



# ASTRA

## AEROSPACE STANDARD

PROCEDURE

### Technical Witnessing and Method-Family Coverage

AF-AST-PR-009

FIRST EDITION

30 September 2026 | English master text

Aviation / Space / Defense / Future systems

# Publication identity and use

| Control                      | Publication information                                                                                                                                                            |
|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Code and title               | AF-AST-PR-009 — Technical Witnessing and Method-Family Coverage                                                                                                                    |
| Edition and publication date | FIRST EDITION   30 September 2026   English master text                                                                                                                            |
| Accountable function         | Technical Assessor                                                                                                                                                                 |
| Controlling technical basis  | AF-AST-STD-001 / AF ASTRA-100:2026; supplied 248-page FIRST EDITION, Clauses 0–80 and Annexes A–AR.                                                                                |
| Source fingerprint           | fe0f775b3f57e43c7ad6b3d4ab17ac0ff872d3ce8c88fcd9ae9a0116b23209b1                                                                                                                   |
| Portfolio                    | 108 retained document codes; F01–F08; 68 retained technical subjects. All-space and verification domains are applicability tags, not additional families.                          |
| Publication and operation    | Prepared publication. Actual technical approval, consultation, institutional adoption, operational effectivity and individual scope activation require separate authentic records. |

## Purpose and application

Witnessing of manufacturing, testing, inspection, maintenance, services, education or statement activities within an approved profile and safe access boundary.

## Source requirements and added implementation detail

The controlling ASTRA source is identified above by content fingerprint. Numbered source clauses and annexes retain their own authority. The retained operating material is restructured and expanded with implementation methods, additional profile controls, worked synthetic examples, decision diagrams and record contracts. Added implementation detail is not presented as an earlier institutional approval or as a change to the supplied core standard. Any additional binding criterion requires the applicable technical adoption process.

The displayed publication date identifies the edition; it is not a fabricated authoring, test, approval or operational date. Actual records retain genuine event times and controlled versions. No named outside organisation or standard is incorporated as a normative reference. AF internal instruments and separate legal or contractual duties remain applicable within their actual scope.

### Acceptance boundary

A positive grant requires every applicable mandatory condition to PASS, every N/A to have independent justification, every in-scope nonconformity to be verified closed, and competent independent authority. HOLD, unknown state, missing evidence, a favourable average, a signature image or a completed form cannot substitute for those conditions.

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# 1 Scope, trigger and responsibility

Witnessing of manufacturing, testing, inspection, maintenance, services, education or statement activities within an approved profile and safe access boundary.

Trigger: A plan requires observed technical performance or an end-to-end evidence trail.

Accountable process owner: Technical Assessor. Actual named appointments and deputies are recorded separately. The process owner coordinates execution; technical review, independent conformity decisions and operational permissions retain their separate mandates.

| Input                                                                   | Output / destination                                                                               |
|-------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| Actual request or triggering event, scope and current technical basis   | A traceable process record linked to its case/object and the required form modules.                |
| Competence, conflict, authority and access evidence                     | Approved assignment and lawful access before affected work begins.                                 |
| Original observations, technical results, limitations and prior history | Reasoned accept/hold/escalation decision; preserved adverse evidence and recipient communications. |
| Controlling clocks and genuine event timestamps                         | Actual due/completion records in SC-003 and the relevant register; no administrative reset.        |

# 2 Operating sequence

## PR-009 – Technical Witnessing and Method-Family Coverage

Trigger: A plan requires observed technical performance or an end-to-end evidence trail.

### 1. Select the technical trail

The assessor chooses an actual output and a representative task from the approved population. Include routine, changed, failed and lower-volume work where relevant. Document why the selection represents the requested capability and which limits remain.

### 2. Confirm readiness and authority

Verify actual performer, task authorisation, method, article configuration, equipment, software and environmental conditions. Confirm safe access and the responsible stop authority. An assessor observes competence and does not take operational command of hazardous work.

### 3. Trace backward to the basis

Link the output to customer or mission need, applicable criteria, approved technical data, sources, materials, personnel and configuration. Check original records rather than relying solely on a summary certificate. Record missing or inconsistent links before drawing a conclusion.

### 4. Observe essential execution

Witness required preparation, setup, work, monitoring and interpretation. Record actual parameters and deviations within authorised specialist procedures. State assistance, coaching or simulation openly. A curated completed item does not establish independent routine execution of hidden steps.

