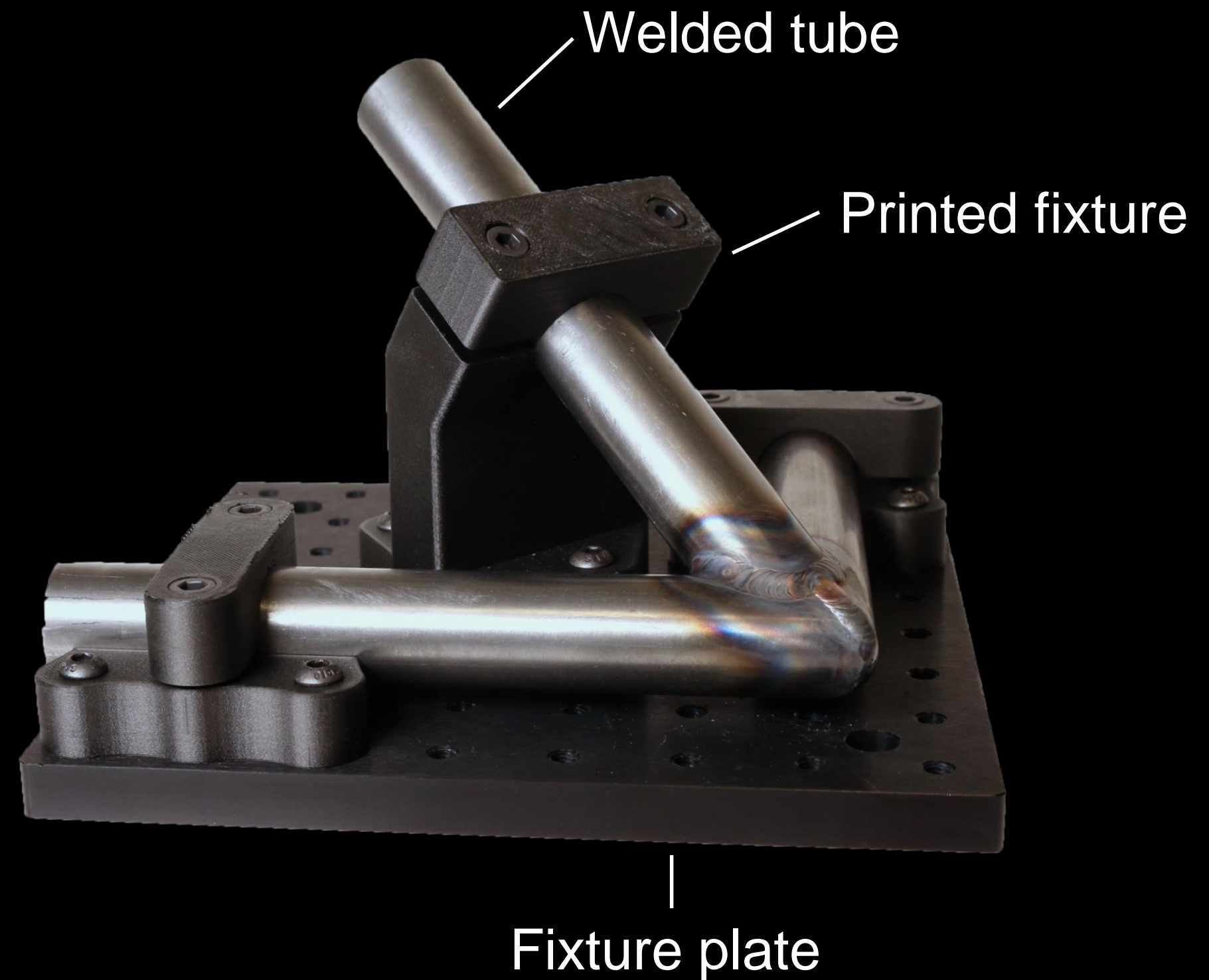


# PRINTED FIXTURING

Complex structures with non-standard geometries are difficult to fixture.

Traditional fixtures make the process lengthy and custom fixturing is costly.

Printed fixtures are an affordable solution for tack welding steel and simplify setup.









# PRINTED FIXTURING

Markforged materials have high heat deflection and will withstand if outside the heat affected zone.

The weld can be completed off the fixture after the tacking is complete.

