

AVIATION MRO · TOOL CONTROL AND RTLS

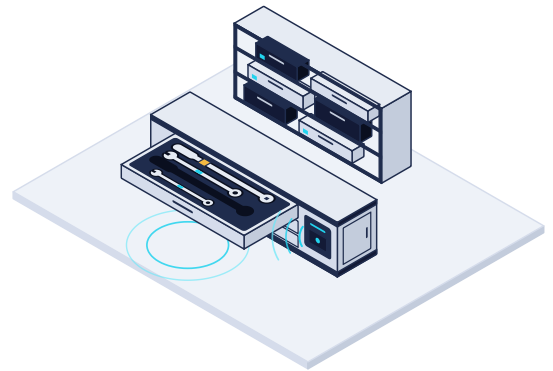
Tool control in the hangar: know who has each tool, and whether it is in calibration

An independent guide for MRO operations managers, engineering, quality, IT/OT, procurement and executives. It covers tool cribs, hangars, FOD and lost-tool events, check-in and check-out, calibration, kits and shadow boards, and compares barcode, passive RFID, active RFID/BLE, UWB and smart cabinets.

Where tool control breaks down

Pain points cribs and hangars often recognise

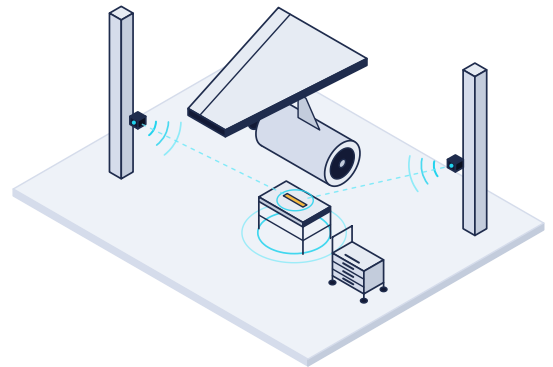
- **A tool missing at shift end:** the count does not reconcile, the aircraft cannot be released and engineers search the bay, the panels and the floor.
- **Paper chits and tag boards:** tools are booked out under the wrong name or not at all, with no link to the work order.
- **Calibration that slips:** a torque wrench past its due date is issued, and a recall means tracing every job it touched.
- **Kits that come back short:** a kit or trolley is returned with a gap that nobody notices until the next job.



What good looks like

Accountability you can prove in an audit

- **Every tool tied to a person and a job:** issue and return are recorded against the engineer and the work order, without extra typing.
- **Calibration checked at every issue point:** the system refuses to issue an overdue or quarantined tool, backed by physical separation and a clear exception route.
- **A quick shift-end check:** the crib sees open issues, the recorded holder and the last read, with gaps flagged for investigation.
- **Lost-tool events handled with evidence:** the search starts from the last recorded holder and location, and the record shows how the event was closed.



WHO SHOULD READ WHAT

Operations managers

Pages 2, 4 and 5: process, kits, lost-tool events and the pilot.

Engineering and quality

Pages 2 to 4: calibration, technology limits, FOD risk.

IT/OT

Pages 4 and 5: work order link, identity, export and offline mode.

Procurement

Pages 3 and 5: option comparison and questions for technology providers.

Executives

This page and page 5: KPIs, payback and the pilot decision.

Planning tool control? Book a [free 30-minute call](#) and bring your crib layout, tool list and any proposal for a second opinion.

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Follow one tool through its life

Technology comes after this map, not before

Walk the process with crib staff, engineers and quality before you look at any product. Failures often sit at the hand-offs: shift change, borrowing between bays, tools sent for calibration and tools brought in by contractors.

1 Enrol

Tool master record, serial, owner, calibration interval, how it is marked.

2 Issue

To a person and a work order, at the crib, cabinet or kit.

3 Use

In the bay, on or in the aircraft, sometimes lent to another team.

4 Return

Checked for completeness and damage, back to its slot.

5 Reconcile

At shift end and before the aircraft is released.

6 Calibrate or retire

Sent out, quarantined, repaired, replaced or scrapped.