### 5. Trace forward to release

Follow the observation into raw data, calculation, report review, technical disposition and actual authorised release. Check whether the conclusion matches the evaluated item and whether recipients received required restrictions. Separate process qualification, product acceptance and provider competence.

## 6. Challenge adverse evidence

Examine failures, interruptions, out-of-tolerance equipment, rework and repeated attempts. Test whether causes and affected populations were addressed. Expand the sample when a shared control or contradictory record suggests a wider issue.

## 7. Record method and inference limits

State detection, range, access, sampling, uncertainty and configuration boundaries. Distinguish direct observation from instrument-derived information, model inference and declaration. Do not use an easy reference demonstration to claim detection of every relevant installed defect.

## 8. Hand over for independent review

Provide an attributable witness record with sources, actual observations, findings and precise conclusion. Identify any supplementary work still required. The witness recommendation is evaluation evidence, not the independent final conformity decision.

Hold / escalation: An unobserved essential step, inappropriate method, invalid equipment or unsupported representative grouping requires additional demonstration or an explicitly restricted conclusion.

Record handover: AF-AST-FR-007, AF-AST-FR-009, AF-AST-FR-010, AF-AST-FR-011.

# 3 Completion, holds and handover

An unobserved essential step, inappropriate method, invalid equipment or unsupported representative grouping requires additional demonstration or an explicitly restricted conclusion.

## Decision and authority boundary

A positive grant, renewal or extension requires valid scope, every applicable criterion fulfilled, sufficient usable evidence, closure of every in-scope nonconformity, current competent independent decision authority and effective required permissions. No score, majority vote, membership status or future corrective promise replaces a missing gate. An operational technical release, a programme outcome and an administrative publication are separate actions.

| Required record | Capture responsibility                    |
|-----------------|-------------------------------------------|
| AF-AST-FR-007   | Assessment plan and time                  |
| AF-AST-FR-009   | Witness and vertical technical trail      |
| AF-AST-FR-010   | Evidence and sample index                 |
| AF-AST-FR-011   | Technical result and measurement decision |

The performer hands the actual record to the designated owner or reviewer. The receiving function verifies scope, version, usable evidence, open conditions, original dates and the action it may take. Sending an email, completing a form or setting a database flag is not acceptance of that handover.

# 4 Timing and escalation

| Control / source | Trigger and interval | Required response |
|------------------|----------------------|-------------------|
|------------------|----------------------|-------------------|

Use actual awareness, notification, completion, decision, issue and expiry timestamps with a declared time zone. Days are calendar days unless explicitly stated otherwise. Month intervals end on the corresponding date, or month-end where that date does not exist. Earlier applicable duties prevail. Source: Annex H.

## 5 Worked application and failure response

Synthetic example: A synthetic laboratory demonstrates one technique on an accessible reference item. The requested scope includes a different geometry with restricted access. The witness supports the first boundary only; separate technical evidence is required for the second.

Before closure, challenge a missing essential input, an expired or conflicted role, wrong configuration, contradictory evidence and an incomplete receiving handover where applicable. Record expected and actual behaviour. A completed synthetic exercise tests reasoning or workflow only; it cannot replace required technical witnessing.

# E1 Explicit acceptance and evidence contract

Apply the following logic to the exact evaluated object and responsible function. A procedural checkpoint, product characteristic, competence decision and public credential are different objects. Their states shall not be collapsed into one score. Source: ASTRA 62.1–62.7 and Annex AL.

| State | Sufficient basis                                                                                | Required next action                                                                                    |
|-------|-------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| PASS  | Applicable; current approved predicate met by valid, purpose-specific evidence.                 | Retain the original evidence and bounded inference. Other mandatory gates still apply.                  |
| FAIL  | Applicable; valid evidence demonstrates that the approved predicate is not met.                 | Contain affected use; retain the failure; assess cause, extent and required corrective verification.    |
| HOLD  | Applicability, criterion, method, evidence, uncertainty or authority is unresolved.             | Resolve the missing basis. Do not manufacture a value, favourable default or product-defect conclusion. |
| N/A   | Activity trigger and retained responsibility are absent; independent exclusion approval exists. | Retain the scope-specific reason and reassess when activity or responsibility changes.                  |
| UNSET | Only an uncompleted field in this PDF; not a conformity state.                                  | No conclusion is recorded. Complete review before the field can support a decision.                     |

For a compound source clause, create a child-condition ledger containing every separately testable condition, location, phase and operating mode. A sentence-level checkpoint is a navigation aid, not permission to merge unrelated predicates. Each child receives an ID, responsible owner, criterion, method, source evidence, uncertainty where relevant, current state and independent review. The parent cannot PASS while any mandatory child is FAIL, HOLD or UNSET.

