

HANDBOOK • VOLUME 1

Engineer-Approved Automation

Automation levels for requirements, traceability and assurance in safety-critical and mission-critical engineering programmes.

AEROSPACE & DEFENCE

SPACE

EVTOL • UAM • UAS

RAIL & TRANSPORT

AUTOMOTIVE

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Why traceability breaks

Every aircraft, spacecraft, drone, train and vehicle programme makes the same promise to its regulator, assessor or customer: each requirement is understood, designed for, verified and backed by evidence. Traceability is how you keep that promise. It is also usually the first thing to fall behind.

Requirements change faster than links

Each change to a requirement can make the links beneath it suspect: the design elements, the tests, the evidence. Rechecking them by hand competes with delivery work, so it gets deferred, and deferred checks become a backlog.

The thread runs across tools and suppliers

Requirements sit in DOORS, Polarion, Jama or Codebeamer, architecture in Cameo, Enterprise Architect or Capella, tests in Jira, a test bench or a spreadsheet, evidence in SharePoint. Suppliers hand over their own specifications in yet another format. Every boundary is a place where a link can break without anyone noticing.

Reviews sample. Gaps don't.

Manual reviews check a sample of requirements. The orphaned requirement or the missing verification method is rarely in the sample, and it waits.

Problems surface late

A gap found at a design review, an independent safety assessment, a process audit or a certification submission costs far more to close than the same gap found the week it was introduced, because by then other work depends on it.

The answer isn't more reviewers. It's automation that checks continuously, and engineers who decide what changes.

Automation in safety-critical engineering carries its own risk. A tool that quietly rewrites a baselined requirement, or creates a trace link nobody checked, undermines the evidence it was meant to protect. Speed bought that way is paid back at the next audit.

This handbook sets out a way to get the speed without giving up control. It describes four levels of automation for requirements and traceability work, from fully manual to routine fixes that have been approved in advance. At every level, authority over the baseline stays with named engineers.

It is written for systems engineers, requirements managers and assurance leads on programmes where evidence matters:

AERO & DEFENCE	Aircraft, weapons and mission systems with a certification basis or a defence safety case to maintain.
SPACE	Satellites, launch and ground segments working to agency or prime-contractor product assurance.
EVTOL · UAM · UAS	Aircraft on the road to type certification, and drones seeking class marks or operational approvals.
RAIL & TRANSPORT	Rolling stock, signalling and infrastructure assured through independent safety assessment.
AUTOMOTIVE	Vehicle systems and software developed to functional-safety, cyber and process-capability standards.

HOW TO USE THIS HANDBOOK

Read chapters 2 and 3 to understand the levels. Use chapters 5 to 7 to decide what to automate, at which level, and when to move up. Chapter 8 maps the approach to your sector's assessors and standards. Chapter 9 is a 30-day plan you can start this month.

Five principles

Everything in this handbook rests on five principles. They apply at every level, in every sector.

01 **Nothing changes without approval.**

Automation can detect and propose. Only a named engineer can approve a change to a requirement, a trace link or a verification record. At the highest level, that approval is given in advance for a narrow, written class of change, never implied.

02 **Every finding shows its source.**

Each issue and each suggestion points back to the exact requirement, paragraph or link it came from, with a plain-language reason. If a finding can't be explained, it isn't shown.

03 **Rules first, AI second.**

Deterministic rules catch what rules can catch: orphans, broken links, empty fields. Language models are used where judgement about meaning helps, such as spotting ambiguity or suggesting a candidate link, and their output is always a suggestion.

04 **Everything is logged and reversible.**

Every detection, suggestion, decision and write-back is recorded: who, when, what and why. Any approved change can be traced and rolled back.

05 **Work where the data lives.**

Requirements stay in your existing tools. Automation works alongside them: hosted, in your own cloud, or air-gapped.

The Kelvora automation levels

The levels describe how much of the work automation does. They don't describe how much authority it has: at every level, that stays with engineers. Levels are set per project, and can differ between draft and baselined items in the same project.

