STECKER MACHINE

Case Study

SMC

Partnership Ensures
Success On Turnkey
Clutch Housing
Cell Development

By The Numbers

(a high-level look at the project)

- **$3.5 million** invested
- **0.5%** machine downtime
- **1 partnership** between two industry leaders

It's quite an advantage to have a 40-year relationship to lean on when a key OEM customer turns to you with a complex machining project. Stecker Machine looked no further than State Machine Tool, a trusted partner for decades.

The task was to configure and create the most efficient and cost-effective work cell to machine vehicle transmission clutch housings, complex pieces with extreme tolerances. After some brainstorming, the teams at both companies agreed on a plan: a cell with two independent mirrored halves that use advanced, industrial robotics that meet in the middle at a synced CMM system.

SITUATION

We knew that we were challenging ourselves to develop a competitive solution that meets both large volumes and demanding quality.

— **Brad Kurtzweil,**
Co-President,
Stecker Machine

Castings loaded onto carousels are queued for input into the lathe.

The complexity of the vehicle transmission clutch housings was significant. Add to that the tolerance required and the high volume expected by the customer, and the project becomes challenging on many fronts.

State Machine Tool, a full-service machine tool distributor that serves medium- to large-size manufacturers, came to mind immediately as Stecker considered the project. Their ability to do full turnkey projects from start to finish (raw casting to finished part) made State Machine Tool a natural fit.

Plus, there's a unique relationship between Stecker Machine and State Machine Tool, which has helped Stecker grow and develop over the years. These two have collaborated on many projects for 40+ years, helping both grow and thrive.

Collaboration was vital. Early on, the teams sent potential machine solutions back and forth for each other to review and provide input. Stecker shared their customer's needs based on the prints and the parts, and State Machine Tool shared time studies and cycle time estimates that would be machined with this cell. State Machine Tool took on the responsibility for the machines and robotic automation including robot gripper jaws, chuck jaws, conveyors — and Stecker had responsibility for mill fixture, all cutting tools, and all CNC programs. This hybrid approach between buying machine tools or ordering a full turnkey system allows both partners to focus on what they do best. Stecker Machine focuses on CNC machining, and State Machine provides equipment and automation.

CHALLENGES

The nature of the parts presented some challenges: tight tolerances, complicated work-holdings, and achieving all specifications. Work-holdings required precise and robust design. Clamping pressures to the slightly pliable part affected its desired shape, so holding jaws needed to be adjusted perfectly so their pressure didn't deform the product's shape.

> *This is a cost-sensitive part, and we studied it for a while before quoting the project. It took upfront planning, robot design exploration, and collaboration to win the business.*
>
> — **Scott Waak,** Project Manager, Stecker Machine

To meet project demands, Stecker needed to purchase a new lathe: the Muratec MW400 — a new machine for Stecker, yet familiar to State Machine Tool. The MW400 is a self-contained automation platform for turning including twin spindles and integrated gantry loader.

The machine's capabilities were not in doubt, but there was an added challenge of orientating the part upon entry. The solution? Robotic vision is used. The gantry presents the part to a camera that measures the exact casting rotation and the spindle aligns to it. With eight different parts (four large, four small) eventually running through the cell, the camera also error-proofs the process by ensuring the correct casting is being machined.

During project development, the idea of fully auditing parts on the machine floor was discussed. Having a coordinate measurement machine (CMM) within the cell was a novel idea that could virtually guarantee product quality.

"Knowing that there would be a lot of parts produced very quickly, we wanted to inspect the parts as close to production as possible. With a CMM, we could check everything," says Brad Kurtzweil.

As desirable as that idea is, it created two more challenges: 1) interfacing the CMM within the system, and 2) determining how to handle parts if/when kicked out by the CMM; shut down the system? Keep production going? Resolving these issues required a solid reaction plan that minimizes the impact on production.

SOLUTIONS

We looked at this as a partnership. We knew from the beginning that situations would come up that changed from the original schedule. We're expecting to work together to solve small changes.

— **Jerry Kaye,**
Corporate Sale Manager,
State Machine Tool

Within a project of this scope, multiple solutions were needed: coordinating industrial robots, utilizing a CMM on the shop floor, seamless changeover of fixtures for different parts, and more. It's easiest to break solutions down into the areas required to pull each off.

THE TEAM

No solution works without the right people in place to build it. In this case, it meant that two State Machine Tool employees were embedded at Stecker during the project, providing guidance as the cell took shape.