An acceptable measurement interval and an acceptable authority chain are independent prerequisites. Use finite, unit-consistent, unrounded values; negative uncertainty, reversed limits, unknown version or wrong-object evidence produce HOLD. For inclusive [L,H] and accepted interval [a,b], PASS requires  $a \geq L$  and  $b \leq H$ ; FAIL requires  $b < L$  or  $a > H$ ; otherwise HOLD. Approved one-sided or exclusive boundaries retain their own declared predicate.

## Positive-decision conjunction

Every applicable mandatory child is PASS AND each N/A is independently justified AND every in-scope nonconformity is verified closed AND scope, competence, independence and actual authority are valid AND required panel participation and voting rules are satisfied. No average, majority preference or payment supplies missing evidence.

# E2 Source-to-implementation crosswalk

The references below use the supplied 248-page FIRST EDITION. Each row retains the original clause identifier and source page. The operating instructions in this document elaborate implementation; they do not replace the full source condition or its applicable annexes. A reference to a whole chapter requires selection of every triggered subclause, not only the examples printed here.

| ASTRA ID / page | Source subject                          | Implementation use                                         |
|-----------------|-----------------------------------------|------------------------------------------------------------|
| 12.3 / 23       | Method-family witnessing                | Requirement, objective evidence and local child predicates |
| 13.1 / 24       | Opening, safety and access confirmation | Requirement, objective evidence and local child predicates |
| 13.2 / 24       | Implementation and vertical trails      | Requirement, objective evidence and local child predicates |
| 13.3 / 25       | Witness control                         | Requirement, objective evidence and local child predicates |

| ASTRA ID / page | Source subject                               | Implementation use                                         |
|-----------------|----------------------------------------------|------------------------------------------------------------|
| 13.4 / 25       | Technical judgement and conflicting evidence | Requirement, objective evidence and local child predicates |
| 19.12 / 33      | Technical witnessing for accreditation       | Requirement, objective evidence and local child predicates |
| 41.2 / 62       | Integrated route and hidden characteristics  | Requirement, objective evidence and local child predicates |
| 42.1 / 63       | Requirement-led test strategy                | Requirement, objective evidence and local child predicates |
| 58.3 / 83       | Vertical trails and shared failure           | Requirement, objective evidence and local child predicates |
| 62.3 / 88       | Evidence validity before conformity          | Explicit verification and acceptance predicate             |
| 64.5 / 92       | Heritage and similarity                      | Explicit verification and acceptance predicate             |
| 75.3 / 114      | Essential variables and remote monitoring    | Explicit verification and acceptance predicate             |
| 77.2 / 118      | Campaign design and article pedigree         | Explicit verification and acceptance predicate             |
| 77.3 / 118      | Measurement and uncertainty readiness        | Explicit verification and acceptance predicate             |
| 77.7 / 119      | Retest and corrective verification           | Explicit verification and acceptance predicate             |

## E3 Detailed operating extensions

### AF-AST-PR-009 – Technical Witnessing and Method-Family Coverage

Implementation basis: 12.3 (p. 23); 13.3 (p. 25); 19.12 (p. 33); 41.2 (p. 62); 62.3 (p. 88); 64.5 (p. 92); 75.3 (p. 114); 77.2 (p. 118); 77.3 (p. 118); 77.7 (p. 119)

#### X09.1 Define the method family technically

Group only common principles, geometry/material ranges, equipment, competence and failure mechanisms. Identify unique or high-consequence boundaries that cannot be inferred.

Completion / hold: No unrelated technique is added because it shares a performer or report template.

#### X09.2 Observe the complete task

Follow identification, preparation, setup, essential execution, raw data, interpretation, reporting and independent release within safe authorised arrangements.

Completion / hold: A selected favourable demonstration cannot replace missing essential preparation or interpretation evidence.