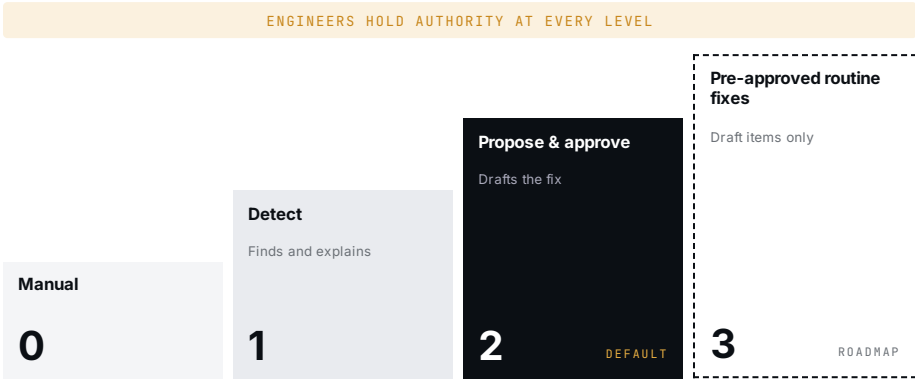


Fig. 1 – Four levels. More automation at each step; the same approval authority throughout.

LEVEL	AUTOMATION DOES	ENGINEERS DO
0	Nothing	Find and fix every issue by hand
1	Finds issues continuously and explains each one	Decide and fix
2	Drafts the fix: rewrites, candidate links, verification entries	Approve, edit or reject each change before it is written back
3	Applies changes of a class approved in advance, to draft items only	Own the rules, work the review queue, undo if needed



LEVEL 0

Manual

Engineers find and fix traceability issues by hand, usually through periodic reviews and spreadsheet checks.

Coverage depends on individual diligence and available time. Quality is often high where people look and unknown where they don't. Most programmes start here, and many stay here longer than they intend, because the cost of falling behind is invisible until a milestone.

APPROVAL POINT	Implicit in each engineer's own edits.
WHAT'S LOGGED	Whatever the requirements tool records, which is usually the change but not the reasoning behind it.
SUITS	Very small requirement sets and early concept work.
WATCH OUT FOR	Gaps building up quietly between reviews, and findings arriving at the worst moment: just before a design review, assessment or submission.

1

LEVEL 1 Detect

Automation checks requirements and trace links continuously and explains every issue it finds. It changes nothing.

Kelvora reads from your requirements tool or uploaded documents and flags orphaned requirements, broken and suspect links, missing verification methods, ambiguous wording and duplicates. Each finding links to its source with a reason, so an engineer can judge it in seconds.

APPROVAL POINT	None needed. The automation is read-only at this level.
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WHAT'S LOGGED	Every finding, when it was raised, who resolved it and when.
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SUITS	The first step on any programme, and programmes where no external tool may write to the baseline.
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WATCH OUT FOR	A long list of findings on day one. Triage by severity, and start with the items nearest your next review milestone.
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2

LEVEL 2 · RECOMMENDED DEFAULT

Propose & approve

Automation drafts the fix for each finding. Nothing is written back until a named engineer approves it.

For an orphaned requirement, Kelvora suggests candidate parent and child links, each with a confidence level and a one-line reason. For an ambiguous requirement, it proposes a rewrite shown side by side with the original. For a missing verification method, it proposes an entry for the verification matrix. Engineers accept, edit or reject, one at a time or in batches, and only approved changes are written back to the source tool.

APPROVAL POINT	Every change, before write-back.
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WHAT'S LOGGED	The finding, the suggestion, the decision and who made it, any edits, before-and-after values, and the rules or model version behind the suggestion.
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SUITS	Most programmes in every sector, including safety-critical, defence and air-gapped deployments.
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WATCH OUT FOR	Rubber-stamping. Batch approval is fast, so make sure reviewers still open anything below high confidence, and track who approves what.
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3

Pre-approved routine fixes

An engineering authority approves a narrow class of routine change in advance. Automation applies only those changes, only to draft items, and puts each one in a review queue.

A typical rule: *link a draft subsystem requirement to its parent where the identifiers follow an agreed pattern and confidence is high*. Anything outside the approved class drops back to Level 2. Baselined and released items are never changed automatically.

APPROVAL POINT	The rule itself, signed off by a named authority. Each resulting change can be reviewed and undone in one click.
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WHAT'S LOGGED	The rule, its approver and version, every change made under it, and any reversals.
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SUITS	Teams with large, fast-moving draft requirement sets and several months of Level 2 acceptance data.
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WATCH OUT FOR	Rules that grow. Keep them narrow, give each an owner and an expiry date, and re-approve them after any significant process change.
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Inside the approval gate

An approved change passes through six stages. The fifth never happens without the fourth.

