

TECH & AI CASE STUDY - AEROSPACE SUPPLIER - 2026

A Digital Twin That Lifted Production-Line OEE 14 Points

Based on a delivery engagement with Auralis Aerostructures

+14 pts
LINE OEE

-34%
UNPLANNED DOWNTIME

88% to 97%
ON-TIME DELIVERY

\$46M
CONTRACT VALUE PROTECTED

A fillable practice edition: the full story, 8 actions,
6 reflections and a 90-day plan - work it with your team.

Free - no email required
emersontechnology.com

MAKE THIS PRACTICE BOOK YOURS

Work it, do not just read it

This practice book turns the Auralis Aerostructures case study into a working session for your team. Read the full story first - what happened, what was built and what it changed. Then tick the 8 actions you can commit to, write short answers to the 6 reflections, and finish with a 90-day plan. Every field in this PDF is fillable: open it in Adobe Acrobat Reader, Chrome, Edge or macOS Preview, type directly into the boxes and save.

YOUR NAME

ROLE

COMPANY

TEAM / DEPARTMENT

DATE

EMAIL (OPTIONAL)

MY GOAL FOR THIS PRACTICE SESSION

- 01

The story - What happened at Auralis Aerostructures - before, during and after the project.
- 02

The results - The numbers that changed, plus industry benchmarks from public research.
- 03

The 8-action checklist - Tick boxes as your organization completes each step. Owner and date fields included.
- 04

The 6 reflections - Fillable questions that pressure-test your own roadmap.
- 05

My 90-day plan - Three fillable phase cards that turn this case study into your roadmap.

RUN IT AS A 90-MINUTE TEAM SESSION

25 min READ Read the story together. Ask everyone to note the one number that surprised them most.	40 min PRACTICE Work the 8-action checklist and the 6 reflections. Assign an owner and a date to every action you commit to.	25 min COMMIT Fill in the 90-day plan. One goal per phase, one number that tells you it worked. Book a review date before you leave the room.
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THE STORY

What happened, and why it worked

01 The Company

Auralis Aerostructures machines and cures composite wing components for commercial and defense programs, operating under an AS9100 quality system where every material lot, cure cycle and inspection is traceable to the record. Its constraint is unforgiving in the way aerospace constraints are: a single flow line of CNC machining cells, composite layup stations, autoclaves and cure ovens feeds a \$46M defense contract, which means throughput on that line translates directly into contractual obligation. Composite manufacturing amplifies the stakes further — a panel that cures with a defect is not reworkable, only scrapable, and each scrapped panel represents \$18,000 in materials alone before labor is counted. The plant had been reliable enough to survive for years, but reliability and visibility are different things, and the difference was starting to cost money. The company's competitive position added urgency. New contract bids increasingly required credible on-time-delivery evidence, not assurances, and a six-week late delivery the prior year had nearly triggered penalty clauses on the defense program. Auralis needed to demonstrate — with data a customer's auditors would accept — that it could see, simulate and improve its constraint line before the next audit cycle and the next bid season.

02 Where Things Stood

Before Emerson Technology engaged, the plant's understanding of its own performance was largely retrospective. Overall equipment effectiveness sat at 67%, but nobody could say where the missing 33 points went, because downtime was logged on paper at the end of each shift by whoever remembered the day's interruptions. Categories were broad, entries were late, and disputed stops were simply rounded away. The autoclave schedule — the single most consequential sequencing decision in the plant, since cure ovens and autoclaves are the bottleneck resource that every layup batch queues behind — lived in the head of one veteran planner who had developed the judgment over decades and had no documented successor. Scrap on cured parts ran at 7%, an almost routine figure inside the plant and an alarming one outside it. Every failed cure destroyed \$18,000 of material and, worse, consumed bottleneck autoclave time that a good panel could have used. Maintenance operated on fixed intervals with an escalation path that began when something already sounded or smelled wrong; spindle and vacuum-pump failures arrived as surprises and consumed days of unplanned downtime each. The result was a plant that hit 88% on-time delivery in a good quarter and missed badly in a bad one, with no model that could explain the difference in advance.

The knowledge concentration made everything slower to fix. Because downtime data was handwritten and the schedule was experiential, improvements were argued from anecdote rather than evidence. Engineering proposals to rebalance the line could not be tested without risking real production, so they were rarely tested at all. The plant was not short of opinions about what was wrong; it was short of any instrument that could say which opinions were worth the money.

03 The Challenge

The challenge was to make an opaque, capital-intensive, heavily regulated line visible and simulable without stopping production or violating the discipline of an AS9100 environment. That meant instrumenting machines that were never designed to report their own state, capturing downtime with codes people would actually use, and doing it all at the constraint, where any interruption is measured in lost contract throughput. It also meant the data had to serve two masters at once: operational decisions on the floor and audit evidence for the quality system, which is why sloppy data collection was never an option.