#### X09.3 Challenge hidden and remote properties

State what is directly measured, validly inferred or unknown and test relevant difficult boundaries and false-negative mechanisms.

Completion / hold: Process telemetry or nominal equipment output cannot replace an unobservable required product property.

#### X09.4 Review change and corrective retest

After an interruption, source change or failed witness, preserve originals and define corrective demonstration including the original failed mechanism.

Completion / hold: A fresh favourable run does not validate earlier affected output or automatically extend method scope.

Record contract: the actor records the input baseline, actual work, deviations, result and evidence link; the named receiving function acknowledges access and the permitted next action. A returned or incomplete handover retains the original event history. Use the associated FR modules and RG record links; no document or database field confers actual authority.

## E4 Application-specific parameter completion

These are required information groups from Annex AO, not pre-approved engineering limits. For every triggered group, populate actual values or observable attributes before evaluation, with unit, inclusivity, phase/mode, technical derivation, uncertainty/dependence, method version, owner, independent review, authentic approval and change trigger. An absent trigger requires an approved exclusion; an unsupported or missing essential value is HOLD.

### P01 — Mission and scope

Legal owner, performer, family/module, object, domain, configuration, location, duration and modes.

Derivation and evidence: Scope tuple and mission concept; approved applicability matrix.

Completion test: No undefined essential object, duty, phase or exclusion.

### P02 — Environment and exposure

Quantity, spatial/temporal boundary, distribution or bound, source/model, uncertainty and coupled effects.

Derivation and evidence: Mission environment baseline and qualified specialist rationale.

Completion test: Selected conditions bound each claimed use; unknown critical mechanisms remain HOLD.

### P03 — Requirements and acceptance

Stable ID, owner, characteristic, units, bound inclusivity, predicate, observation and essential-step marker.

Derivation and evidence: Requirement baseline and Annex AL decision rule.

Completion test: Every condition is evaluable before observations are judged.

### P05 — Materials and process qualification

Material type/condition, geometry, sources, variables, qualified window, machine/tool state and hidden properties.

Derivation and evidence: Actual representative qualification; lot/build genealogy.

Completion test: All influential variables and required product properties are supported.

### P06 — Test article and fixtures

Article pedigree, differences from delivered object, mounting, boundary conditions, operating state and exposure history.

Derivation and evidence: Approved representativeness and cumulative-test analysis.

Completion test: No material difference or prior damage invalidates the intended inference.

### P07 — Measurement and uncertainty

Measurand, instrument/range, corrections, sensitivity, covariance, coverage, time/space sampling and calibration.

Derivation and evidence: Complete measurement model; valid raw data.

Completion test: Uncertainty and detection capability are fit for the approved decision rule.

### P13 — Contamination and samples

Relevant substances/particles, pathway, limit, method/detection, custody, cleanliness, containment and receiving.

Derivation and evidence: Mission-specific technical/protection basis.

Completion test: Required integrity and scientific cleanliness are demonstrated for the actual sample/use.

## P14 — Software, AI and models

Purpose/domain, source/build/weights/data, dependencies, target, errors, uncertainty, prohibited behaviour and change limits.

Derivation and evidence: Independent verification and model/use validation.

Completion test: Essential scenarios and target conditions pass; experimental outputs remain separate.

## P18 — Decision, continuity and terminal duties

Closed findings, reviewer competence, independence, authority, status clocks, final-state criteria, custody and open obligations.

Derivation and evidence: Authenticated decisions and verified terminal/transfer evidence.

Completion test: Every mandatory gate is complete; incomplete or unknown terminal state remains explicit.

# E5 All-space applicability and bounded responsibility

The following Annex AK tags are selected because the document can support these responsibilities. Applicability is decided for the actual case. Tags do not expand a family, create an operating permission or place a whole mission inside a supplier's limited scope. Resolve domain, phase, mode, environment and retained duty before accepting a claim.

