



Quartz Chamber Installation

Technical Proposal Rev F

Prepared for ASM

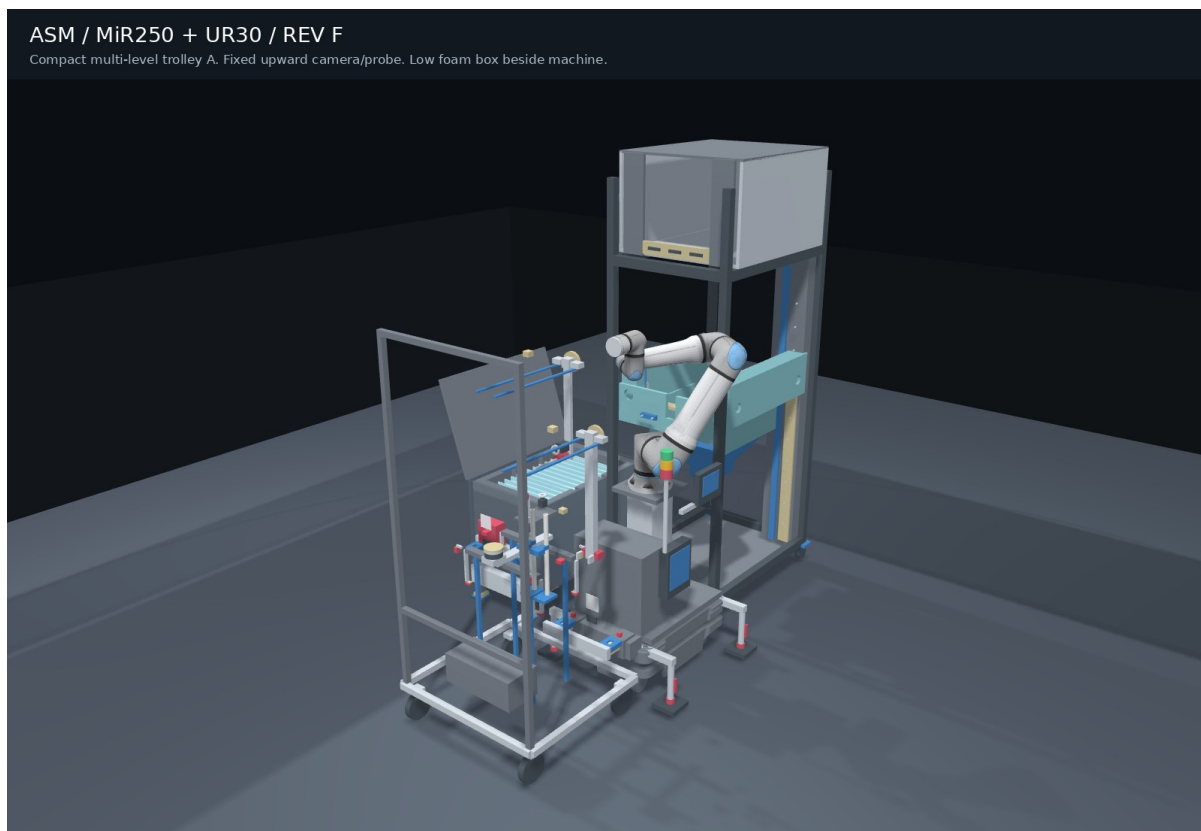
Mr Daniel and the project engineering team

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AETEC proposes a permanently mounted UR30 on MiR250 with exchangeable tooling trolleys. Trolley A uses height and side access to reduce tool-storage space. Its upward camera and probe remain fixed while the robot moves the retained chamber through the measurement sequence. A fixed-arm POC precedes mobile implementation.

