MEASURING THE FINANCIAL IMPACT OF CLOSED-LOOP ROBOT CONTROL IN ADVANCED MANUFACTURING.

Robot accuracy changes continually under real production conditions.

Thermal variation, mechanical wear, payload shifts and tooling movement introduce deviations between programmed and executed motion.

These deviations accumulate quietly — increasing scrap, causing unplanned downtime, and absorbing engineering resources. Small deviations compound into large financial consequences.

Here we quantify the financial impact of uncontrolled robot drift. We demonstrate how continuous measurement and in-process correction can generate six-figure annual savings per production cell.

Automotive and aerospace sectors have been chosen as examples.
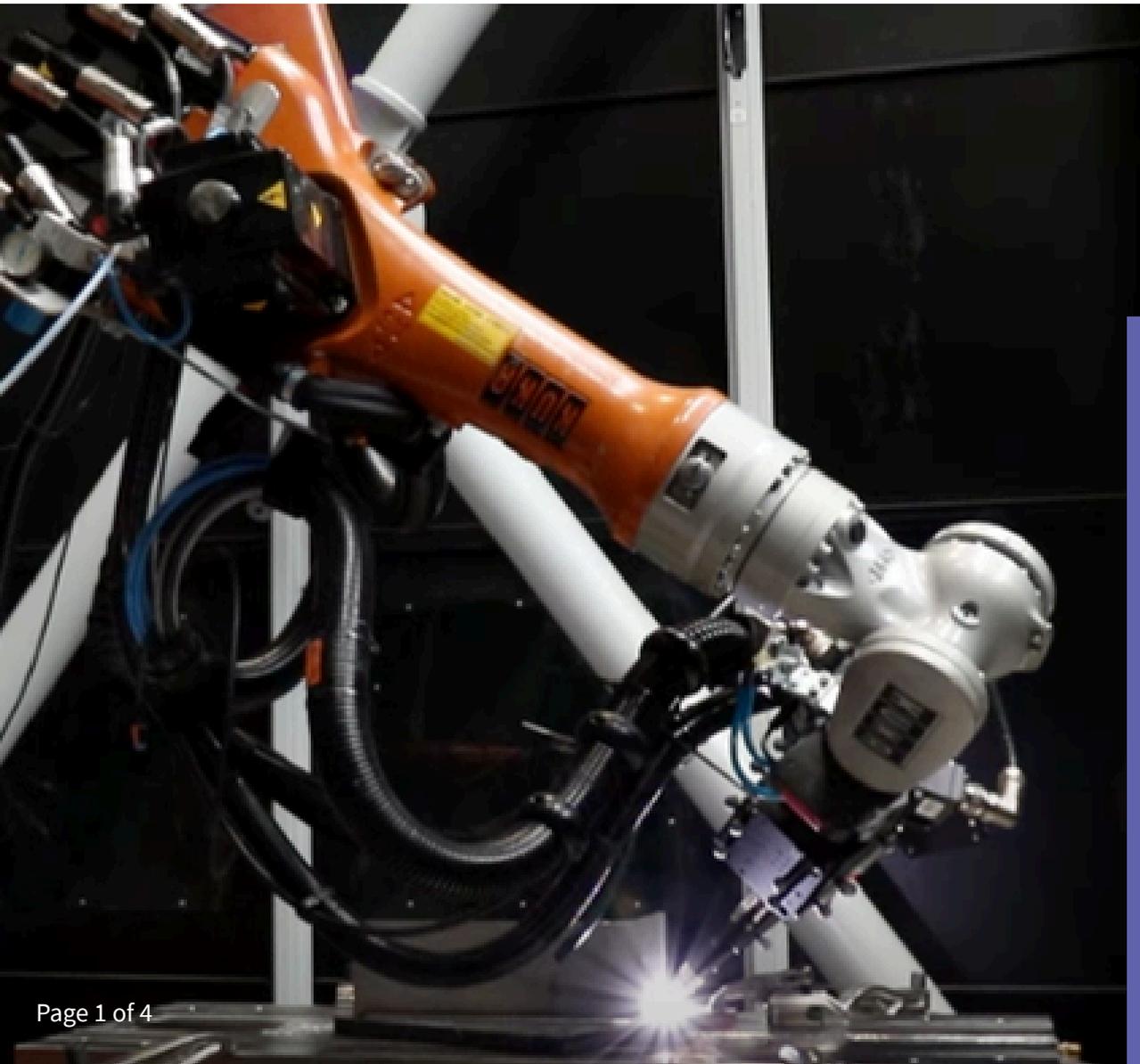
1. Downtime from recalibration and re-teach

Consider a tier 1 automotive supplier operating a robotic welding cell, processing over **£19 million of product annually.**

Metric	Value
Parts per hour	20
Operating hours per year	3,840
Value added per part	£250
Annual value throughput	**£19.2m**

If drift causes 10 unplanned recalibration events per year, each lasting five hours, at a cost of £3,500 per hour, annual downtime equals £175,000 per cell.

When continuous measurement and closed-loop correction reduce those events by even 50%, **the saving is approximately £87,500 per cell per year.**

2. Scrap and rework from accuracy degradation

In aerospace drilling or composite layup, tolerances are tight and material costs are high.

Metric	Value
Parts per hour	15
Hours per year	3,500
Value per part	£1,200
Annual production value	**£63M**

With 1.2% scrap linked to positional error, losses reach £756,000 annually.

A conservative 30% reduction through continuous monitoring and in-process correction produces **savings of approximately £226,800 per year.**

In aerospace, the financial case strengthens further when considering engineering rework time, inspection bottlenecks, certification and compliance delays.

3. Engineering firefighting time

Robot drift rarely presents as a single obvious failure. More often it appears as gradual tolerance creep, intermittent quality flags, and increased operator intervention.

Engineers then spend time diagnosing symptoms rather than improving throughput.

Metric	Value
Engineer hourly rate	£85
Hours per year	576
Annual firefighting cost	**£48,960**

Two engineers spending six hours per week addressing drift at £85 per hour equates to £48,960 annually.

Reducing this by 60% **recovers approximately £29,000 per year in productive engineering time.**

More importantly, those engineers return to value-adding optimisation projects instead of reactive maintenance.

Combined annual impact per cell

Using the conservative examples above, a single high-value production cell may realise:

Source of loss	Annual saving
Downtime reduction	£87,500
Scrap/rework reduction	£226,800
Engineering time recovery	£29,000
Total potential impact	**£343,300**

Is it worth it?

Yes - taking steps to address robot drift in-process can make a huge difference to operational value.

Even if only part of these example savings are realised, payback periods are typically measured in months rather than years.

ADDITIONAL CONSIDERATIONS

The examples provided exclude secondary effects such as expedited shipping, disrupted sequencing, or customer schedule penalties.

Late delivery penalties in automotive and aerospace contracts are not uncommon. A single missed delivery can result in financial penalties, lost preferred supplier status, and reduced future order volumes.

If stabilising robot accuracy prevents even one significant delivery delay per year — conservatively valued at £50,000–£100,000 — the commercial justification strengthens considerably.

IONA provides continuous, metrology-grade measurement of robot behaviour inside the production cell. It captures what the robot is actually doing under real operating conditions.

ORA software compares that measured activity to the intended program, displays it through a live digital twin, and applies in-process correction where necessary.

Conclusion

Robot drift is inevitable. Uncontrolled drift is expensive. Continuous measurement and in-process correction transform robot accuracy into a controlled production variable.

Traditional robot management assumes accuracy remains stable between calibration events. But modern production cells run faster, closer to tolerance limits, with greater product variation, and under higher customer scrutiny.

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