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SAMPLE DELIVERABLE

Site Assessment Analysis and Report

Throughput Recovery

Corvane Fluid & Thermal Systems | Ridgeline Plant

PREPARED FOR

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Sample deliverable. This report is a composite. Company names, people, locations, and figures have been changed to protect client confidentiality. The method, analysis, and recommendations reflect our work.

How to Read This Sample

This is a sample of the report a Webineering site assessment delivers. It is a composite. Company names, people, locations, and figures have been changed to protect client confidentiality. The method, the analysis, and the recommendations reflect our work.

What each part of the report shows:

Report section	What it shows
3.1–3.3 Constraint map and furnace model	Locating the constraint from WIP, queue, and capacity data, and sizing what is recoverable
3.4 Estimating accuracy	Estimate-to-actual study across thousands of operation records
3.6 Chemistry and contamination control	Process discipline on special processes under load
3.7 MRB and material substitution	Quality workflows outside the ERP and a forced material change
3.8 Material visibility	Scan compliance and inventory record accuracy
4.6 Shift leadership	Tier meetings, leader standard work, and 5S
5.1 and Appendix D Metrics	Flow metrics with formulas, benchmarks, and sequencing

Engagement at a Glance

Item	Detail
Question we were asked	Why has on-time delivery fallen while the plant reports record output, and what will it take to recover?
Duration	2-week pre-visit data review, 2.5 days on site across all three shifts, 3 weeks of post-visit analysis
Evidence base	13 months of daily metrics, a 3,956-job WIP snapshot, 9,840 operation time records, a 13-week furnace load log, 23 structured interviews
Areas covered	CNC machining, vacuum brazing, coating line, precision cleaning, cleanroom assembly, leak test, data-center assembly line, CMM inspection, outside processing, receiving, stores, and shipping
Deliverables	This report, the constraint model behind it, and a 90-day action plan with owners

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2 Background & Context
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1 Executive Summary

Ridgeline can bring on-time delivery back above 85% within two quarters without a capital request, once the braze backlog clears and the CMM lab keeps pace (assumptions in Appendix C). The plant's binding constraint is Furnace 2, the only vacuum furnace large enough for data-center parts. Measured in effective loads, it delivers about a third of a full week's output; partial loads, thermal-profile changeovers, re-brazes, and unstaffed weekend hours take the rest. Changing how the furnace is loaded, staffed, and fed raises effective braze output by about 48%, which is more than the gap between what the furnace produces today and what demand requires.

The constraints documented here cost the plant an estimated $5.0M per year, with a further $2.1M of one-time working capital available by clearing the certification packet queue, releasing material held for requalification, and shortening outside processing. These are order-of-magnitude estimates built from operating data. They exclude lost or delayed revenue, which is the larger exposure.

What Changed at Ridgeline

Data-center liquid-cooling hardware grew from 12% to 36% of Ridgeline's shipments in 13 months. That business runs higher volumes, shorter lead times, and far more engineering changes than the semiconductor equipment work the plant was built around. Both product lines now share the same furnace, the same CMM lab, the same cleaning line, and the same planners.

The team absorbed that growth with real effort. Machining hours are at 112% of target, the braze cell runs three shifts, and leadership holds daily tier meetings on first shift. The plant's systems for scheduling, change control, and measurement were designed for a slower, lower-mix business, and they have not kept pace.

Where We Stand

Measure	Sep 2025	Sep 2026	Target
On-time in-full (OTIF)	86.4%	58.2%	95%
Past-due order value	$1.12M	$6.41M	$0.5M
Work in process	–	$14.02M across 3,956 jobs	–
Share of WIP downstream of machining	–	76%	below 50%

One of the plant's two largest customers, a hyperscale integrator, has issued a formal corrective action request and begun qualifying a second source for two cold plate families. The largest semiconductor customer has moved Ridgeline to conditional status on its supplier scorecard.

The Plant Measures Activity, and Activity Looks Strong

Every department report we reviewed showed a department working hard. Machining is over its hours target. Furnace 2 logs 101 run hours a week and is described on the floor as fully loaded. None of the reports shows how many effective loads leave the furnace each week, so the loss of flow at the plant's tightest point went unseen for most of the year.

The plant's reports count effort, and none of them counts what leaves the furnace each week. That gap is the central finding of this assessment, and every recommendation in this report closes part of it.

Why Furnace 2 Is the Constraint

The braze cell holds $3.42M of WIP, 24.4% of the plant total, with an average wait of 19 days. In an average week, Furnace 2's 168 hours break down as follows: 101 hours running loads, 40 hours unstaffed, 11 hours waiting for parts or fixtures, 10 hours on profile changeovers, and 6 hours of maintenance.

The loads it does run are 60% full on average. One load in three goes in partial to expedite a late order, and 7.8% of brazed parts fail leak test and go back for a second braze cycle. Counted in effective loads, it produces 5.2 per week against demand of 6.4, so its queue grows every week. An effective load is one full furnace load that passes first time; a partial load counts by its fill. Those 5.2 loads equal about 56 hours of furnace time, one third of the week.

What Feeds the Constraint

The furnace queue starts upstream. The data-center line released 214 engineering changes in six months, against 37 on the semiconductor side, and 61% reached the floor after material had already been released. Machining on new data-center parts runs 34% over its time estimates on average, so parts reach braze late and in bursts. Each burst triggers expediting, expediting triggers partial loads, and partial loads cut the furnace's real output further.

The same engineering changes tripled first-article inspection demand at the CMM lab, which is the plant's secondary constraint. Outside plating and passivation, the tertiary constraint, adds 24 days on average and returns 6.2% of lots without a traceable job ID.

What to Do Now (0–90 Days)

Phase 1 uses scheduling, staffing, and process discipline. None of it needs a capital request.

- Run Furnace 2 in campaigns by thermal profile, with a minimum fill rule and a written expedite policy.
- Add a Saturday second shift and assign a dedicated load-building crew so the furnace never waits for a load.
- Return nine fixture sets to service, and qualify 14 short part numbers on the underused Furnace 1.
- Release machining work to the furnace schedule and hold a time buffer in front of the furnace.
- Add second-shift CMM coverage and triage first-article work by change class.
- Close 318 completed-but-open jobs worth $1.91M, and fix scan compliance at outside-processing receiving.
- Extend tier meetings and leader standard work to second and third shift.

What to Build Toward (3–18 Months)

Phase 2 fixes the conditions that created the constraint: engineering change control for the data-center line, corrected time standards for new parts, MRB and material-substitution workflows inside the ERP, chemistry and contamination control on the coating and cleaning lines, and a flow-based metrics set. Phase 3 carries those requirements into the Strathmoor ERP template and the planned MES, and builds depth behind the two people who hold most of the plant's braze and cleanroom knowledge.

A third-furnace request should wait until Phase 1's recovered capacity is in use, so the business case rests on demonstrated throughput.