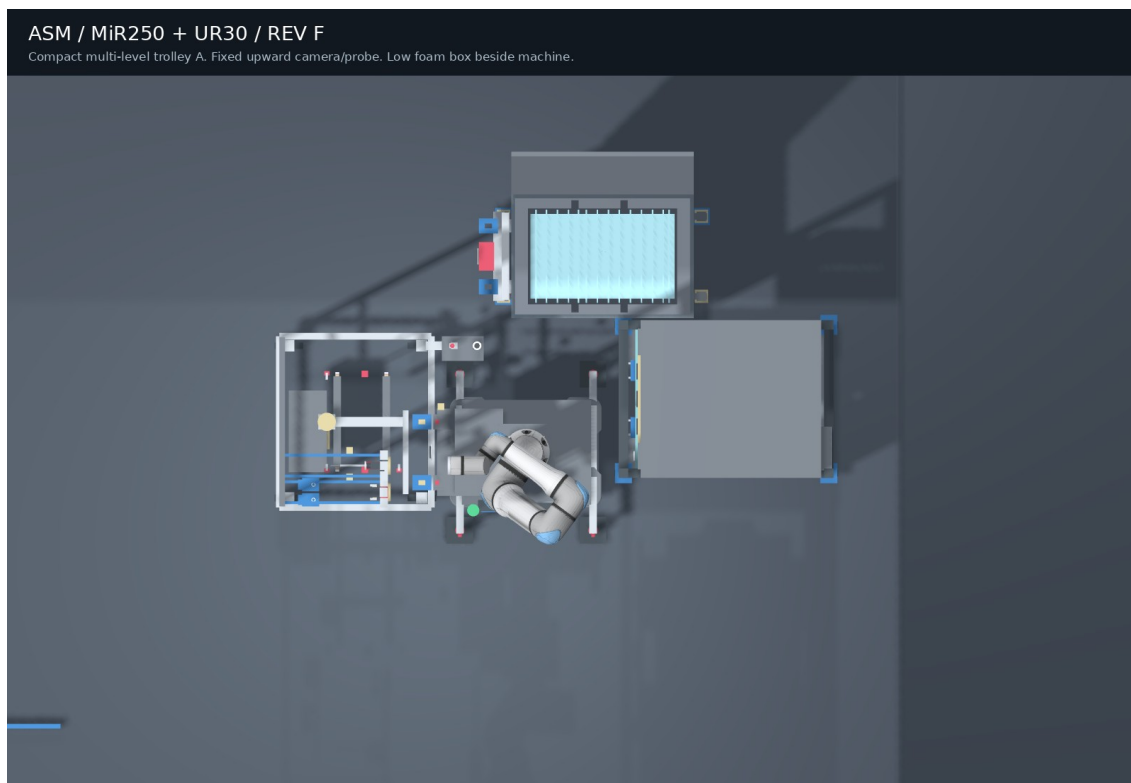


Initial concept for discussion. Model dimensions are tied to customer callouts where available; the remaining machine geometry is reconstructed and requires a survey. Signals and measurements in the simulation are illustrative.



1 Compact mobile architecture

Assembly	Rev F design
MiR250 and UR30	UR30 stays on the AMR. A custom support frame includes monitored stabilizers, the robot controller, pendant, linked industrial computer and OK/HOLD/NG stacklight.
Trolley A	Independent wheeled rack captured by paired retained locking keys and a wide bridge. AprilTag/RFID identify it; mechanical datums and lock/seat sensors establish retention. Upper tools store vertically in side-entry nests; the chamber gripper uses the lower open level. A drawer stores consumables.
Fixed upward station	Rigid camera and probe bracket on trolley A. The robot translates and rotates the held chamber to present each bore and bottom-plane reference. The station has no scanning axes.
Floor-supported box	Low top-opening foam box on 150 mm transport casters. A separate holder carries the structural underside and transfers load to floor stands. Wheels are unloaded during robot handling; floor locators restrain movement.
Trolley C option	Powered under-box carrier, jacks, common rigid receiver and isolated AMR-supplied power. Transport and tool trolley functions share the interface, with one trolley attached at a time.
Trolley B option	Separate inspection cassette with camera, probe and laser triangulation. Trolley exchange occurs at defined docking bays before returning to the machine.



Storage footprint and operating clearance are different quantities. The compact rack reduces the tool-storage envelope, but robot sweep, container lid clearance, stabilizer footprint, trolley turns and safeguarded access still govern the complete cell layout. This layout is a checked design candidate, not a mathematical proof of global minimum area.