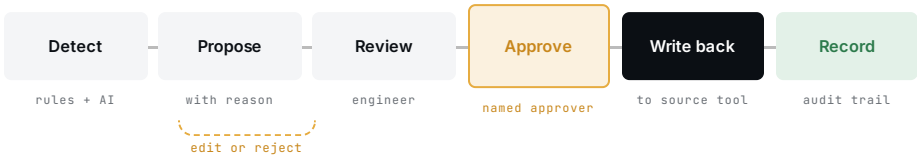


Fig. 2 – The approval gate. Rejected or edited suggestions return to the engineer, never to the baseline.

The audit record

Every change leaves a record that answers an auditor's or assessor's questions without anyone having to reconstruct them:

finding	ID, type, severity
source	tool · module · requirement · paragraph
suggestion	proposed change + one-line reason
basis	confidence · rules / model version
decision	approved · edited · rejected – by whom
values	before → after
time	decision · write-back
rollback	reference to undo

If you can't say who approved a link, and why, you don't have traceability. You have links.

What to automate first

Start with checks that are frequent, tedious and quick to verify. They return the most time for the least risk.

CHECK	WHAT IT CATCHES	START AT
Orphaned requirements	No parent, or nothing derived from it	LEVEL 2
Broken links	Links to deleted or moved items	LEVEL 2
Missing verification method	No test, analysis, inspection or demonstration assigned	LEVEL 2
Ambiguous wording	"Adequate", "as appropriate", several "shall" statements in one requirement	LEVEL 2
Suspect links after change	Links whose source changed since they were last confirmed	LEVEL 1
Verification without evidence	Method assigned but no result or evidence linked	LEVEL 1
Duplicates and conflicts	Near-identical or contradictory requirements, including across supplier specifications	LEVEL 1
Standards coverage gaps	Clauses of an applicable standard, such as DO-178C, ECSS, EN 50126 or ISO 26262, with no requirement mapped	LEVEL 1

Checks that depend on meaning, such as duplicates, conflicts and coverage, stay at Level 1 longest, because a wrong suggestion there takes more effort to catch.

Choosing a level

Set levels per project, then limit them further by the status of each item. Two factors matter most: how settled the item is, and how much depends on it.

ITEM STATUS	STANDARD ITEMS	SAFETY-SIGNIFICANT (DAL · SIL · ASIL)	DEFENCE / AIR- GAPPED
Draft	Up to 3*	2	2
In review	2	2 + second reviewer	2
Baselined / released	2, through change control	2 + second reviewer, through change control	2, through change control

* When Level 3 is available and your acceptance data supports it (chapter 7). Any item can be held at Level 1 if your process or customer requires a read-only tool.

Three rules of thumb

Settled items move slowly. The closer an item is to a baseline, the more a wrong change costs, so the level drops or the approval gets stricter.

Safety links get two pairs of eyes. Where a requirement traces to a hazard mitigation, a safety requirement or a safety claim, whatever your sector calls its integrity level (DAL, SIL, ASIL or criticality category), add a second approver rather than relying on confidence scores.

The administrator locks the ceiling. Engineers can always choose a lower level for their own work. Only an administrator can raise the ceiling for a project.

Moving up a level, with evidence

Don't move up because a tool can. Move up because your own data shows it's safe. Level 2 generates that data as a by-product of normal work.

What to measure at Level 2

ACCEPTANCE RATE	Share of suggestions approved unchanged, by check type and confidence band.
EDIT RATE	Suggestions approved only after an engineer changed them.
REVERSAL RATE	Approved changes later undone, and why.
REJECTION REASONS	The most common reasons engineers say no. These show where suggestions need to improve.
TIME TO DECISION	How long findings wait before someone decides.

EXAMPLE CRITERIA — AGREE YOUR OWN

A check type becomes eligible for Level 3 when, over at least three months, high-confidence suggestions are almost always approved without edits, no approved change of that type has been reversed for being wrong, and the engineering authority has reviewed a sample and signed off a written rule.

Moving down is normal too. After a process change, a tool migration or a reversal, drop the affected check back a level until the data rebuilds.

Regulators, assessors and automation

The names differ by sector, but every regulator, assessor and customer is asking for the same thing: an unbroken, explainable line from requirement to evidence, and a process that keeps it that way.