Recommendation

Start Phase 1 within 30 days, led by the plant General Manager with a weekly constraint review. The constraint model, metrics, and change-control process built here carry to Corvane's other two plants and should shape the Strathmoor ERP template. Webineering recommends a structured implementation engagement that measures progress against this baseline and re-maps the constraint as it moves.

2 Background & Context

Ridgeline is the largest of Corvane's three plants and the one carrying the business unit's data-center growth. That growth is part of Strathmoor's public growth story, so the plant's delivery performance now shows up in segment results and in what the parent commits to investors.

2.1 Corvane and Strathmoor's Growth Commitments

Corvane Fluid & Thermal Systems is a business unit within the Advanced Technologies segment of Strathmoor Industries, a publicly listed diversified industrial company. Corvane designs and builds precision fluid-handling and thermal-management hardware for two markets: semiconductor capital equipment and data-center liquid cooling.

Strathmoor has told investors that the data-center thermal business will roughly double over the next three years. Corvane carries most of that commitment. Delivery failures at Ridgeline therefore affect more than one plant's scorecard: they put the segment's growth guidance, its margin targets, and Strathmoor's credibility with two strategic customers at risk.

This context shapes how the recommendations should be read. Capital requests at Strathmoor require a payback case and segment approval, and a rollout of the corporate ERP template and operating system is already scheduled. Recommendations here are sequenced to recover performance inside the plant's existing authority first, and to feed corrected requirements into the corporate programs second.

2.2 The Ridgeline Plant

Attribute	Detail
Facility	215,000 sq ft, high-mix precision machining, brazing, finishing, and assembly
Headcount	440 employees
Shipments	$9.7M per month on average over the last quarter
Operating pattern	Machining and braze 24 hours Monday–Friday plus Saturday day shift; other areas on two shifts
Semiconductor products	Gas-delivery manifolds and weldments, aluminum gas-panel bases, brazed stainless chamber cooling plates, cleanroom subassemblies
Data-center products	Copper cold plates, coolant manifolds, coolant distribution unit (CDU) subassemblies
Key processes	5-axis and horizontal CNC machining, two vacuum braze furnaces, in-house conversion-coating line, precision cleaning, ISO Class 5 and Class 7 cleanroom assembly, helium leak and flow test, CMM inspection
Outside processes	Nickel and gold plating, passivation, heat treat
Customers	Two semiconductor equipment OEMs (42% of WIP combined), a hyperscale integrator and a CDU manufacturer (34% combined), 40+ smaller accounts
Certifications	ISO 9001, ISO 14644-1 cleanroom classification
Systems	Legacy site ERP in use for 12 years; migration to the Strathmoor ERP template planned within 14 months; MES pilot proposed by corporate

2.3 Engagement Objectives

Corvane's VP of Operations engaged Webineering to answer four questions:

1. Where is the plant's throughput constraint, and how severe is it?
2. Why has delivery deteriorated while every department reports strong output?
3. Can current staffing, shift patterns, and equipment support the data-center growth plan?
4. What should the plant fix now, and what should it build toward so the next stage of growth does not produce the same result?

2.4 Systems Landscape: ERP Template and MES

The legacy ERP holds job routings, inventory, and shipping. Scheduling happens in the ERP and in a set of planner spreadsheets. MRB records, material substitutions, first-article status, and certification packets are tracked outside the ERP in spreadsheets and shared folders.

Strathmoor plans to move Ridgeline onto its standard ERP template within 14 months, with an MES pilot to follow. We support both. The template will only schedule well if Ridgeline's routings, time standards, and change-control rules are corrected before migration. Several findings in Section 3 are written as requirements the template and MES must meet.

> **KEY INSIGHT**
> A new ERP configured around today's routings will schedule against time standards that understate new-part run times by about a quarter and will have no record of the furnace's real capacity. Correcting the process and the data first protects the value of the system investment.

2.5 Methodology and Evidence

The assessment combined four streams of evidence. Where they agree, confidence in a finding is high. Where they diverge or data was incomplete, we say so in a data confidence note.

Stream	What we did
Pre-visit data analysis	Reviewed 13 months of daily metrics, a WIP snapshot, 13 weeks of operation time records, and the furnace load log; built a preliminary constraint hypothesis and interview plan
On-site observation	Walked material flow end to end on all three shifts, timed furnace loading and changeovers, observed tier meetings, audited 5S in braze prep and cleanroom gowning
Stakeholder interviews	23 structured interviews across plant leadership, planning, engineering, quality, shift leads, operators, receiving, and shipping
Post-visit analysis	Built the furnace capacity model, WIP aging and concentration analysis, estimate-to-actual variance study, engineering change analysis, and the financial impact model

A full list of data sources and where each is used appears in Appendix A.

3 Site Assessment: Current State

Ridgeline's delivery problem is a flow problem centered on one furnace. Work piles up in front of Furnace 2, then again at CMM inspection and outside processing, while every upstream department reports strong output. This section is organized by theme because the causes cross departments.

3.1 Delivery Performance and the Activity–Flow Gap

OTIF fell from 86.4% to 58.2% between September 2025 and September 2026. Past-due order value rose from $1.12M to $6.41M over the same period. In those 13 months, machining hours rose from 101% to 112% of target and the data-center share of shipments tripled from 12% to 36%.