Fiber reinforcement keeps the fixture rigid and stable during setup and welding.





# CUSTOM RISERS & MOUNTS

It may be necessary to keep the frame in the fixture during the entire welding job.

Standard welding fixtures do not guarantee a repeatable process.

Custom fixturing can be costly for odd orientations because of machining capabilities.





# CUSTOM RISERS & MOUNTS

Printed risers and mounts are cost effective and can be made quickly.

Inserted fixture supports isolate the heat and prevent it from spreading to the part.

Setup time is minimized as each fixture is uniquely designed for its application.



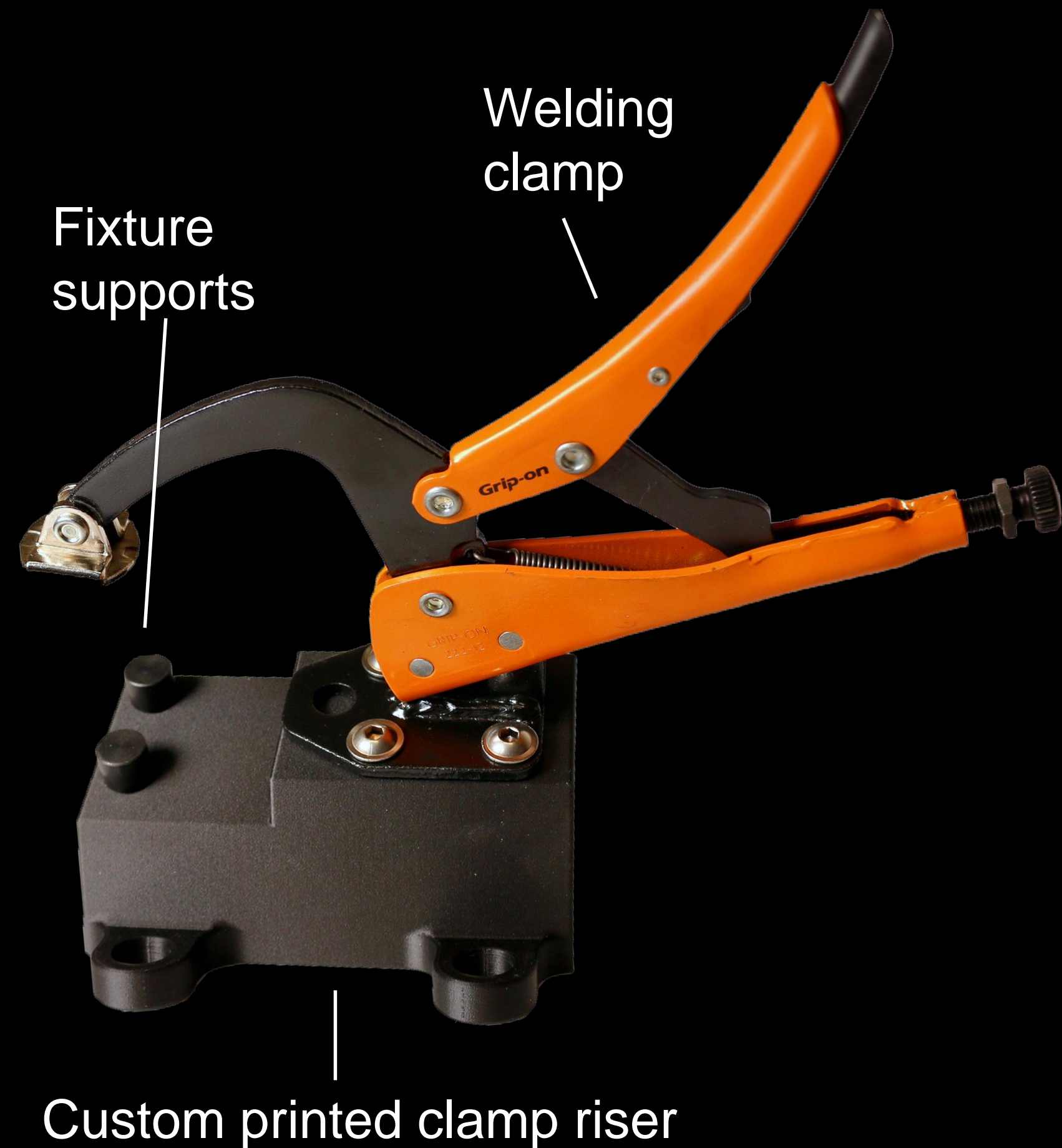


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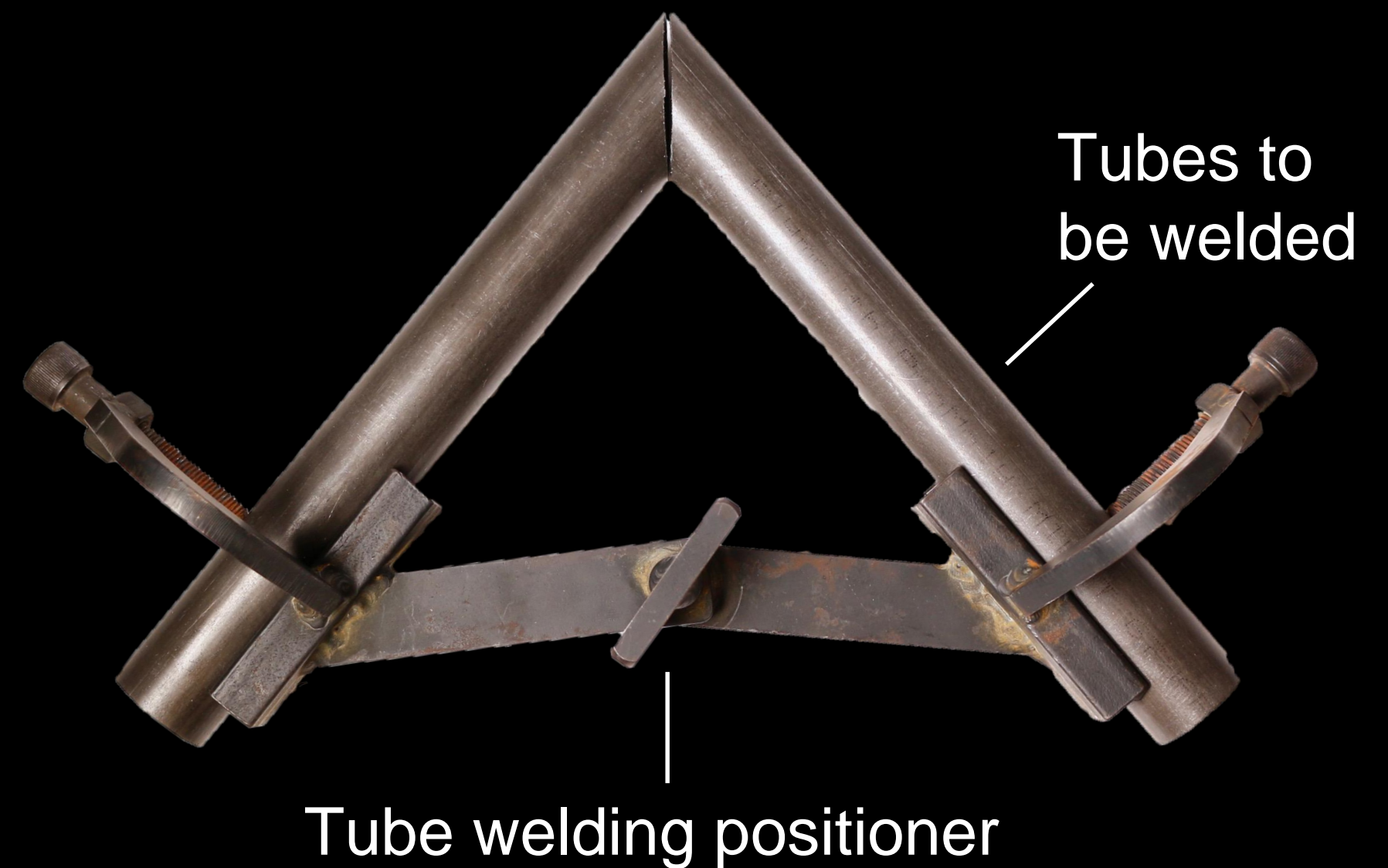


# ALIGNMENT JIGS & CHECK GAGES

Modular welding fixtures are imprecise and can lead to misalignment.