CHECKLIST

Tool crib and check-in / check-out

- ☐ **Tool master is clean:** every tool has one record, one unique ID, a named owner and a home location.
- ☐ **Issue rules are written:** who can draw which tools, for how long, and against which work orders.
- ☐ **Personal, contractor, loaned and alternative tools are covered:** accepted, marked, calibrated and controlled under your procedures, or kept off the aircraft.
- ☐ **Shift handover is explicit:** open issues pass to a named person, not to a whiteboard.

CHECKLIST

Calibration due dates

- ☐ **One source of truth:** due dates live in one system and the crib reads from it.
- ☐ **Block at every issue point** (counter, cabinet or kit): the system refuses a tool that is overdue or will fall due before its expected return.
- ☐ **Recall trace:** for a tool found out of tolerance, list the work it was issued against since its last good calibration.
- ☐ **Quarantine is physical and digital:** a quarantined tool is held apart and blocked in the system.

We tailor the rest to your crib in the survey.

Start with the rule, not the radio. If you hold a maintenance organisation approval, your quality system already expects tool control and calibration procedures. The technology should produce evidence for those procedures and make them easier to follow, not replace them.

SURVEY

What we tailor to your crib

- **Marking** that suits each tool and its calibration.
- **Out-of-hours issue**, when the crib is not staffed.
- **Consumables**, and the items that stay under tool control.

CALIBRATION REVIEW

What we check with your quality team

- **The warning window** before a tool falls due.
- **Send-out and return**, so tools at the lab show as away.
- **Certificates** linked to each tool record.

SECOND OPINION

What we go through on the call

- **Your crib:** issue, return and reconcile today.
- **Calibration:** where a tool can slip through.
- **The options:** the mix that fits your tools.
- **Any proposal:** scope, cost and export.

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Five options compared

Many hangars use a mix: match the technology to the job

Option	Best for	Strengths	Limits	Test in a pilot
Barcode or 2D code	Low-cost issue and return at a staffed counter; marking small tools.	Cheap per tool. Etched or engraved codes last well. Fits existing scanners and habits.	One scan per tool, so it depends on discipline. No location. Needs line of sight and a clean, readable mark.	Tested on your own tools in the pilot.
Passive RFID (UHF or HF)	Cribs, drawers, kits, trolleys and doorway read points.	No battery. UHF reads many tools at once. HF reads at short range and can suit small tools. Metal affects both, so test tags on your actual tools. Compare both designs. Tags can be small and hard-wearing.	Metal detunes tags, so on-metal tags and careful antenna design are needed. Very small tools are hard to tag. Shows a tool is at a read point or in a reading drawer, not where it is elsewhere.	Tested on your own tools in the pilot.
Active RFID or BLE	Larger items: tool boxes, kits, trolleys, stands and test equipment.	Room or zone-level location across the hangar. Simpler infrastructure than UWB.	Battery tags, too large for most hand tools. Usually room or zone level; finer location needs more infrastructure. Batteries need replacing.	Tested on your own tools in the pilot.
UWB	Finding specific high-value items live in a bay, such as test sets, stands and kits.	Fine-grained location for suitable tagged items, when anchors are well placed and the site has been surveyed.	Anchors, cabling and calibration add cost. Battery tags, larger than passive ones. Airframes, stands and doors reflect signal, so results depend on the bay.	Tested on your own tools in the pilot.
Smart cabinets and drawers	Controlled issue of high-value or critical tools, often unstaffed.	Access by badge and, depending on the sensing method, a per-slot record of what was taken and returned.	Cost per cabinet. Only covers what is inside it. Records can be locked into the manufacturer's software unless export is agreed.	Tested on your own tools in the pilot.

CHECKLIST

Hangar realities to check with any option

- ☐ **The tag must not become FOD:** check how it is fixed, what happens when it breaks off and whether it is visible on the aircraft.
- ☐ **Fluids and cleaning:** tags and marks must survive hydraulic fluid, fuel, solvents, heat and cleaning.
- ☐ **Radio rules:** check your site rules for transmitters near aircraft, in fuel tank work and in any hazardous area.
- ☐ **Hazardous areas:** equipment used there needs the right hazardous-area certification for that zone and region.