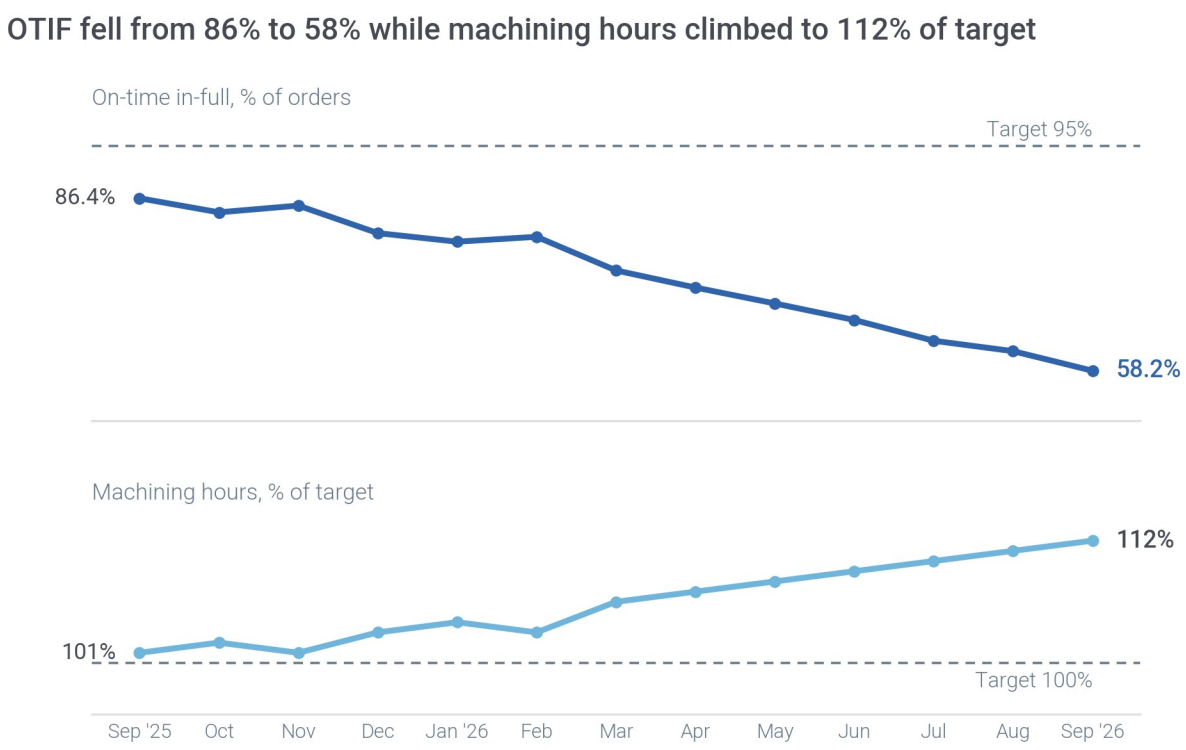


Figure 3.1 · Daily metrics workbook, Sep 2025 – Sep 2026 · Values adjusted for confidentiality

Jobs now take longer than quoted on both product lines. The velocity ratio (actual cycle time divided by quoted lead time) is 1.41 on data-center jobs and 1.18 on semiconductor jobs.

KEY INSIGHT

The plant's daily reports track hours worked, machine run time, and units completed by department. Each one rose while delivery fell. No report shows good output at the constraint or the queue in front of it, so the furnace queue grew for most of a year before it was named as the problem.

DATA CONFIDENCE NOTE

OTIF is calculated from ERP ship dates against promise dates. Promise dates were reset on 18% of data-center orders during the period, so OTIF against the original commitment is likely lower than reported. Recalculating OTIF against the first committed date is a Phase 1 action.

3.2 Constraint Map and WIP Distribution

WIP shows where work accumulates, and at Ridgeline it sits overwhelmingly downstream of machining.

Measure	Ridgeline	Healthy high-mix plant
Total WIP	$14.02M across 3,956 jobs	–
WIP in the braze cell	24.4% ($3.42M)	below 10%
Share of WIP downstream of machining	76%	below 50%
Upstream to downstream WIP ratio (excludes MRB holds and engineering)	1 : 4.6	about 1 : 1
Completed but not closed	13.6% ($1.91M, 318 jobs)	near 0%
Jobs more than 60 days at one location	29.9% (1,184 jobs)	below 10%
Largest customer share of WIP	29%	below 25%
WIP turns (annualized)	8.3×	10–15×

The braze cell holds 24% of plant WIP, more than any other area

WIP value by area: $14.02M across 3,956 jobs

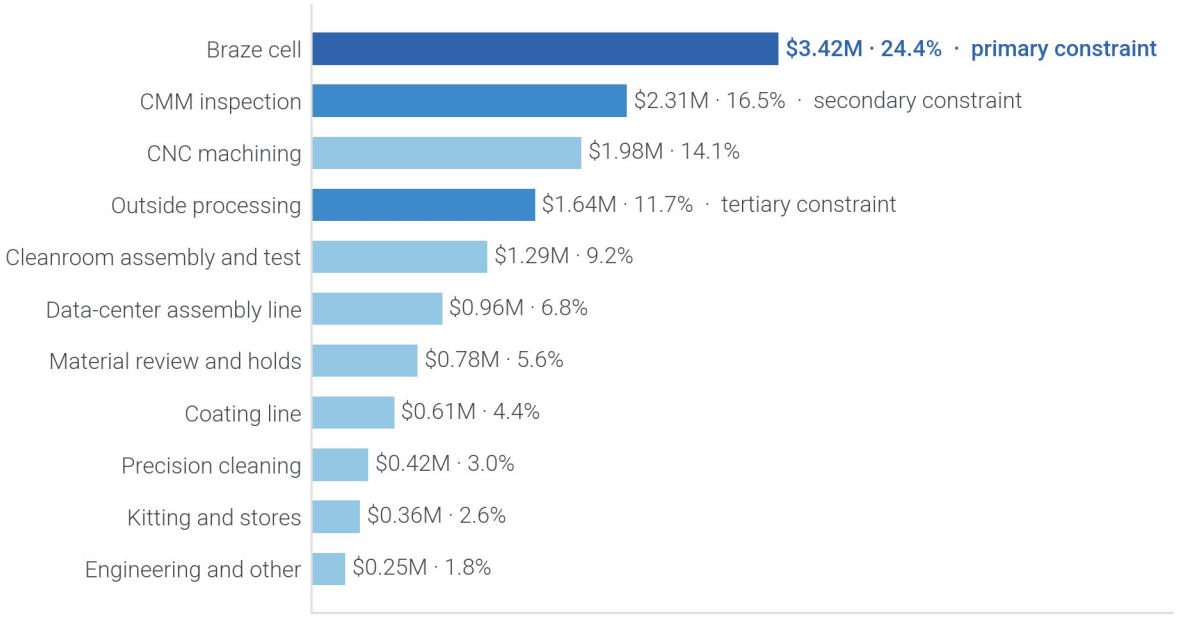


Figure 3.2 · WIP snapshot, September 14, 2026 · Values adjusted for confidentiality

Primary Constraint: The Braze Cell

The braze cell holds $3.42M across 486 jobs, with an average wait of 19 days. Its value per job ($7,000) is the highest in the plant, because parts arrive fully machined and cleaned. Section 3.3 explains why the furnace cannot keep up.

Secondary Constraint: CMM Inspection

The CMM lab holds $2.31M across 402 jobs, waiting 11 days on average. First-article inspection demand from data-center engineering changes drives most of the queue (Section 3.5).

Tertiary Constraint: Outside Processing

Plating and passivation vendors hold $1.64M across 371 jobs, out an average of 24 days.

Completed but Not Closed

318 jobs worth $1.91M are physically finished but still open in the ERP. They inflate WIP and distort every WIP-based metric, including the turns and aging figures in this section. Figure 3.2 counts them at their last ERP location.

DATA CONFIDENCE NOTE

WIP figures come from a single-day snapshot taken September 14, 2026. Two prior month-end snapshots show the same pattern of downstream concentration, so the structure is stable even though individual values move daily.

3.3 The Primary Constraint: Furnace 2

Ridgeline runs two vacuum braze furnaces. Furnace 2 is the only one long enough for data-center manifolds and large chamber cooling plates, and it handles 78% of braze volume. Cycles average 10.6 hours because heavy copper fixtures need a slow cool before gas quench. It runs copper cold plates and stainless semiconductor parts on different thermal profiles, and the two cannot share a load. Furnace 1 is older, takes parts up to 24 inches, and runs only 46% of its staffed hours.