2 Interchangeable tooling and process

Tool	Function
T1 standard	Camera and low-contact-force probe. Camera views establish safe coarse approaches before probing the source, machine pins, three seating-plane points and parked gripper datum.
T2 standard	Four support shoes enter approved fin slots and contact the two flat side lands. External F/T, pad loads and retention sensing monitor pickup, foam extraction and seating.
T3 optional	Small gripper for two removable Teflon guiding fixtures. Their cassette and nest stay on trolley A.
T4 optional	Trolley B camera/probe/laser tool for dimensional inspection, 3D scanning, object detection and AI defect inspection.

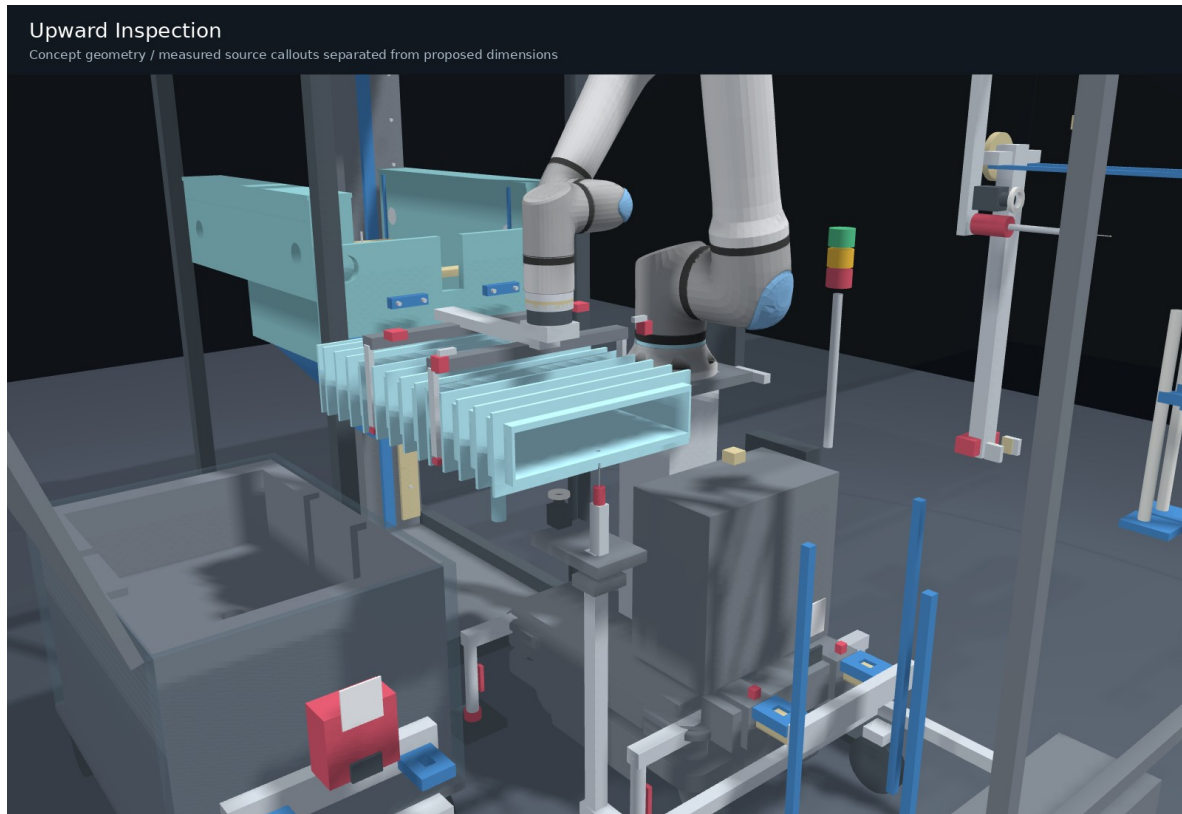
After T1 registers the source and destination, the robot verifies the parked T2 datum, returns T1 and captures T2. Tool ID, latch and nest support must agree before ownership changes. T2 enters the foam slots, closes beneath the flat lands and lifts slowly while monitoring expected weight, lateral force and moments. Excess resistance causes retained HOLD.