| Domain / source page                                    | Coverage                                                                                                     | Required boundary                                                                                  |
|---------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| AK01 / 187 Terrestrial engineering and supply           | Design offices, manufacturing, material sources, procurement and integration.                                | Every delivered characteristic and essential supplier interface is traceable to accepted evidence. |
| AK02 / 187 Test facilities and technical providers      | Environmental, structural, materials, calibration and inspection services, including mobile and remote work. | Actual method competence and valid result evidence are separately demonstrated.                    |
| AK03 / 187 Launch sites and spaceports                  | Site infrastructure, handling, ground services, emergency interfaces and actual permissions.                 | No site outcome is used as vehicle, launch or mission permission.                                  |
| AK04 / 187 Launch and deployment interfaces             | Vehicle/payload integration, handling, ascent environment, separation and commissioning.                     | Every required integration and protective condition is met before the actual commitment.           |
| AK05 / 188 Reusable launch and return articles          | Cumulative exposure, refurbishment, thermal protection, hidden damage and life decisions.                    | Reuse is based on actual history and accepted condition, never a reset life.                       |
| AK06 / 188 Low Earth orbit systems                      | Satellites, stations and services in the declared near-Earth operating environment.                          | Environment-specific qualification and end-of-life capability support the bounded mission.         |
| AK07 / 188 Medium, geosynchronous and high Earth orbits | Navigation, communication, relay and other specified orbit-dependent services.                               | No lower-orbit or nominal-link evidence automatically covers a different environment.              |
| AK08 / 188 Highly elliptical and transfer regions       | Missions crossing materially different exposure, geometry and communication regimes.                         | Every phase and transition has a supported envelope and verification path.                         |
| AK09 / 189 Cislunar and libration-region systems        | Lunar vicinity, relays, gateways, transportation interfaces and regional services.                           | The exact operating domain and service dependencies are technically complete.                      |
| AK10 / 189 Constellations and formation services        | Distributed functions, inter-satellite links, fleet management and shared ground support.                    | Distributed performance and independent redundancy assumptions are validated.                      |

| Domain / source page                                         | Coverage                                                                               | Required boundary                                                                                       |
|--------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|
| AK11 / 189 Orbital traffic and tracking support              | Tracking, conjunction information, data services and inter-operator coordination.      | A metric is accepted only for its validated data/model scope; missing data are not zero risk.           |
| AK12 / 189 Cooperative docking and servicing                 | Authorised inspection, connection, transfer, repair and service interventions.         | All essential interface and completion states are independently supported.                              |
| AK13 / 190 On-orbit assembly and manufacture                 | Assembly, additive or other production, finishing and output verification in space.    | Process execution is not substituted for evidence of required output properties.                        |
| AK14 / 190 Stations and inhabited orbital platforms          | Habitation, payload integration, visiting vehicles, occupants and support.             | Integrated human protection and resources are accepted independently of mission success.                |
| AK15 / 190 Extravehicular and isolated crew work             | Individual equipment, user/task, environment, support and rescue dependencies.         | Essential individual and integrated protective tasks pass without averaging.                            |
| AK16 / 190 Lunar surface systems                             | Landers, rovers, infrastructure, observation and processing on the Moon.               | Destination-specific evidence bounds the actual region, phase and operating mode.                       |
| AK17 / 191 Planetary landers and surface vehicles            | Surface exploration, scientific instruments, mobility and handling.                    | Terrestrial analogy is justified; unknown critical surface conditions remain restricted.                |
| AK18 / 191 Atmospheric and buoyant exploration               | Planetary atmospheric vehicles, balloons, aircraft and relevant instruments.           | All relevant environment-specific structural and functional predicates pass.                            |
| AK19 / 191 Small-body and comet operations                   | Observation, cooperative contact, sampling and resource demonstrations.                | Uncertain body/interaction properties are not treated as established terrestrial conditions.            |
| AK20 / 191 Subsurface and ocean-world exploration            | Subsurface, liquid, ice and extreme-pressure exploration systems and their interfaces. | Specialist boundary and contamination evidence precedes dependent use.                                  |
| AK21 / 192 Interplanetary cruise and deep-space missions     | Spacecraft, relays, science operations and long-delay mission support.                 | Human and autonomous actions are feasible within actual timing and resource limits.                     |
| AK22 / 192 Solar and heliophysics missions                   | Solar observations and missions with relevant thermal, plasma and radiation extremes.  | Protection and data-quality evidence cover the actual mission envelope, not a screening equation alone. |
| AK23 / 192 Outer-system and distant observatories            | Low-flux, long-life, long-delay science and infrastructure applications.               | Required lifetime and survival margins are met with credible continuity and data integrity.             |
| AK24 / 192 Interstellar precursor and future distant systems | Bounded research and demonstrable capabilities for very long-range or novel concepts.  | Research promise is not an operational grant; unsupported capability stays in development.              |
| AK25 / 193 Human exploration and surface habitats            | Crew transport interfaces, habitation, exploration support and emergency protection.   | Every essential human protection and feasibility predicate is supported by specialists.                 |
| AK26 / 193 Planetary protection and sample return            | Forward/backward contamination, scientific cleanliness, samples and receiving chain.   | No dependent commitment precedes complete protection and receiving evidence.                            |
| AK27 / 193 Resource utilisation and remote processing        | Resource characterisation, processing, quality, storage, use and residues.             | Resource yield, product eligibility and permission remain distinct.                                     |
| AK28 / 193 Space logistics and distributed supply            | Warehousing, transfer, spares, custody, condition, receiving and service continuity.   | Only physically or otherwise validly confirmed accepted usable inventory supports mission budgets.      |