It takes time to adjust these types of fixtures to achieve the desired results.

Welds may need to be redone if the parts aren't held or oriented correctly.



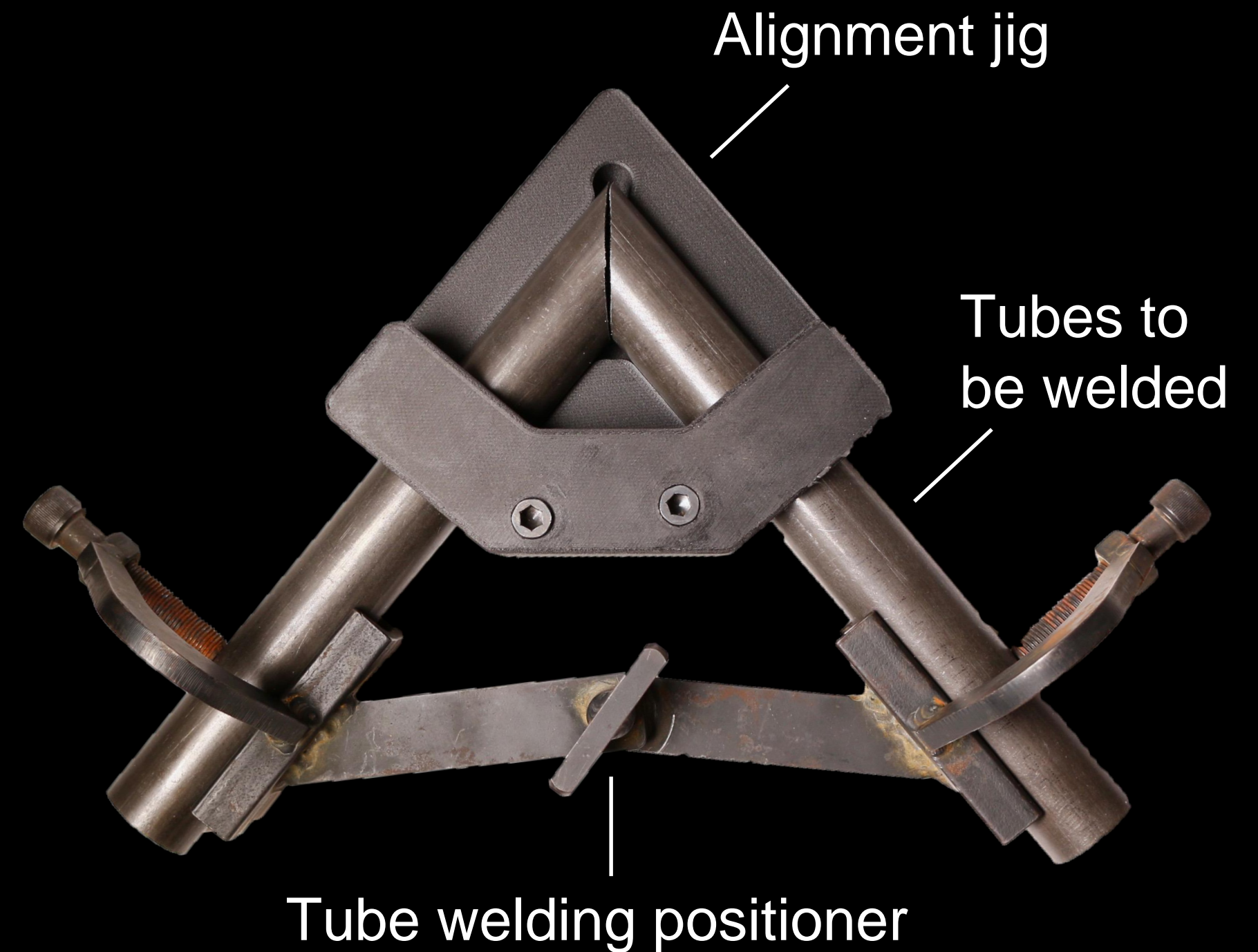


# ALIGNMENT JIGS & CHECK GAGES

A printed jig ensures proper part alignment during setup.

This decreases setup time and allows welders to confirm setups easily.

The jig can further act as a quality assurance tool to confirm the model meet specifications.



**QUESTIONS?**

[www.markforged.com](http://www.markforged.com)