The fixed upward camera checks the held chamber first. The robot then presents each datum hole to the fixed probe and measures the bottom plane. The three-hole frame is compared with the measured three-pin frame. An accepted bounded correction must pass reach, clearance and retreat checks before use.

The base recipe enters the machine level, aligns square to the three pins and descends slowly under sensitive force monitoring. Confirm all three seats and load handover before unloading and opening the gripper. Guides are optional; the base sequence does not depend on them.



3 Fixed metrology and quartz protection

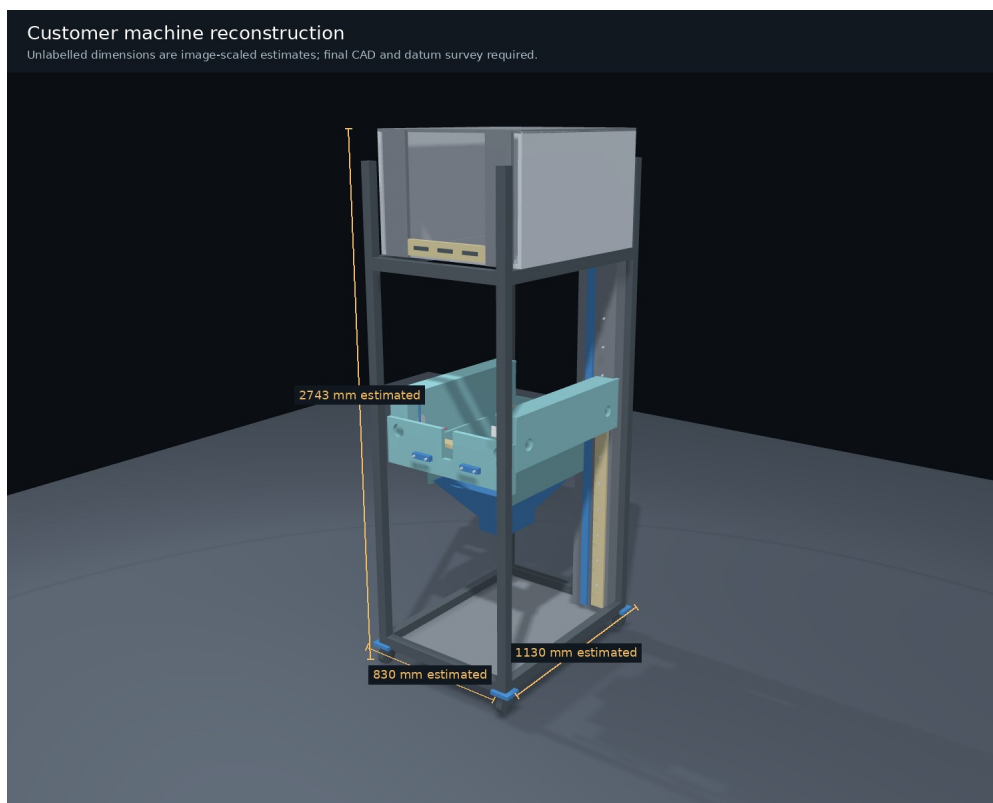


Condition	Control
Fixed upward probe	Use a calibrated stylus radius and small bounded touches. Lift the chamber clear of the stylus and tubulation hazards before a large traverse or rotation.
Foam extraction	Compensate gravity and motion. Monitor load and moment versus displacement/time, not only peak weight. Do not pull harder automatically when stuck.
Transparent quartz	Prove lighting and optical response on actual samples. Laser ranging to opaque targets and dedicated glass optics require application trials.
Pattern mismatch	Frame correction cannot fix hole pitch, diameter, form or thermal mismatch. Three round pins may overconstrain an inconsistent pattern.
Fault recovery	Keep the part supported and retained. HOLD/NG signals block continuation. Reset acknowledges the condition; a separate deliberate restart follows clearance checks.