| Domain / source page                                     | Coverage                                                                                      | Required boundary                                                                           |
|----------------------------------------------------------|-----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|
| AK29 / 194 Specialised energy infrastructure             | Generation, storage, conversion, remote delivery and controlled high-hazard power interfaces. | Performance never substitutes for safety, source authority or terminal accountability.      |
| AK30 / 194 Ground, communication and navigation services | Mission control, RF/optical links, timing, data processing, relays and PNT support.           | Availability, correctness, authority and completion are separately demonstrated.            |
| AK31 / 194 Digital and autonomous space systems          | Software, programmable hardware, AI, models, twins and defensive security.                    | All essential behaviours and prohibited transitions are verified for the actual deployment. |
| AK32 / 194 Retirement and long-term stewardship          | Disposal, passivation governance, loss-of-contact states, records and residual obligations.   | Final-state claims are truthful and every unresolved duty has an accepted owner.            |

## E6 Workflow and evidence relationships

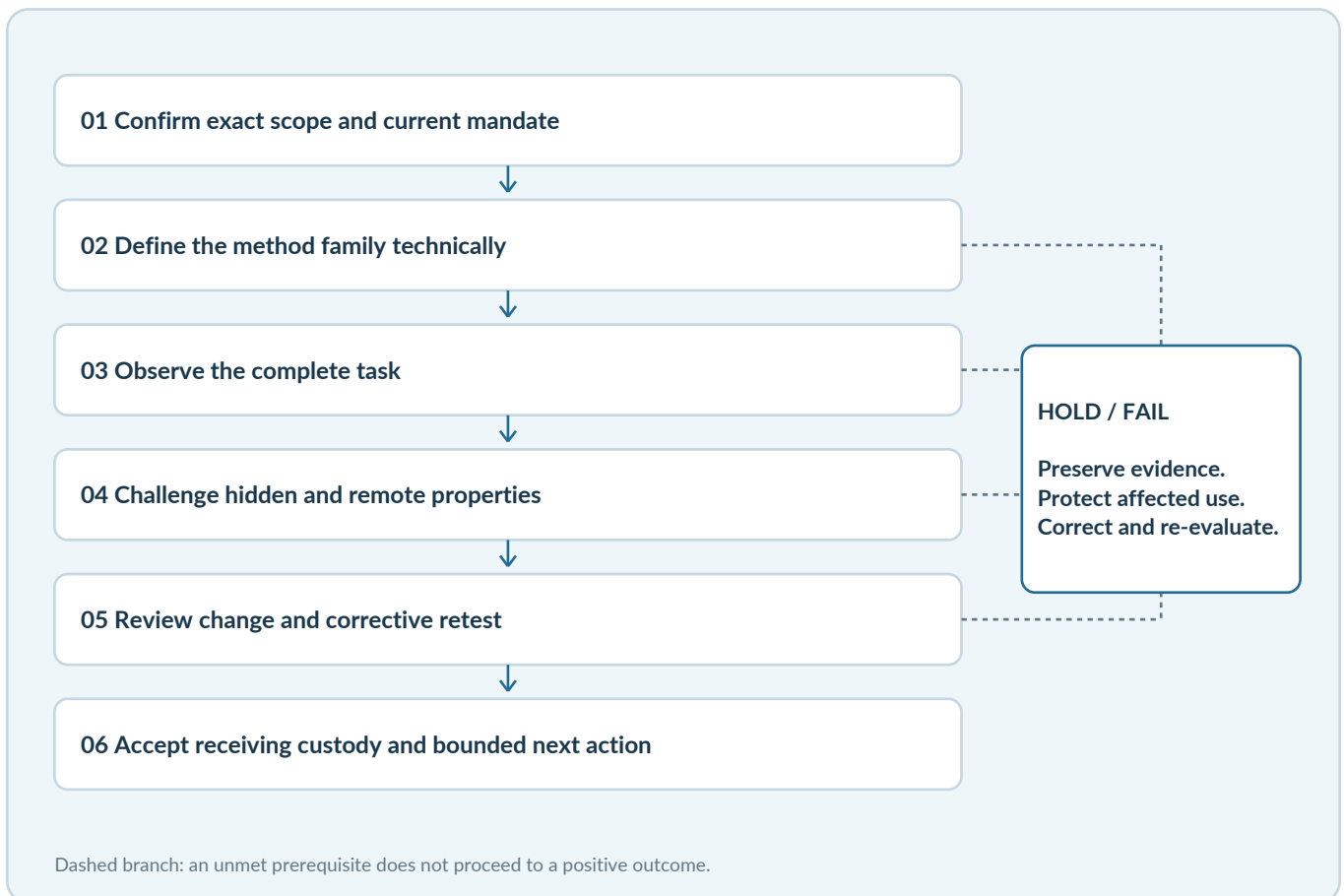
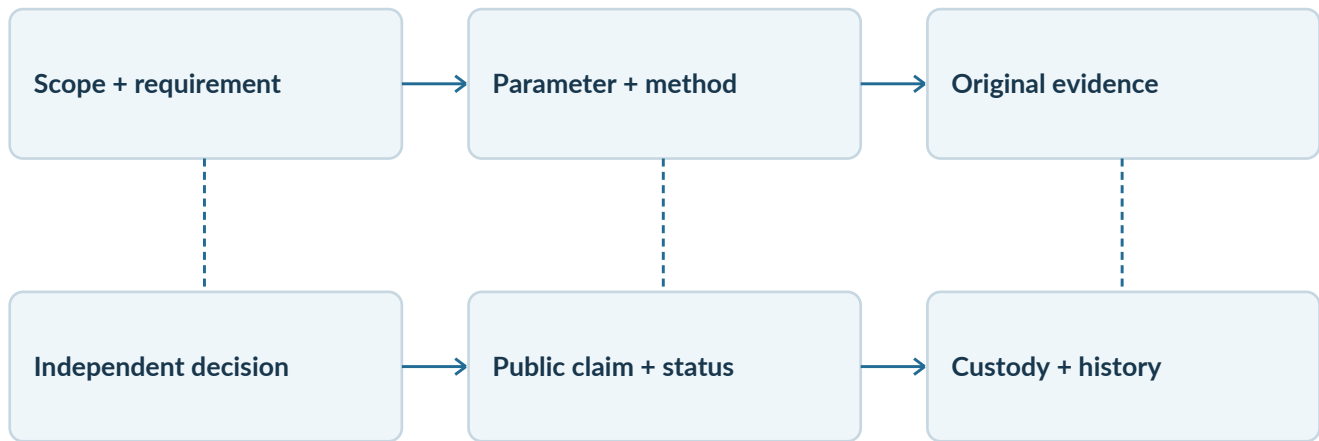


Figure — Implementation sequence for AF-AST-PR-009. Explanatory diagram; the source prerequisites and actual authority remain controlling.



Each relationship carries object identity, controlled version, actual event time and purpose-specific validity.

Figure — Scope-to-custody evidence relationships. A relationship is validated for its decision purpose, not merely because two identifiers exist.

## E7 Calculations, assumptions and synthetic charts

The worked calculations below reproduce the supplied standard's Annex AM examples. Charted extensions are newly computed synthetic illustrations of those equations, not measured mission performance or new universal limits. A result is usable only when the actual inputs, model, units, uncertainty and approved application predicate are valid. A successful arithmetic check is not field validation.

### AM.Q01 Measurement uncertainty and covariance

Source: ASTRA Annex AM, Q01, page 200. All numerical inputs in this example are synthetic.

$$u_c^2 = \sum(c_i^2 u_i^2) + 2\sum(i < j)(c_i c_j cov_{ij})$$

$$U = k u_c$$

#### Variables and units

$u_i$  is a standard uncertainty;  $c_i$  is a sensitivity coefficient;  $cov_{ij}$  is covariance;  $k$  is the justified coverage factor. Variance terms carry squared output units.