SECTOR	WHO ASSESSES THE EVIDENCE	STANDARDS YOU'LL MEET
Aerospace & Defence	Certification authority, military airworthiness authority, delivery team and independent safety auditor	ARP4754B, DO-178C, DO-254, Def Stan 00-055 / 00-056, MIL-STD-882E
Space	Agency or prime customer product assurance; launch and orbital licensing	ECSS-E-ST-10-06, ECSS-E-ST-40, ECSS-Q-ST-80, NASA NPR 7150.2
eVTOL · UAM · UAS	EASA, FAA, UK CAA and national aviation authorities	EASA SC-VTOL, ARP4754B, DO-178C, SORA, UAS class marks
Rail & Transport	Independent safety assessor, assessment body, notified and designated bodies, infrastructure manager	EN 50126, EN 50129, EN 50716 (formerly EN 50128), CSM-RA
Automotive	Type-approval authority, OEM customer, functional-safety assessor, Automotive SPICE assessor	ISO 26262, ISO 21448, ISO/SAE 21434, Automotive SPICE, UN R155 / R156

Approval fits existing change control

Automation that proposes, with a named approver and a complete record, slots into the change control and configuration management you already run, whether that is a design organisation procedure, an ASPICE-assessed process or a railway safety management system. The decision is the engineer's. The record shows how it was made.

Consider tool qualification early

Where a tool's output is relied on without independent verification, most safety frameworks expect the tool itself to be assessed or qualified. Each sector frames this differently:

AIRBORNE	DO-330 sets out tool qualification levels, driven by the criteria in DO-178C. Applies to aircraft, eVTOL and certified UAS software.
SPACE	ECSS-Q-ST-80 and NASA NPR 7150.2 both expect software tools used in development and verification to be assessed before their output is relied on.
RAIL	EN 50716, like EN 50128 before it, classifies support tools (T1 to T3) and asks for more evidence the more a tool's output is trusted.
AUTOMOTIVE	ISO 26262-8 derives a tool confidence level from the tool's impact and the likelihood that its errors are detected.
DEFENCE	Tool use is argued in the safety case under Def Stan 00-055 / 00-056 and agreed with the delivery team and independent safety auditor.

The common thread: keeping an engineer's approval on every change keeps automation in the role of an assistant whose output is checked. That review is itself an error-detection measure, which can simplify the qualification argument. Discuss the position with your certification or safety lead before relying on it.

Make the record easy to hand over

Auditors and assessors shouldn't need access to your tools. Export the audit trail for the period under review, with decisions, approvers and before-and-after values, as part of your evidence pack or safety case.

This chapter is general guidance, not regulatory advice. Agree your approach with your certification authority, safety assessor, customer or safety lead.

Your first 30 days

A plan for one programme. No change to your requirements tool, and nothing written back without approval.

WEEK 1 **Connect and baseline · Level 1**

Connect your requirements tool or upload a ReqIF, CSV or document export. Run every check and record your starting point.

WEEK 2 **Triage**

Sort findings by severity and next milestone, and agree owners. Fix a few by hand to agree what good looks like.

WEEK 3 **Propose and approve · Level 2**

Turn on suggestions for orphaned requirements and missing verification methods in one module. Approve in small batches, and note every rejection reason.

WEEK 4 **Review the data**

Compare acceptance, edit and reversal rates against week 1. Decide which checks to extend and which stay at Level 1.

BEFORE YOU START

- ☐ Named approvers agreed for each project
- ☐ Level ceilings set by project and item status
- ☐ Baselined items protected by change control
- ☐ Tool-use position agreed with your safety or certification lead
- ☐ Audit export tested, starting metrics recorded, review date set

About Kelvora

Kelvora is a requirements and assurance platform for engineering teams in aerospace and defence, space, eVTOL, UAM and UAS, rail and transport, and automotive. It finds gaps in requirements, traceability and verification, proposes fixes, and writes back only what your engineers approve.

SECTORS	Aerospace & Defence · Space · eVTOL, UAM & UAS · Rail & Transport · Automotive
WORKS WITH	DOORS, Polarion and Jama, or exports such as ReqIF, Word and Excel. Your requirements stay where they are.
EXPLAINABLE	Rules first, AI second. Every finding is traced to its exact source.
DEPLOYMENT	Kelvora Cloud on Microsoft Azure (UK), inside your own Azure, or fully air-gapped with a local model.
TRY IT	Every plan starts with a free two-week trial on your own requirements.

SEE IT ON YOUR REQUIREMENTS

Book a demo at kelvora.ai

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Automation that proposes. Engineers who decide.

Requirements, traceability and assurance for aerospace, defence, space, advanced air mobility, rail and automotive programmes.