CHECKLIST

Questions that decide the mix

- ☐ **Do you need to know that a tool came back, or where it is now?** Return is often enough; location costs more.
- ☐ **How many tools, and how small?** This decides between marking, passive tags and cabinets.
- ☐ **Is the crib staffed around the clock?** If not, cabinets or self-service read points matter more.
- ☐ **Which items are worth finding live?** Usually kits, trolleys, stands and test sets, not every spanner.

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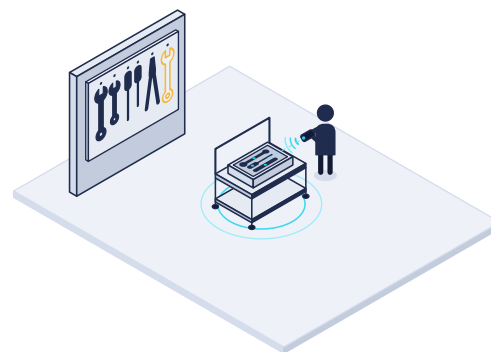
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Kits and shadow boards

Make a gap obvious, then make it traceable

- **One ID per kit, one per tool:** the kit is issued as one item, but every tool in it is known and checked on return.
- **Shadow boards and foam inserts:** they show a gap at a glance. Pair them with a read or a scan so the gap is also recorded.
- **Contents change control:** adding or removing a tool from a kit is a controlled change, not a quiet swap.
- **Mobile kits on trolleys:** track the trolley as a whole with an active tag, for example BLE, if you need to find it.



CHECKLIST

Kits and shadow boards

- ☐ **Each slot maps to one tool record,** so a gap names the missing tool.
- ☐ **Return check is quick enough** to happen at every shift change.

CHECKLIST

FOD and lost-tool events

- ☐ **A written lost-tool procedure:** who is told, what work stops and how the search is run.
- ☐ **Aircraft release rule:** no release until the lost-tool procedure, any required inspection and the assessment are complete, and authorised staff have recorded the decision.
- ☐ **Last known location and holder** are shown at once to the person leading the search.

CHECKLIST

Data and integration

- ☐ **Work order link:** issue and return events reach your MRO or ERP system against the work order.
- ☐ **Data export:** you can export all tool and event history in an open format.
- ☐ **Offline mode:** issue and return still work when the network or server is down.

Covered in the survey: the rest of each list, set for your crib, kits and hangar.

Plain-language glossary

Hangar terms

- **MRO:** maintenance, repair and overhaul.
- **FOD:** foreign object debris, meaning anything left where it should not be, such as a tool in an engine. Foreign object damage is the harm it causes.
- **Tool crib:** the controlled store that issues and receives tools.
- **Shadow board:** a board or foam insert with the outline of each tool, so a gap shows.

Technology terms

- **RTLS:** real-time location system, showing where tagged items are now.
- **Passive RFID:** battery-free tags read by a nearby reader. UHF reads further, HF reads at short range.
- **Active RFID and BLE:** battery tags that report their zone.
- **UWB:** ultra-wideband, battery tags located by fixed anchors.

Project terms

- **ERP and IT/OT:** the business system for stock, purchasing and finance; office IT and the operational systems that run the site.
- **Baseline:** how the KPIs look today, before any change.
- **Pilot:** a time-limited trial on your site with pass and fail criteria.
- **Reconciliation:** checking that every issued tool is back or accounted for.

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Pilot method

One crib or one bay, real tools, real shifts

1 Baseline

Measure today: shift-end gaps, search time, calibration findings, kit returns.

2 Scope

One crib, one bay or one kit family, with one link to the work order system.

3 Criteria

Pass and fail thresholds agreed in writing before any pilot equipment arrives.

4 Survey and install

Site survey, then rented pilot equipment installed on your real tools.

5 Run live

Several weeks on normal shifts, including nights and weekends.

6 Decide

Go, adjust or stop, with the evidence and a costed roll-out plan.

QUESTIONS

Ask every technology provider

- ☐ Show reads on **our own tools and drawers**. What fails, and how is a missed read flagged?
- ☐ How are **issue, return and lost-tool events** written into our work orders, and who builds that link?
- ☐ What is the **five-year cost**: tags, cabinets, licences, support, batteries and re-surveys when bays change?