The human side was equally delicate. The veteran planner's autoclave judgment was genuinely excellent, and any system perceived as replacing him would be quietly sabotaged by the very schedules it was meant to improve. Maintenance technicians had seen dashboards come and go. Operators had been blamed with data before. A solution that produced confident nonsense, or that appeared on one screen for managers and never reached the floor, would join the graveyard of previous initiatives — and the plant could not afford another one of those before bid season.

04 Discovery and Diagnosis

Emerson Technology began with a three-week discovery sprint focused exclusively on the constraint line. The team instrumented nothing at first; instead they reconstructed 18 months of shift records, work orders and quality holds into a coherent picture of where time and yield actually went. The diagnosis confirmed the leadership's suspicion and quantified it: the six big OEE losses — breakdowns, setup and adjustment, minor stops, reduced speed, startup rejects and production rejects — could now each be traced to recurring, nameable causes, and several were worth thousands of dollars per hour at the constraint. Industry benchmarks from the Nakajima methodology place world-class OEE at 85% against a typical factory near 60%, so the plant's 67% was neither shameful nor acceptable for a line feeding a defense contract.

The data audit found the plant's telemetry mostly aspirational: a handful of newer CNC cells spoke OPC-UA natively, the autoclaves reported cure cycles to a local recorder nobody exported, and the layup stations reported nothing at all. Historical downtime attribution was unreliable, which meant any model built on it would reproduce confident nonsense at scale. McKinsey's IoT research, estimating that predictive maintenance can cut machine downtime by 30-50% and extend equipment life by 20-40% in typical deployments, shaped the decision to include condition monitoring rather than stop at scheduling. The plan that emerged was sequenced deliberately: instrument first, validate against history second, and only then let the twin influence live decisions.

05 The Solution

Emerson Technology connected the constraint line first — CNC machining cells, layup stations, autoclaves and cure ovens — streaming OPC-UA telemetry into an AWS IoT data lake, then built a digital twin that combines a discrete-event simulation core with live plant data. The architecture has three layers.

Instrumentation and the data lake

Every constraint asset was wired to report machine state, cycle counts, alarm codes and cure parameters on a common time base. Downtime was redefined in the process: instead of end-of-shift recall, stops are recorded automatically at the machine and confirmed with a short code by the operator, which made the data accurate enough to be trusted and specific enough to be audited. The data lake preserves raw telemetry alongside the modeled events, so quality engineers can trace any anomaly back to its source — a requirement that later paid for itself when downtime codes began flowing automatically into AS9100 audit evidence. The plant learned a rule that every manufacturing data program eventually learns: accurate downtime codes, not model sophistication, are what separate a twin from an expensive animation.

The twin core

At the center sits a discrete-event simulation of the line — machines, buffers, cure vessels, tooling and labor rules — continuously synchronized with live telemetry. The twin was validated against 18 months of historical production until its output matched actual shift records within 3%, which is the threshold at which the planning team agreed to treat its output as evidence rather than opinion. Once validated, the twin could replay every shift, quantify each of the six OEE losses in dollars, and run what-if schedules before planners committed autoclave slots — testing, for example, whether holding a batch for a fuller autoclave load beats running it part-full against

the contract schedule. Predictive-maintenance models for spindles and vacuum pumps flag degradation days ahead of failure, converting the worst downtime category from surprise to planned event.

The decision surfaces

A Next.js floor dashboard shows operators the same model planners see, with losses expressed in the floor's own vocabulary rather than consultant acronyms — shared models build the data culture; secret ones breed suspicion. Planners use the twin's scenario mode in a weekly cadence: propose a schedule, simulate it, compare ground time and due-date risk, then commit. Maintenance receives degradation alerts with recommended intervention windows, and the quality team receives downtime and rejects data formatted as audit evidence without manual assembly. The same numbers now reach all three audiences from one source, which ended the parallel-spreadsheet economy the plant had been running for years.

06 The First 90 Days

Weeks one and two were spent on instrumentation design — sensor selection, OPC-UA mapping and the downtime-code taxonomy negotiated jointly with operators, since codes they did not recognize would produce data they did not trust. Weeks three through eight wired the constraint line and began streaming into the data lake, with the first month devoted almost entirely to data hygiene: confirming machine states matched reality, catching a vacuum-pump sensor mounted in the wrong location, and correcting cure-cycle timestamps that were offset by the recorder's clock. Weeks nine and ten rebuilt the historical record against the new codes, and the twin's simulation core was run against the prior 18 months until output converged with actuals within 3%. Weeks eleven and twelve moved from building to using. Planners began running what-if scenarios before committing autoclave slots, starting with one decision a week rather than everything at once, and the first validated catch arrived quickly — the twin showed that a planned batch consolidation would breach a layup out-time limit, a violation invisible in the spreadsheet the plan had been built on. Operators saw the same simulation on the floor dashboard, including the dollar value of the loss being avoided, and the weekly production meeting switched from arguing about last week's paper log to reviewing the replay of last week's shift.