Vision and touch probing provide different measurements but do not automatically form safety-rated redundant channels. Shared calibration and frame errors remain possible. UR30 specifies built-in F/T accuracy of 10 N [2]; the proposed precision probe and external force sensor need their own validated range, bandwidth, overtravel and stopping limits.



4 Machine geometry and simulation evidence



Evidence	Treatment
Customer PowerPoint	Information for AETEC_20261023.pptx, all ten slides. Type 1 envelope 759 x 490 x 159 mm, body height 113 mm, internal opening 433 x 88 mm, tubulation diameter 34 mm.
Machine dimensions	700, 310, 450 and 230 mm interface callouts anchor the reconstruction. Overall frame approximately 830 x 1130 x 2743 mm is image-scaled. Perspective scaling is not a tolerated survey.
Embedded CAD	Original tong and both manual-guide STEP files are retained unchanged. Their assembly transforms require confirmation.
Robot references	Official UR30 graphical/collision models and nominal kinematics. MiR250 community reference mesh, not verified OEM CAD.
Fit assumptions	Pin diameter 8 mm and hole diameter 10 mm are assumptions, not released customer tolerances.

Current sampled audit: 22,417 configurations; 278,510,990 broad-phase pairs; 221,261 narrow-phase mesh tests. Verdict: no unintended contact in sampled reconstruction.

Separate reports additionally cover the optional container-carrier scenario and the fixed-arm POC with automatic tool changes and a machine-shaped dummy. All reports identify the exact sampled scope.

The audit covers the displayed nominal path and models, including parked and active tools, low box, chamber/tubulation, fixed metrology, trolley exchange and inspection. It does not establish continuous swept clearance, cable/hoses, production tolerance extremes, actual probe forces, payload/CG, structural stiffness, floor loading or safe stopping distance. Corrected paths need a new check. The optional guide sequence requires its own final validation.