CRITERIA

Pilot pass criteria to agree

- ☐ Out-of-calibration issue blocked every time in the test script.
- ☐ Crib staff and engineers can use it on a busy shift without workarounds.

We agree the full pass criteria with you before any equipment arrives.

How we work, in five stages: Discovery, Assess and shortlist, Pilot with KPI baseline, Integrate, Multi-site roll-out. We baseline your KPIs before the pilot and work out payback from your own numbers.

KPIS TO TRACK

A KPI is a number you track, before and during the pilot.

- **Tools not reconciled at shift end**, per shift
- **Time to close a lost-tool event**, from raised to closed
- **Tool search time** per job
- **Out-of-calibration issues** blocked at issue or found at audit
- **Kit completeness** at return
- **Tool replacement spend** for lost items
- **Time to produce tool history** for an audit query

We agree how each KPI is measured, and the baseline, in the pilot plan.

TOTAL COST AND PAYBACK

ROI (return on investment) compares what you gain with what you spend. Payback is the time until the savings cover the cost.

What drives payback here

- Search and counting time at shift end
- Tools no longer lost and replaced
- Aircraft delays and audit findings avoided

If the benefit is not bigger than the running cost, there is no payback.

Bring to the call

- Your crib layout and tool list
- Shift-end gaps and search time today, from your records
- Your MRO or ERP system, and how tools are issued today

We work out total cost and payback with you from your own pilot data, not technology provider averages. **Bring rough figures to a free 30-minute call.**

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What it means for each role

YOUR ROLE

WHAT IT MEANS FOR YOU

Operations	Every tool returned or accounted for at shift end, tagged kits and trolleys found quickly, fewer delays to aircraft release.
Quality	Tool and calibration evidence you can produce on request.
Engineering	Tools that are in calibration when they are issued.
IT/OT	Tool events into the work order system, on a network design you approve, under your change control. Tool records linked to named staff are personal data: check local privacy and employee-consultation rules, such as works councils or unions.
Procurement	Options scored on the same tools, the same test and a five-year cost.
Executives	Accountability that does not depend on one person, proved in one crib or bay before roll-out.

How a TRACIO project works: five stages

1 Discovery

Your pain points, site, process and KPIs.

2 Assess and shortlist

Site survey, then the options that fit compared.

3 Pilot with KPI baseline

KPIs measured first. Pass marks agreed in writing before set-up.

4 Integrate

If useful, one agreed link into your MRO or ERP system, under your change control.

5 Multi-site roll-out

Only after a go decision, one area at a time.

How a pilot runs: set-up, then live weeks in normal use, then a short written report with a go or no-go. Timings are agreed per site.

Questions we hear

"We already have a system."

We give a free second opinion and check how it performs against your KPIs, using your live data and a site visit.

"How do we know it will work here?"

Judge us on method: a pilot, KPIs measured before and during it, and a written go or no-go.

"Can you bid with us, or for us?"

Yes. We team with integrators, or act as the buyer's independent adviser, but never both on the same bid.

"Do you sell or resell hardware?"

No. We don't sell hardware, so our advice stays independent. We rent pilot equipment and offer survey and installation support.

Free second opinion

Send us your technology provider's quote or spec for a free second opinion. What to send: the quote or spec, a floor plan or site photos, item counts and your current process. Bring it to the call or send it via tracio.com/contact.

TRACIO consultancy fees

- **UK:** £3k to £30k per project, £1,200 a day
 - **Europe:** €3.5k to €35k per project, €1,400 a day
 - **US and Canada:** \$4k to \$40k per project, \$1,600 a day
 - **Middle East and Australia:** \$4k to \$40k per project, \$1,600 a day
 - **Rest of the world:** \$3.5k to \$35k per project, \$1,400 a day
- Scoped per project, no packages. Fees cover our work only; hardware, software licences and other supplier costs are separate. \$ = US dollars. Travel extra.

Why TRACIO: we work for you, not for the technology providers. We compare the options across the market that fit your site, provide site surveys and installation support, and work worldwide under your change control.

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