The team set an explicit trust rule for the transition: whenever the twin's recommendation conflicted with the veteran planner's judgment, the case was logged, simulated in front of the planning group, and reviewed — twice, the planner was right, and the model's cure-vessel parameters were corrected; three times, the simulation was right, and the planner became its most vocal advocate. Maintenance alerts were tuned conservatively during the quarter, accepting a few missed early warnings rather than spending credibility on false alarms. By day 90 the twin was steering real schedules at the constraint, unplanned downtime had visibly begun to fall, and the quality manager had identified the audit-evidence integration as the next build.

07 The Results

Within eleven months, line OEE climbed from 67% to 81% — a 14-point gain — as unplanned downtime fell 34%, tracking the range McKinsey's research predicts for predictive-maintenance deployments. On-time delivery reached 97%, up from 88%, and the \$46M defense contract has recorded no late deliveries since the twin went live. Scrap on cured panels dropped from 7% to 4.9%, saving roughly \$95,000 per month in materials, and the program paid for itself inside the first year. The twin's simulation evidence now anchors new contract bids, turning the plant's previously unprovable reliability story into a differentiator with auditable backing.

METRIC	BEFORE	AFTER
Line OEE	-	+14 pts
Unplanned downtime	-	-34%

METRIC	BEFORE	AFTER
On-time delivery	88%	97%
Contract value protected	-	\$46M

The cultural gains compounded the spreadsheet ones. The autoclave schedule now lives in a validated model with a documented logic rather than in one planner's memory, and the planner's judgment has been promoted into the model's rules instead of retired with him. Downtime codes flow automatically into AS9100 audit evidence, reclaiming quality-team hours that previously went into manual evidence assembly. GE has credited its industrial digital-twin program with more than \$1B in cumulative customer savings across fleet and plant applications, and Auralis's leadership now cites that lineage when explaining to customers why its OTD claims come with a simulation attached. Engineers propose line changes and see them tested against the twin before capital is requested, which has changed the character of continuous-improvement meetings from opinion contests to scenario reviews.

08 What Your Business Should Do

Auralis's playbook transfers to any plant, and its first rule is restraint. Start with the constraint line only: instrument and model the bottleneck before touching the rest of the plant, because savings at the constraint translate directly into throughput while savings everywhere else usually do not. Instrument machines before building any models — collect OPC-UA or MQTT telemetry with accurate downtime codes first, since a twin built on sparse or mislabeled data produces confident nonsense at scale. Validate the twin against history by replaying 12 to 18 months of past shifts and requiring it to reproduce actual output within a few percent; an unvalidated simulation is an opinion, not a decision tool. Price the six big OEE losses in dollars per shift, because teams prioritize differently when one recurring fault is labeled in real time at \$4,000 an hour.

Then put the twin to work where it pays fastest. Simulate schedules before committing autoclave, oven and machining slots — in aerospace job shops this is consistently where twin models return value first. Show operators the same model planners use, with losses expressed in their own language, because secret models breed suspicion while shared models build the data culture you need. Automate audit evidence collection by routing downtime codes, quality checks and calibration records straight into audit-ready form; in regulated plants, the reclaimed preparation hours often rival the maintenance savings themselves. Finally, recalibrate after every process change — tooling, materials or schedules — because twins drift silently, and a stale model is more dangerous than no model at all. The direction of the industry is not subtle: GE attributes more than \$1B in cumulative customer savings to its digital-twin program, and world-class OEE of 85% versus a typical 60% is precisely the gap these models are built to close.

Before the first sensor ships, sit with the questions Auralis's leadership had to answer honestly. Could your team name the biggest single OEE loss on your constraint line, in dollars, today? How much of your schedule knowledge lives in one planner's head, and what happens when they leave? What would 14 points of OEE be worth annually on the line that gates your throughput? If your largest customer demanded on-time-delivery evidence next quarter, could you produce it credibly? Where does downtime get recorded today — automatically at the machine, or on paper at shift end? Would your operators trust a simulation enough to change how they schedule the next autoclave run? Bring them to your team alongside the action checklist in this practice book, and revisit them every quarter as your line, your labor and your contracts all change.