A senior application engineer proved out the functionality of the Muratec MW400 lathe on the different parts. Working with Stecker engineers, they quickly solved the especially tricky work-holding pressure issue, which accelerated the project's success. A senior service engineer specializing in electrical engineering handled the interface of the cell's different components on the programming system. These two were on the shop floor daily for several months, and the corporate sales manager was regularly at Stecker.

> *With the amount of parts we'd be putting out in a day, we wanted to be able to track real-time data.*
>
> **— Brad Kurtzweil**

Stecker selected two experienced employees who were key to overseeing the cell's development. An experienced machinist who is a setup pro was chosen because of his background and ability to understand turning, milling, and the cell's robotic components. A long tenured, manufacturing engineer and lathe expert was instrumental working with State Machine Tool's engineers on the Muratec MW400, the new piece of equipment for Stecker. The team was key to success, putting in the extra effort to get over hurdles during development and when the rubber hit the road.

The team expanded to other experienced Stecker operators who were as adept at quality control as machining. An operator, who can run two machines with help from the robots, not only makes sure finished parts meet quality specs, they can also focus on renewing tools and ensuring inserts are replaced when needed.

The left side of the cell. The Muratec MW400 lathe is on the left, CMM results are displayed on the right, and the operator awaits machined, washed parts on the exit conveyor.

THE MACHINES

- 2 Lathes: Muratec MW400 twin-spindle, gantry loaded, OP10 and OP20
- 2 Mills: Toyoda FH500J horizontal machine center
- 3 Robots: 2 larger Fanuc robots, 1 small robot
- 1 CMM to check all parts
- 2 Washer/Dryers

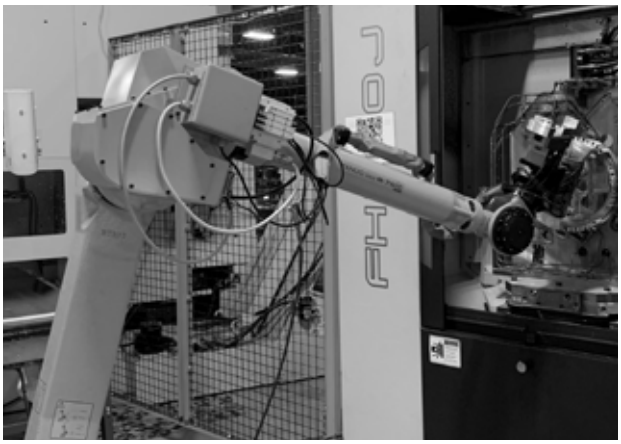
"Choosing the right equipment going in is critical on a cell like this to make sure that it maintains and runs for years without having a whole lot of trouble," says Jerry Kaye. There's no substitute for the reliability of uptime, and if an issue does arise, being able to service it immediately is important.

Stecker made the following investments in the clutch housing cell:

$2.7M Robotic Cells
(initial development)

+ $0.8M Manual Cell
(added later for additional capacity)

$3.5M Total

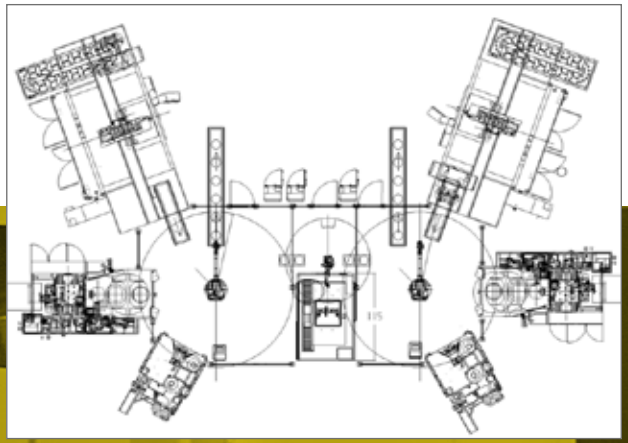


Robot loads the fixture in the Toyoda FH5000J horizontal machine.

THE CELL LAYOUT

Determining how a cell is configured depends on the equipment involved and what's required by the cell. Before considering components, teams at State Machine Tool and Stecker discussed machine layout, available floor space, and flow of the cell, including keeping the raw parts and finished parts separated.

The agreed-to floor design, featuring a mirrored layout, has the CMM in the center of the cell to handle both sides. In this configuration, the operator can access the machine tool and make offset adjustments on the control without interrupting production or stopping the robots. Finished parts of both cells are presented in one area, so a single operator can handle both parts of the cell, if needed.



The cell is mirrored (right to left) with a shared robot in the center and the CMM.