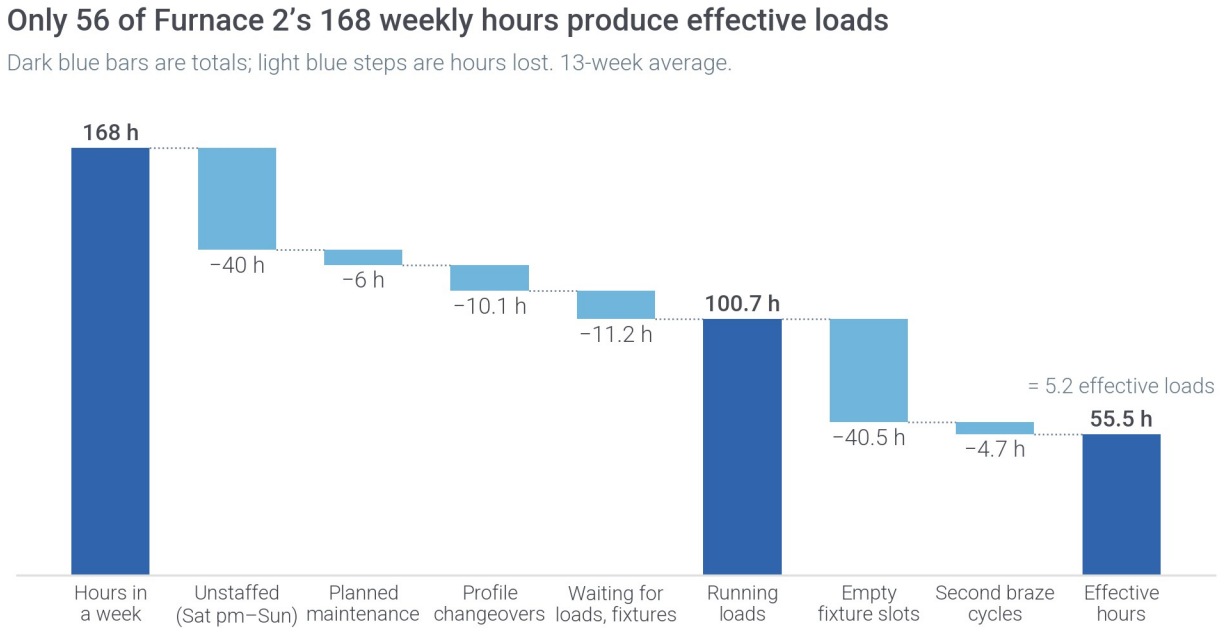


Figure 3.3 · Furnace 2 load log, 13 weeks to September 2026; 10.6-hour average cycle · Values adjusted for confidentiality

Furnace 2 is staffed 128 of 168 hours each week. Of those staffed hours, 101 are spent running loads; the rest go to profile changeovers, maintenance, and waiting for a load to be ready. The 40 unstaffed hours run from Saturday afternoon to Monday morning.

Furnace 2 load measure (13-week average)	Value
Loads per week	9.5
Average load fill (fixture slots used)	60%
Loads run partial to expedite an order	33%
Thermal-profile changeovers per week	4.2 (about 2.4 hours each)
Parts needing a second braze cycle	7.8%
Effective loads per week	5.2
Demand in full-load equivalents per week	6.4

Three causes drive the low fill. Planners schedule the furnace by due date, so profiles alternate several times a week. Customer service escalations go straight to the braze lead, and the furnace is run partly empty to ship one order. Nine of 31 data-center fixture sets are out for repair, so loads are sometimes short for lack of fixtures.

Scheduling, staffing, and fixtures recover enough of this loss to cover today's demand without a new furnace.

Lever	Current	Phase 1 target
Staffed hours per week	128	136 (Saturday second shift)
Profile changeovers per week	4.2	2.8 (campaign scheduling)
Average load fill	60%	72% (minimum fill rule, fixtures restored)
Second braze cycles	7.8%	5.0%
Loads per week	9.5	11.3
Effective loads per week	**5.2**	**7.7 (+48%)**

At 7.7 effective loads per week against demand of 6.4, the furnace gains about 1.3 loads a week. The braze queue holds about 14 load-equivalents, so it clears in about 11 weeks once the changes are in place.

KEY INSIGHT

Part of Ridgeline's constraint is structural: the plant has one furnace for long parts. Most of it is self-inflicted, created by how the furnace is scheduled, loaded, and staffed. The self-inflicted part can be fixed in weeks. The structural part should be addressed with capital only after the recovered capacity is in use.

DATA CONFIDENCE NOTE

The furnace log is a paper record transcribed weekly. Fill is measured in fixture slots used, which approximates load mass and volume. A thermocouple-and-door-cycle data capture on Furnace 2 would confirm these figures within two weeks.

3.4 Upstream Drivers: Engineering Change and Estimating Accuracy

Two upstream conditions make work arrive at the furnace late and in bursts.

Engineering Change Churn

The data-center line released 214 engineering changes in six months, against 37 on the semiconductor side. 61% of data-center changes reached the floor after material had been released, and new data-center

parts average 2.3 revisions before they stabilize. The plant has no change classes, so every revision is handled the same way and every revision triggers a full first-article inspection.

Estimating Accuracy

We analyzed 9,840 operation time records from June through August 2026, including 2,416 CNC records with run-time estimates. CNC operations used 4,410 more hours than estimated, a 12.7% overrun against 34,800 estimated hours.