REAL-WORLD PROOF & BENCHMARKS

McKinsey's IoT research estimates that predictive maintenance can cut machine downtime by 30-50% and can extend equipment life by 20-40% in typical deployments. - McKinsey & Company

GE has reportedly credited its industrial digital-twin program with more than \$1B in cumulative customer savings across fleet and plant applications. - GE Digital, reported 2019

Benchmarks widely cited from the Nakajima methodology place world-class OEE at 85%, while the typical factory operates near 60% — a gap digital twins target. - Industry benchmark (Nakajima)

THE PRACTICE PAGES

The 8-action checklist

Work through the list with your team. Tick each box as your organization completes the step, and fill in an owner and a target date so every action has a name and a deadline.

☐**1. Start with the constraint line only**

Instrument and model the bottleneck line before touching the rest of the plant. Savings at the constraint translate directly into throughput; everywhere else they usually do not.

OWNER

TARGET DATE

STATUS

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☐**2. Instrument machines before building models**

Collect OPC-UA or MQTT telemetry with accurate downtime codes before any modeling. A twin built on sparse or mislabeled data produces confident nonsense at scale.

OWNER

TARGET DATE

STATUS

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☐**3. Validate the twin against history**

Replay 12-18 months of past shifts and require the twin to reproduce actual output within a few percent. Unvalidated simulations are opinions, not decision tools.

OWNER

TARGET DATE

STATUS

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☐**4. Price the six big OEE losses**

Quantify availability, performance and quality losses in dollars per shift. Teams prioritize differently when one recurring fault is labeled in real time at \$4,000 an hour.

OWNER

TARGET DATE

STATUS

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☐**5. Simulate schedules before committing**

Run what-if scenarios against the twin before locking autoclave, oven and machining slots. This is where twin models consistently return value fastest in aerospace job shops.

OWNER

TARGET DATE

STATUS

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☐ **6. Show operators the same model**
Give floor teams the dashboard planners use, with losses in their own language. Secret models breed suspicion; shared models build the data culture you need.

OWNER

TARGET DATE

STATUS

☐ **7. Automate audit evidence collection**
Route downtime codes, quality checks and calibration records straight into audit-ready evidence. In regulated plants, the reclaimed audit-preparation hours often rival the maintenance savings themselves.

OWNER

TARGET DATE

STATUS

☐ **8. Recalibrate after every process change**
Revalidate the twin whenever tooling, materials or schedules change materially. Twins drift silently, and a stale model is more dangerous than no model at all.

OWNER

TARGET DATE

STATUS

AFTER THE CHECKLIST: OUR TOP 3 PRIORITIES

From the eight actions above, write down the three you will start first - and the single number you expect each one to move. Three priorities with owners beat eight without any.

PRIORITY 1 NUMBER IT SHOULD MOVE	PRIORITY 2 NUMBER IT SHOULD MOVE	PRIORITY 3 NUMBER IT SHOULD MOVE
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THE PRACTICE PAGES

Reflections for your team

Use these questions in your next planning session and type short answers into the boxes. The gaps you find are usually the fastest wins.

Q1. Could your team name the biggest single OEE loss on your constraint line, in dollars, today?

Q2. How much of your schedule knowledge lives in one planner's head, and what happens when they leave?

Q3. What would 14 points of OEE be worth annually on the line that gates your throughput?

Q4. If your largest customer demanded on-time-delivery evidence next quarter, could you produce it credibly?

Q5. Where does downtime get recorded today — automatically at the machine, or on paper at shift end?

Q6. Would your operators trust a simulation enough to change how they schedule the next autoclave run?

THE PRACTICE PAGES

My 90-day plan

Finish the session by committing to a plan. Three phases, one goal each, one number that tells you it worked. Bring this page to your next leadership review - or to a free consultation with Emerson Technology, and we will pressure-test it with you.

Days 1-30 Focus: audit and alignment

PRIMARY GOAL**KEY ACTIONS****HOW WE MEASURE SUCCESS****OWNER**

Days 31-60 Focus: build and prove

PRIMARY GOAL**KEY ACTIONS****HOW WE MEASURE SUCCESS****OWNER**

Days 61-90 Focus: scale and measure

PRIMARY GOAL

KEY ACTIONS

HOW WE MEASURE SUCCESS

OWNER

Tip: save a copy per team so each group keeps its own answers. Revisit the reflections every quarter - the questions stay the same even as the numbers move.

BOOK THE REVIEW BEFORE YOU CLOSE THE BOOK

Plans without a review date drift. Before you close this practice book, agree on when you will come back to these pages, who will run that session, and when you will check the numbers again. If you want an outside pair of eyes, bring this page to a free consultation with Emerson Technology and we will pressure-test the plan with you.

REVIEW DATE	REVIEWED BY	NEXT CHECK-IN
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Ready for a transformation like Auralis Aerostructures's?

Emerson Technology designs and builds the data, AI, cloud and automation systems behind results like these. On a free consultation call we will map this exact playbook to your business - your data, your constraints, your numbers.

Book a free consultation

support@emersontechnology.com

or start online: emersontechnology.com/contact