The cell's main HMI screen allows the operator to track the machining of parts and all safety functions (operator access doors).

Parts leaving the lathe on the way to the robot which places them in the mill (left) and then the washer/dryer (behind the robot).

Two parts from each side of the mirrored cell are checked by the CMM each hour. With a 12-minute cycle time, the CMM checks four parts total every hour. If the CMM itself requires attention, it can be accessed without interrupting production.

All machines in the cell communicate to the cell controller with an integrated HMI (human machine interface) that's presented to the operator who can see, at a glance, how the cell overall is performing. State Machine-provided leading edge technology with a first-time use of ethernet IP to communicate between all machines and robots (Fanuc) and the Allen Bradley cell controller.

THE PROCESS

Here are the steps involved throughout the entire cell:

1. Raw parts loaded by operator into palletized conveyor system
2. Robot pick up part, raise and rotates it
3. Camera system orients and checks part
4. OP10 lathe machining in first spindle
5. Robot flips part, places in second spindle chuck for OP20 machining
6. Gantry holds part to dot peen marking unit for PN, timestamp, serial number, cell ID
7. Placed onto outfeed conveyor
8. Mill machining (horizontal)
9. 5-station rotating table wash, rinse, dry
10. Placed onto outfeed conveyor to operator
    - Parts to be checked in CMM placed on cooling table
    - CMM robot alternates both sides and loads CMM
    - Approved parts returned to outfeed conveyor to operator (not approved to reject slide)
11. The operator reviews the CMM process on a video monitor to oversee results and spot trends

A DEDICATED CMM — MAXIMIZE PRODUCTION, MINIMIZE RISK

Having three robots within one cell may initially sound like the most impressive aspects of the project. Yet, it's the inclusion of a CMM on the shop floor that's really the eye-opener.

Typically, parts to be checked are on a CMM in a Quality Assurance Lab throughout the day. However, this cell, with its own CMM, allows Stecker to get a real-time look of the cell's performance. It checks upwards of 100 critical and non-critical features (some impossible to measure by hand with gauges), and if any is out of tolerance, it's immediately removed and evaluated.

> *When you look at typical auditing systems, monitoring production with a CMM like this is only done 5% of the time, if that.*
>
> **— Jerry Kaye**

"The parts are both high-volume and have critical tolerances. Instead of checking one part per shift, we're checking four parts per hour with the in-cell CMM," says Brad Kurtzweil.

Stecker purchased the CMM from Hexagon Manufacturing Intelligence, maker of fully integrated shop-floor CMMs, yet it was State Machine Tool who ensured the software interfaced properly with the cell robots.

"Jerry's (State Machine Tool) work to integrate the CMM with the two other robots in the cell was tremendously helpful. His past experience with cells like this got all software talking," Scott Waak says.

In addition to the CMM, tracking of each part is also done: a dot peen marking unit applies a part number, machine number, cell number, plus date and time of when the part was lathed and milled. All of these initiatives greatly minimize the possibility of defective parts.

The robot loads/ unloads the CMM where parts are checked against specs. Up to 100 critical features are checked.

RESULTS

RESULTS OF THE CLUTCH HOUSING PROJECT

ERP data measures both clutch plate robot cells uptime exceeds 95% over a one-year period.

STATE	PERCENT
Run	92.5%
Setup	2.6%
Unplanned Maintenance (Equipment Issue)	0.5%
Other Unplanned Maintenance	0.3%
Planned Maintenance	0.6%
Engineering Changes, Tooling Improvements, Other	3.5%

The uptime on the three clutch housing cells is outstanding. Over the last year, the cell was running or in setup 95% of the time. That's an estimated <0.5% downtime for the machines, robots, and automation.

The cell was running at capacity with incredible efficiency. Life was good. Then, the transmission manufacturer increased its demand for these successful parts. When the volume of the project increased, expansion was clearly needed.

An additional cell including Muratec MW400 and Toyoda FH500J, was built to meet demand. Programming was done in only two weeks to get it up and running.

"Working individually, neither Stecker nor State Machine Tool could've come up with such a robust, cost-competitive solution. The collaboration was key; we lean on them, they lean on us," says Brad Kurtzweil.

This successful project has sparked future initiatives and won new projects, including more using robotics. This project has also deepened the respect between Stecker and State Machine Tool and continues to create opportunities for both.

With the amount of parts we'd be putting out in a day, we wanted to be able to track real-time data.

— Brad Kurtzweil

SMC

Stecker has the capabilities and creativity to tackle challenging projects (small to large).

Visit SteckerMachine.com to learn more or call 920-726-4526.