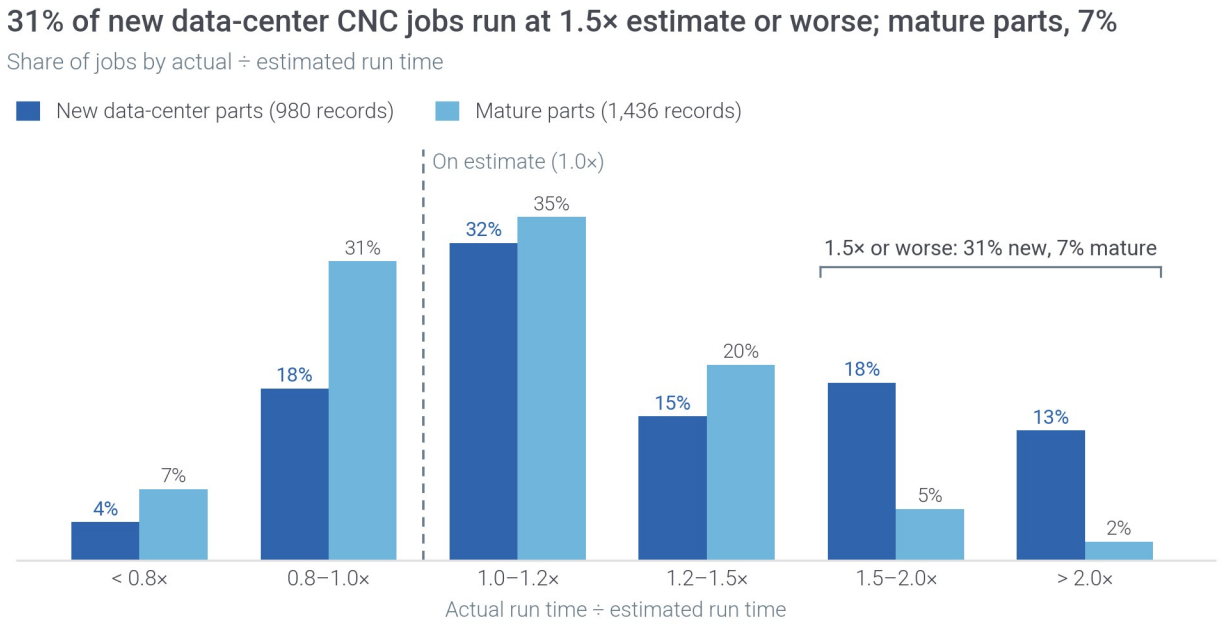


Figure 3.4 · 2,416 CNC operation records with run-time estimates, June – August 2026 · Values adjusted for confidentiality

The overrun is concentrated in new data-center parts. Mature semiconductor parts run at a mean of 1.12× and a median of 1.01× their estimates. New data-center parts run at a mean of 1.34× and a median of 1.14×, with a long tail of jobs above 2×. At a $104 per hour work-center rate, the overrun costs about $459K per quarter, or $1.83M per year.

Interviews point to three likely causes. Estimates for new copper parts were copied from similar stainless parts, and copper machines differently. Fin skiving and deburring steps are missing from many routings. First-piece prove-out time on revised parts is booked as run time.

The effects cascade:

- **Delivery dates slip before the furnace sees the part.** A schedule built on light estimates commits dates the plant cannot meet.
- **Expediting replaces the schedule.** Late parts become hot jobs, and hot jobs become partial furnace loads.
- **Margin erodes quietly.** Quotes built on the same estimates understate cost on the fastest-growing product line.

3.5 Secondary and Tertiary Constraints

CMM Inspection

The lab has three CMMs and five programmer-operators: four on first shift and one on second, with no weekend coverage. First-article inspections rose from 41 to 128 per month as data-center revisions grew. About 23% of CMM time goes to reruns and program edits on revised parts, because programs are rebuilt for each revision.

Outside Processing

Plating and passivation hold $1.64M across 371 jobs. The gold plating vendor is single-sourced and averages 31 days. Shipments go out twice a week in batches. 6.2% of returned lots arrive without a traceable job ID, and matching them takes 2.1 days on average.

3.6 Process Discipline in Chemical, Cleaning, and Test Processes

The plant's special processes have controls on paper that are not consistently followed under load.

- **Coating line.** Bath titration logs are complete on 78% of shifts, and replenishment is set by operator judgment. Three out-of-specification chemistry events in 13 weeks led to 44 lots being stripped and recoated.
- **Precision cleaning and cleanroom.** Cleaned parts wait in open staging for up to three days because of the braze queue, and 11% of lots are re-cleaned before braze. The cleanroom logged nine particle-count excursions in 13 weeks, and gowning compliance was 86% in our audit.
- **Leak and flow test.** 38% of helium leak results are recorded by hand. One of two test stands was down 11% of available hours. The flow test has no current gauge repeatability and reproducibility study.
- **Data-center assembly line.** The pallet conveyor line is designed for 42 units per shift and averages 29. On short shifts it waits for brazed cold plates 54% of the time, and the pressure-decay test station runs at 1.4× takt.

3.7 Quality System and Documentation Flow

MRB

97 MRB records are open with a median age of 34 days, and 141 jobs worth $780K sit in holds. MRB is tracked in a spreadsheet, and 41% of records have no root-cause code, so repeat failures cannot be trended.

Material Substitution

A supplier allocation on an elastomer gasket compound forced an alternate material onto 16 data-center part numbers. Eleven are waiting for customer requalification, holding $430K of WIP. The plant has no standard qualification protocol, so one engineer handles each case individually.

Certification Packets

212 finished semiconductor jobs worth $1.18M are waiting for certification packets, with a median wait of nine days. Each packet is assembled by hand from five sources: material certifications, the cleanliness report, the leak test record, the CMM report, and the traveler.

3.8 Material Visibility and Inventory Accuracy

Scan compliance at move transactions is 73%, and inventory record accuracy from cycle counts is 89% against a 98% target. Planners told us they spend about two hours a day walking the floor to locate jobs,

most often in braze staging and outside-processing receiving. Inventory adjustments cost about $240K over the last year.

3.9 Staffing, Shift Leadership, and Key-Person Risk

Braze cell staffing	Lead	Furnace operators	Load builders	Total
First shift (Mon–Fri)	1	2	3	6
Second shift (Mon–Fri)	1	1	2	4
Third shift (Mon–Fri)	–	1	1	2
Saturday day shift	–	1	2	3
Sunday	–	–	–	0

Only 4 of 15 braze cell employees are trained to build loads for both product lines. Third shift has no lead, so loads built on third shift are the most likely to run partial or fail.

Tier meetings run on first shift only, and second- and third-shift leads have no leader standard work. Braze prep scored 2.6 of 5 on our 5S audit, with fixtures, filler, and part kits stored without fixed locations.

One braze process engineer owns all 38 furnace recipes and every fixture design. One cleanroom lead holds most of the plant's contamination-control knowledge. Neither has a documented backup.

3.10 Customer Risk

The largest semiconductor customer accounts for 29% of WIP and has moved Ridgeline to conditional status. The hyperscale integrator accounts for 24% of WIP, has issued a corrective action request, and is qualifying a second source for two cold plate families. Late-delivery chargebacks under data-center supply agreements totaled $710K over the last 12 months.

Data-center customers typically take six to eighteen months to qualify a new cold plate supplier, and the integrator has already started. That makes the integrator relationship the most exposed, and the most urgent reason to relieve the furnace.

4 Immediate Action Plan (0–90 Days)

Phase 1 recovers furnace capacity, protects it, and builds the measurement needed to manage it. Every action here uses staffing, scheduling, and process discipline within the plant's existing authority. None needs a capital request.

4.1 Furnace 2 Constraint Relief

The goal is 7.7 effective loads per week within 60 days, up from 5.2. Each action below targets one of the losses in Section 3.3.

Schedule by Campaign

Replace due-date sequencing with fixed weekly campaigns by thermal profile: two copper campaigns and one stainless campaign. Planners load each order into the next campaign window for its thermal profile.

Set a Minimum Fill Rule

A load must reach 72% of fixture slots before it runs. Exceptions require the plant General Manager's approval and are logged, so the cost of each expedite becomes visible.