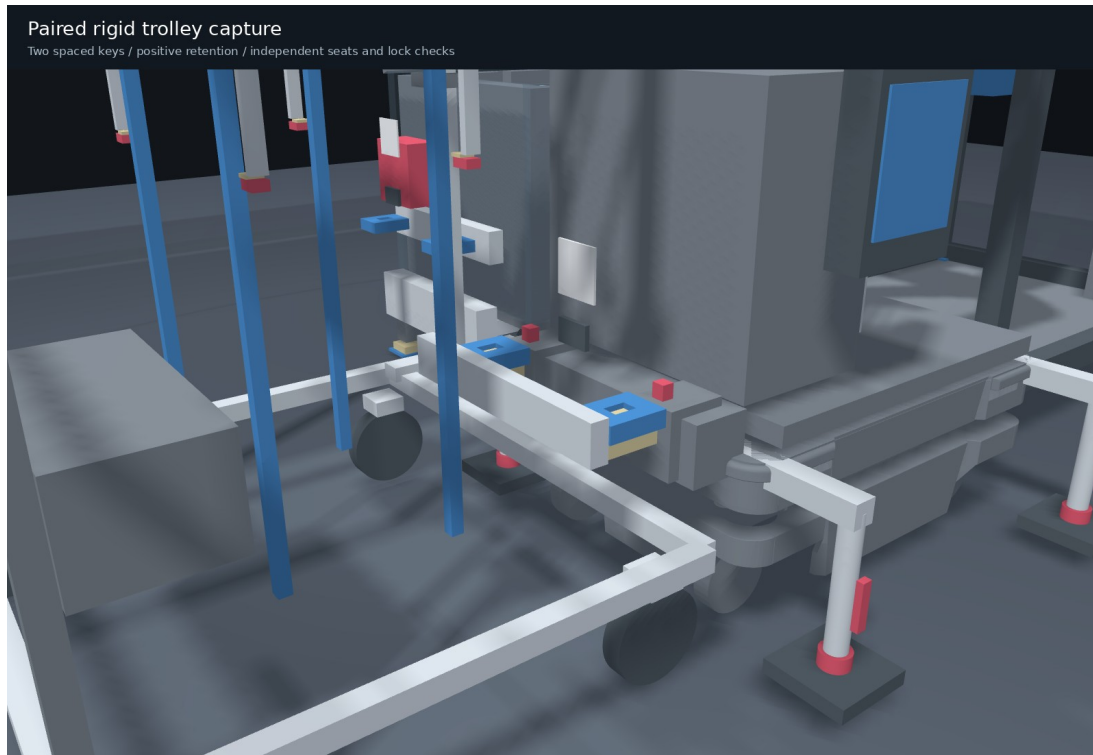


5 Mobility cleanroom and commissioning

Release gate	Required evidence
UR30 loading	Actual chamber plus complete tool mass, CG and wrist moment. Nominal 30 kg payload and conditional 35 kg mode do not approve a 30–35 kg chamber plus tooling.
AMR integration	MiR250 top payload is 250 kg. Include arm 63.5 kg, controller 12 kg, frame, supports, power system, computer and transferred trolley reactions. Verify CG, braking, turns and floor loading.
Lift and latch	Approve the custom yaw-locked capture interface, load transfer, positive retention and trolley ID. OEM Hook ratings do not validate coexistence with a permanently mounted UR30.
Cleanroom	MiR250 offers optional ISO Class 4 configuration [3]. UR30 arm/controller are ISO Class 4 [2]. Qualify the completed operating assembly to the agreed ISO 7 conditions.
Power and services	Engineer the robot AC power supply, battery/runtime, charger interlocks, cables, air/electrical services and safe isolation.
Safety and acceptance	Machine handshake, guarding, mobile protective fields, support reactions, intentional contact limits, retained recovery and FAT/SAT criteria require validation.



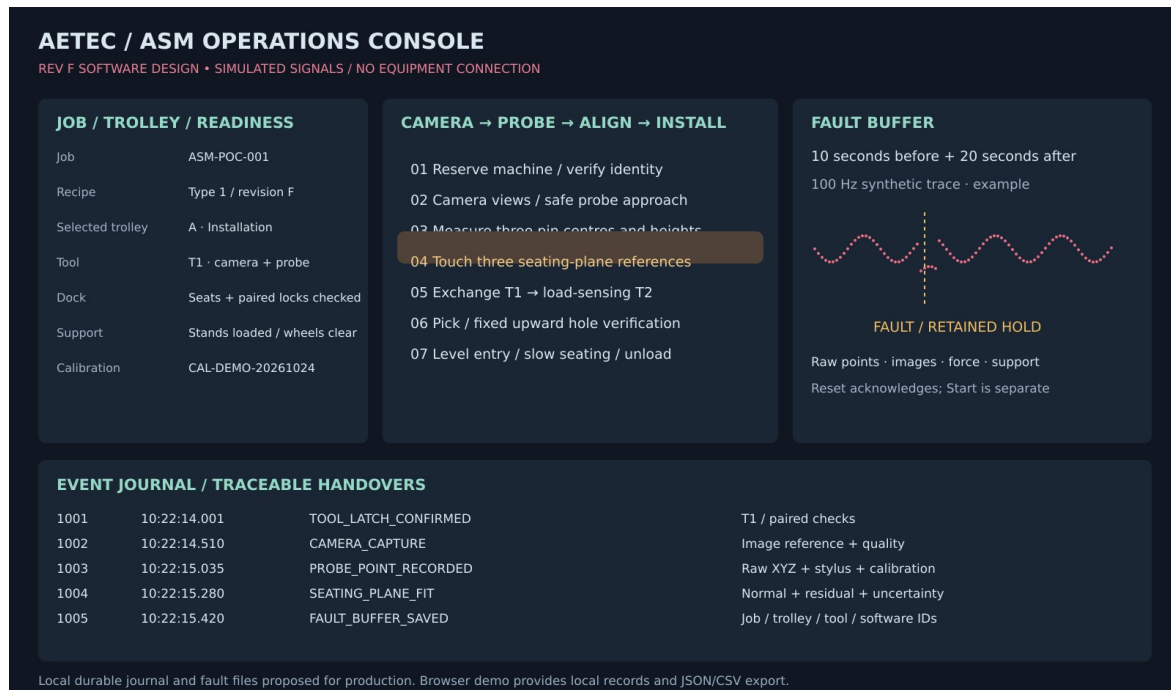
6 Common coupling and supported container