Never Let the Furnace Wait

A dedicated load-building crew stages and verifies the next load before the current cycle ends. Restore the nine fixture sets out for repair and hold a minimum fixture stock for each high-volume family.

Add Hours Where the Furnace Is Idle

Add a Saturday second shift and put a lead on third shift, which has the highest partial and failed load rate.

Move Work off Furnace 2

Qualify 14 short part numbers on Furnace 1, which runs less than half its staffed hours.

Action	Owner (suggested)	Timeline	Expected outcome
Campaign scheduling by thermal profile	Planning Manager, Braze Lead	0–30 days	Changeovers from 4.2 to 2.8 per week
Minimum 72% fill rule with logged GM exceptions	Plant GM	0–30 days	Average fill from 60% to 72%
Dedicated load-building crew, next load staged before cycle end	Braze Lead	0–30 days	Waiting time from 11 to about 4 hours per week
Fixture repair sprint and minimum fixture stock	Manufacturing Engineering	0–45 days	31 of 31 fixture sets in service
Saturday second shift, third-shift lead	Operations Manager	0–45 days	Staffed hours from 128 to 136
Qualify 14 short part numbers on Furnace 1	Braze Process Engineer	30–90 days	About 8% of Furnace 2 volume moved
Root-cause the top three re-braze failure modes	Braze Process Engineer, Quality	30–90 days	Second braze cycles from 7.8% to 5%
Automatic furnace data capture (door cycles, profile logs)	Maintenance, IT	0–30 days	Daily effective-load reporting replaces the paper log

4.2 Pace the Plant to the Furnace

The furnace sets the plant's output, so the rest of the plant should run to its schedule. We recommend drum-buffer-rope scheduling: the furnace campaign is the drum, a staged buffer protects it, and release to machining is tied to the furnace schedule.

Release to the Furnace Schedule

Machining releases work against the furnace campaign it will join. Jobs that cannot make a campaign do not start early.

Hold a Buffer of Ready Loads

Keep about two days of cleaned, kitted, fixture-ready loads in front of the furnace, with buffer status reviewed daily. Time precision cleaning to the braze schedule so cleaned parts stop waiting in open staging.

Write an Expedite Policy

Customer service routes escalations through planning. An expedited order joins the next matching campaign and runs in a full load.

Action	Owner (suggested)	Timeline	Expected outcome
Tie machining release to furnace campaigns	Planning Manager	30–60 days	Upstream WIP stops growing ahead of braze
Two-day ready-load buffer with daily status	Braze Lead, Planning	30–60 days	Furnace never starved for loads
Schedule cleaning to the braze plan	Cleaning Supervisor	30–60 days	Re-clean rate from 11% to under 3%
Written expedite policy routed through planning	Customer Service Manager, Planning	0–30 days	Partial loads from 33% to under 10%

IMPORTANT

Hold machining capacity and overtime at today's level until the furnace and CMM changes are in place. Machining already produces more than braze can absorb, and extra upstream output only lengthens the furnace queue.

4.3 Inspection Relief for the First-Article Surge

CMM inspection becomes the plant's constraint once the furnace recovers, so its relief should start now.

Action	Owner (suggested)	Timeline	Expected outcome
Add or cross-train two CMM programmer-operators for second shift	Quality Manager	0–60 days	CMM queue from 11 days to under 4
Triage first-article inspection by change class (full, partial, none), agreed with customers	Quality Manager, Engineering	30–60 days	First-article volume down by a third
Build a CMM program library with revision deltas	CMM Lead	30–90 days	Reruns and program edits from 23% of CMM time to under 10%
Separate first-article work from production inspection in fixed time blocks	Quality Manager	0–30 days	Production inspection no longer displaced by first-article work

4.4 WIP Cleanup and Financial Accuracy

Closing completed jobs is the fastest, lowest-cost win available. It restores an accurate WIP picture, which every other metric depends on.

Action	Owner (suggested)	Timeline	Expected outcome
Close 318 completed-but-open jobs ($1.91M) in a dedicated sprint	Controller, Operations Manager	0–45 days	Accurate WIP and WIP-based metrics
Rule: close jobs within three business days of completion	Controller	30–60 days	Backlog does not return
Recalculate OTIF against the first committed date and set the baseline	Operations Manager	0–30 days	A trustworthy starting point for recovery
Clear the 212-job certification packet queue with a temporary documentation team	Quality Manager	0–30 days	$1.18M of finished goods shipped and invoiced

4.5 Traceability and Data Discipline

Action	Owner (suggested)	Timeline	Expected outcome
Badge login and fixed scanners at braze staging and outside-processing receiving	IT, Operations Manager	0–60 days	Scan compliance from 73% to 90%
Barcoded job ID on every outbound lot; vendors required to return it	Supply Chain Manager	0–30 days	Untraceable returns from 6.2% to under 1%
Daily cycle counts in braze staging and outside-processing receiving	Materials Supervisor	0–30 days	Record accuracy trending to 95% within 90 days

4.6 Shift Leadership Basics

Second shift, third shift, and Saturday run the furnace for 88 of its 128 staffed hours with less leadership structure than first shift.

Action	Owner (suggested)	Timeline	Expected outcome
Tier 1 meetings on every shift around a constraint board (loads, fill, buffer, queue)	Plant GM	0–30 days	Every shift sees furnace performance daily
Leader standard work for shift leads, including the start-of-shift furnace check and coating-line titration check	Operations Manager	30–60 days	Consistent execution across shifts
5S in braze prep with fixed locations for fixtures, filler, and kits	Braze Lead	30–60 days	5S score from 2.6 to 4 of 5

5 Systemic & Strategic Initiatives (3–18 Months)

Phase 1 relieves the constraint. The initiatives in this section fix the conditions that created it, so Ridgeline can absorb the data-center growth Strathmoor has committed to without the same failure recurring at a larger scale. Each is framed around one question: will this hold at twice today's data-center volume?

5.1 Metrics Architecture

Ridgeline's daily reporting habit is a real strength, and the plant should keep it. The change is in what gets reported. The plant needs a small set of flow metrics that show whether work is moving through the constraint and reaching customers on time.

#	Metric	What it measures	Why it matters at Ridgeline
1	OTIF	Orders shipped complete by the first committed date	The customer's view of performance; partial shipments and reset dates do not count
2	Velocity ratio	Actual cycle time ÷ quoted lead time	Shows whether quotes and execution match, by product line
3	Effective constraint output	Effective loads per week: load fill times first-pass rate	The plant's real output rate; replaces run hours as the furnace measure
4	Constraint buffer and queue	Days of ready loads in front of Furnace 2, and jobs waiting	The early warning before OTIF moves
5	First-pass yield	Braze joints and CMM inspections passing the first time	Every second braze cycle or rerun takes capacity from the constraint
6	WIP turns	Annual shipments ÷ average WIP	Cash and lead time in one number
7	Schedule adherence	Operations completed by their scheduled date	Whether the plan is being followed

Reported today (activity)	Replace with (flow)	Why the shift matters
Machining hours vs target	Velocity ratio, schedule adherence	Hours worked say nothing about whether jobs arrive at braze on time
Furnace run hours	Effective constraint output	A partial load counts as a full run hour
Units completed by department	OTIF by customer and product line	Departmental output can rise while orders ship late
Monthly scrap	First-pass yield at braze and CMM	Rework at the constraint costs plant output as well as material
Total WIP dollars	WIP turns, buffer, and queue depth	Direction and location matter more than the total

Metrics 1, 3, 4, and 6 can start within 30 days from existing data and the new furnace capture. Formulas, data sources, benchmarks, and sequencing for all seven are in Appendix D.

5.2 Engineering Change Control for the Data-Center Line

The data-center line's change volume is the largest single source of upstream disruption. The plant cannot stop customers from changing designs, but it can control how changes enter production.

- **Change classes.** Class 1 changes affect form, fit, or function and require full first-article inspection and customer approval. Class 2 changes affect manufacturing only and require a partial first-article inspection. Class 3 changes are documentation only.
- **Effectivity and freeze windows.** Changes take effect at a defined lot or date. Changes into released material require a cost and schedule sign-off from planning.
- **A pilot lot for new parts.** New data-center parts run one pilot lot with a time study before production standards are set.
- **A joint change board.** A weekly review with the hyperscale integrator and the CDU manufacturer to agree on effectivity and batch changes together.

Target: post-release changes from 61% to under 20% of data-center changes within six months.

5.3 Time Standards and Estimating Program

17% of CNC jobs run at 1.5× their estimate or worse, and three-quarters of them are new data-center parts. Fixing that tail fixes most of the overrun. Mature parts already run close to estimate and should keep their standards.

Workstream	Scope	Expected impact
Re-estimate the top 40 data-center part numbers	Set standards at the 80th percentile of demonstrated time; add missing skiving and deburr operations; book prove-out separately from run time	Jobs above 1.5× estimate from 17% to under 5%
Copper machining capability study	Feeds, speeds, tooling, and burr control on the top 20 copper part families, with Cpk on fin thickness and flatness	Separates estimating error from process capability limits
Quote-to-actual feedback loop	Monthly review of quoted versus actual hours for each new part family	Quotes reflect true cost on the fastest-growing line

Together these should cut the quarterly CNC overrun from 4,410 hours to under 1,800 hours and lift schedule adherence above 85%.

5.4 Quality System Infrastructure

- **MRB inside the ERP.** Every record carries a root-cause code, a disposition, and a cost, so repeat failures can be trended and charged to their source.
- **A standard material substitution protocol.** A fixed test matrix (compression set, coolant compatibility, leak, cleanliness), a customer notification template, and pre-qualified alternates for the 10 most critical purchased materials. The next supplier allocation becomes a planned event.
- **Electronic certification packets.** Packets assemble automatically from material, cleanliness, leak test, and CMM records.
- **Test data capture.** Leak and flow test results recorded directly from the test stands, and a gauge repeatability and reproducibility study on the flow test.

5.5 Special-Process Control: Chemistry and Contamination

The coating line and the cleaning and cleanroom processes are controlled by people remembering to do the right thing under pressure. Both need controls that hold when the plant is busy.

- **Coating chemistry.** SPC charts on bath parameters, scheduled replenishment, and the titration check built into shift-lead standard work. Target: zero strip-and-recoat events per quarter.
- **Contamination control.** A maximum staging time between cleaning and braze, after which parts are re-bagged or re-cleaned. Particle-count trending reviewed weekly, and weekly gowning audits.

5.6 Braze Capacity Strategy

Phase 1 raises effective output from 5.2 to 7.7 loads per week. A second round of operating changes can raise it further, to about 9.6: Sunday staffing, higher-density fixtures for 78% fill, and second braze cycles at 3.5%.

If data-center braze volume doubles as Strathmoor's guidance implies, demand reaches about 9.9 effective loads per week by 2029. Operating improvements alone will not cover that, so a third furnace will likely be needed. Vacuum furnaces carry long lead times, so the business case should be built in Phase 3 against demonstrated throughput.

> **RECOMMENDATION**
> Submit the capital request when Furnace 2 sustains more than 90% of its recovered capacity for eight consecutive weeks and the data-center forecast is confirmed by the two largest customers. A request built on demonstrated output and a validated capacity model clears segment approval faster.

5.7 Material Tracking and System Requirements

The Strathmoor ERP template and the MES pilot should be configured to Ridgeline's corrected processes. The requirements below come directly from this assessment:

- Routings with setup time, run time, and separate prove-out time for every operation
- Finite-capacity scheduling at the furnace, with campaigns by thermal profile
- MRB, material substitution, first-article status, and certification packets managed inside the system
- A scan at every move, with badge login, and automatic capture of furnace and test-stand data
- Job identity carried through outside processing, with barcode or RFID labels on outbound lots and returnable fixtures

> **KEY INSIGHT**
> Capture data where the work happens: a scan at each move, a door-cycle log at the furnace, and test results straight from the stand. Each manual entry Ridgeline removes is one less place for data to go stale.

5.8 Succession and Knowledge Continuity

Ridgeline's two highest key-person risks sit at its constraint and in its most sensitive process. The braze engineer's 38 recipes and fixture designs, and the cleanroom lead's contamination-control practices, should be documented with the reasoning behind them.

The practical steps are to identify the six to eight roles where one departure would hurt most, develop a second braze engineer or a trained braze technician, and cross-train load builders on both product lines (from 4 of 15 to 12 of 15). Routing standardization in Section 5.3 and the system work in Section 5.7 convert more of this knowledge into documented form over time.

5.9 Carrying the Work Across Corvane

Corvane's other two plants share suppliers and customers, and they will soon share the same ERP template. The constraint model, the seven metrics, the change-control classes, and the substitution protocol developed at Ridgeline should become a common playbook. We recommend a small steering group of plant managers, segment operations excellence, and IT to agree what is standard across plants and what each plant may tailor.

6 Implementation Roadmap

The roadmap runs in three phases over 18 months, each with a gate the plant must pass before the next begins. Phase 1 recovers the furnace and builds measurement. Phase 2 corrects the processes and standards that created the constraint. Phase 3 carries them into the ERP template, the MES, and the capital plan.