Feature	Proposed design and verification
Rigid load path	Two spaced lifting keys and receiver blocks with a stiff cross-member. Positive retention carries separation loads; datum faces carry shear. Check normal/braking/cornering loads and fatigue, not only static payload.
Repeatable docking	Use coarse AprilTag guidance, RFID recipe identity, then mechanical round/diamond or equivalent non-overconstrained datums. Seat, lock and electrical connection states are independently monitored.
Power interface	Floating, protected blind-mate connector engages after mechanical alignment. Isolated 24 V jack supply, current limiting and safe disconnect. Actual motor current, cable drop and MiR interface approval remain open.
Container support	Forks load only the structural underside. Feet establish a stable support polygon; load cells and displacement detect uneven support. Release requires unloaded casters, dock restraints and retained support.
Power loss	Do not rely on assumed screw self-locking. Holding brakes and positive mechanical support must retain the load; prove worst-case vibration, failure and recovery.



7 Operator interface and diagnostic records



Screen / record	Required content
Job and fleet	Job/recipe, machine reservation, selected trolley A/B/C, RFID/AprilTag result, tool ID, coupling and nest ownership. All readiness conditions must be true before deliberate Start.
Live process	Machine/part frames, pin and plane fit quality, support loads, wheel-clear/lock states, force/moment, camera triggers and probe touches. Readings in the review app are simulated.
Traceability	Job, part, machine, trolley and tool IDs; calibration and software versions; timestamps, raw touch points, image references, frame transforms, uncertainty and pass/fail reasons.
Fault buffer	Proposed 100 Hz process traces with 10 s before and 20 s after a fault, plus event-triggered images. Freeze the fault window, persist locally and export with the event record. Rates and retention require storage sizing.
Recovery and storage	Append-only production event journal with bounded buffers, monotonic sequence IDs and synchronized timestamps. Detect write failures and full disk; HOLD if mandatory trace evidence cannot be retained. Reset acknowledges; Start remains separate.

The web review implements a browser-local demonstration log and fault buffer with JSON/CSV export. It is not connected to a robot, safety controller, camera or production historian. Production persistence, access control, clock synchronization and MES integration require implementation and validation.



8 POC commercial options and ROI

The fixed-arm POC uses a printed chamber with three datum holes and a machine-shaped dummy with three pins, three seating contacts and the actual access obstructions represented. Automatic T1 camera/probe and T2 gripper exchange is part of this phase. Repeated pick/place, representative foam extraction, fixed upward metrology and fault injections provide evidence before mobile investment. A printed part cannot prove real-quartz fracture or cleanroom performance.

Package	Budget SGD excluding tax
Fixed-arm POC	119,295
Mobile system with trolley A	625,845
Optional two guides and T3	22,110
Optional AI inspection trolley B	140,085
Optional powered container trolley C	78,210

The ROI workbook uses the base budget as investment and preserves missing ASM operational inputs. Measure annual installation events, normal person-minutes, damage/rework rates, replacement costs and maintenance. Do not use video duration as cycle time or assume redeployed labour becomes cash saving. Add only selected options and additional nonduplicated site costs.

Source register

[1] ASM customer PowerPoint dated 23 October 2026 and three embedded STEP files. Latest user instructions define Rev F.

[2] Universal Robots UR30 technical specifications:
https://www.universal-robots.com/manuals/EN/HTML/SW5_25/Content/prod-usr-man/complianceUR30/H_g5_sections/appendix_g5/tech_spec_UR30.htm

[3] MiR250 specifications: <https://mobile-industrial-robots.com/products/robots/mir250/specifications>

[4] MiR250 Hook application: <https://mobile-industrial-robots.com/products/applications/mir250-hook>

[5] Renishaw low-force probe reference: <https://www.renishaw.com/en/tp200--6671>

[6] Indicative supplier prices and allowances are documented in the internal cost workbook. No supplier offer or purchase is implied.