Workstream	Phase 1 · 0–90 days	Phase 2 · 3–9 months	Phase 3 · 9–18 months
Constraint and flow	Furnace campaigns, fill rule, load crew, Saturday staffing, DBR release (4.1, 4.2)	Second-round furnace gains toward 9.6 loads per week (5.6)	Third-furnace business case on demonstrated output (5.6)
Quality and process	Second-shift CMM, first-article triage, certification packet sprint (4.3, 4.4)	MRB in the ERP, substitution protocol, chemistry SPC, contamination plan (5.4, 5.5)	Quality workflows inside the ERP template (5.7)
Engineering	Fixture repair sprint, Furnace 1 qualification (4.1)	Change classes, joint change board, top-40 part re-estimate (5.2, 5.3)	Corrected standards loaded in the ERP (5.7)
Data and systems	WIP cleanup, OTIF baseline, scan discipline, furnace data capture (4.4, 4.5)	Flow metrics beside activity metrics; ERP and MES requirements signed off (5.1, 5.7)	ERP migration and MES pilot; full flow metrics (5.1, 5.7)
People	Tier meetings and leader standard work on every shift, 5S (4.6)	Cross-training and critical-role mapping (5.8)	Succession plans; playbook to the other two plants (5.8, 5.9)
Gate to next phase	**Furnace 2 sustains 7+ effective loads per week for four weeks; OTIF measured against the first committed date**	**Corrected standards loaded for the top 40 parts; post-release changes under 20%; ERP requirements signed off**	–

A Note on Phasing

Relieving the furnace will move the constraint, most likely to CMM inspection. The roadmap should be treated as a living plan, with the constraint re-mapped at each gate and the sequence adjusted to match.

The ERP migration is the most important dependency. Phase 2 process and standards work should be complete, or well advanced, before template configuration begins. Loading today's routings into the template would carry today's scheduling errors into the new system.

Webineering recommends a phased implementation engagement to support this work, with progress measured against the baseline in this report at each gate.

7 Appendices

Appendix A: Data Sources

Source	Description	Period	Used in
Daily metrics workbook	Department output, OTIF, past due, safety, and quality metrics	Sep 2025 – Sep 2026	1, 3.1, 5.1
WIP snapshot	3,956 open jobs with location, value, age, and customer	Sep 14, 2026	3.2, 4.4, App. E
Operation time records	9,840 operations with estimated and actual setup and run times	Jun – Aug 2026	3.4, 5.3, App. E
Furnace load log	Furnace 2 and Furnace 1 loads, profiles, fill, and re-braze records	13 weeks to Sep 2026	3.3, 4.1, 5.6
Engineering change register	Changes by product line, class, and release timing	Mar – Aug 2026	3.4, 5.2
MRB and substitution trackers	Open records, age, disposition, and root-cause coding	Current	3.7, 5.4
Staffing and shift rosters	Headcount, shift patterns, and cross-training by area	Current	3.9, 4.1
Cycle count and adjustment history	Inventory record accuracy and write-offs	Last 12 months	3.8, App. E
Site visit notes and interviews	Floor observation on all shifts; 23 structured interviews	Sep 15–17, 2026	Throughout

Appendix B: Terms

Term	Meaning
CDU	Coolant distribution unit, the pump and heat-exchange module in a liquid-cooled data-center rack
CMM	Coordinate measuring machine
Cpk	Process capability index
DBR	Drum-buffer-rope, a constraint-based scheduling method
Effective load	One full furnace load that passes first time. A partial load counts by its fill, and parts that need a second braze cycle do not count.
FAI	First-article inspection
FPY	First-pass yield
GRR	Gauge repeatability and reproducibility
LSW	Leader standard work
MES	Manufacturing execution system
MRB	Material review board
OTIF	On-time in-full
SPC	Statistical process control
Thermal profile	The time-temperature cycle a furnace runs for a given material and filler
Velocity ratio	Actual cycle time divided by quoted lead time
WIP	Work in process

Appendix C: Methodology and Data Limitations

Pre-visit analysis set a constraint hypothesis that the site visit tested. Observation on all three shifts confirmed the furnace as the primary constraint and showed that most of its capacity loss came from scheduling and loading practice. Post-visit analysis quantified each loss and built the capacity model in Section 3.3. The OTIF estimate assumes the braze queue clears within about 11 weeks of the Phase 1 changes and the CMM queue falls under four days. Jobs that do not pass through braze ship at their current rate.

The main limitations are these. Furnace fill is measured in fixture slots, which approximates load mass. WIP is a single-day snapshot, checked against two month-end snapshots. Operation time records cover queue time only where scan data exists, which is 73% of moves. MRB history is incomplete because 41% of records lack a root-cause code. Each limitation is noted where it affects a finding.

Appendix D: Metric Specifications

Metric	Formula	Benchmark (good / world-class)	Data source today	Start
OTIF	Orders shipped complete by first committed date ÷ orders due	95% / 98%+	ERP sales orders, weekly extract	Within 30 days
Effective constraint output	Sum of (load fill × share of parts passing first time) per week	Demand + 10%	Furnace data capture	Within 30 days
Buffer and queue at constraint	Days of ready loads; jobs waiting at braze	1.5–2.5 days buffer	WIP report filtered to braze	Within 30 days
WIP turns	Annual shipments ÷ average WIP	10–15× / 15×+	ERP finance and WIP	Within 30 days
Velocity ratio	(Ship date − release date) ÷ quoted lead time	1.0–1.15	ERP job history	30–90 days
First-pass yield	First-time passes ÷ total, at braze and CMM	97% / 99%+	Furnace log, CMM results with rework flag	30–90 days
Schedule adherence	Operations done by scheduled date ÷ operations scheduled	90% / 95%+	Requires corrected routings	After Phase 2 standards

Every metric should be segmented by product line (semiconductor and data center) and by customer. An aggregate number hides the line that is failing.

Appendix E: Financial Impact

Cost of constraints	Basis	Annual estimate
CNC run-time overrun	4,410 excess hours per quarter at $104/hr	$1.83M
Overtime and premium freight driven by the braze queue	Last 12 months, braze and CMM overtime plus expedited freight	$1.46M
Late-delivery chargebacks	Data-center supply agreements, last 12 months	$0.71M
Re-braze cycles	0.74 load-equivalents per week at about $6,800 direct cost per cycle; lost furnace time is counted in the throughput figure	$0.26M
CMM reruns and program edits	About 600 hours per quarter at $104/hr	$0.25M
Inventory adjustments	Last 12 months	$0.24M
Coating strip and recoat	44 lots per quarter	$0.11M
Re-cleaning before braze	11% of cleaned lots	$0.09M
Total recurring		About $5.0M

One-time working capital	Basis	Estimate
Ship and invoice jobs waiting for certification packets	212 jobs	$1.18M
Reduce outside-processing dwell by 30%	$1.64M in outside processing	$0.49M
Release WIP held for material requalification	11 part numbers	$0.43M
Total one-time		About $2.1M

These are order-of-magnitude estimates built from operating data and have not been audited. A single $104/hr rate is applied across work centers. Machining is not the constraint, so the CNC overrun line is paid machine and labor time; it does not reduce plant output. They exclude the larger exposure: revenue delayed or lost while past-due orders sit at $6.41M. Phase 1 adds about 2.5 effective loads a week. Until the braze backlog clears, that pulls past-due orders forward. After that, the furnace can meet full demand, about 1.2 loads a week more than today, worth roughly $0.3M of shipments a week at about $280K per effective load, once downstream capacity keeps pace.