#### Example inputs

Synthetic direct sum:  $c_1=c_2=1$ ;  $u_1=0.003$  mm;  $u_2=0.004$  mm. First assume independence, then correlation  $\rho=0.5$ . Illustrative  $k=2$ .

#### Calculation and checks

1. Independent variance =  $0.003^2 + 0.004^2 = 0.000025$  mm<sup>2</sup>.
2.  $u_c = 0.005$  mm;  $U = 0.010$  mm for the stated  $k$ .
3. Correlated covariance =  $0.5 \times 0.003 \times 0.004 = 0.000006$  mm<sup>2</sup>.
4. Correlated variance =  $0.000025 + 2 \times 0.000006 = 0.000037$  mm<sup>2</sup>.
5. Correlated  $u_c = 0.0060827625303$  mm;  $U = 0.0121655250606$  mm.

Decision interpretation: The correlated model produces a larger uncertainty. No PASS/FAIL follows until an approved specification and decision rule are applied.

Validity limits: The linear propagation model requires a valid measurement function and adequate approximation.  $k=2$  is not a universal guarantee of 95% coverage. Known bias requires correction or explicitly justified treatment; uncertainty does not conceal missing requirements.

ASTRA connections: 9.4–9.5; Annex G; 62; 77

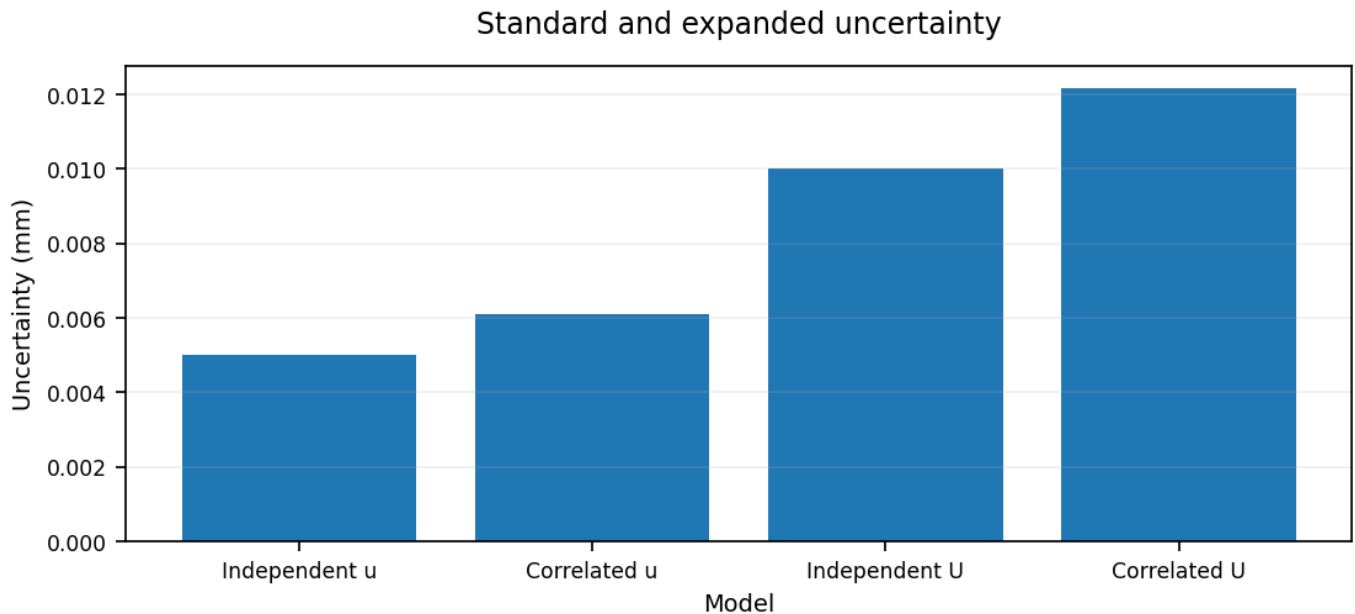


Figure Q01 — Synthetic visualisation. The axes and stated scenario define the quantity; no graph is an accreditation score, approved operating envelope or evidence of a real mission.

Local replay record: retain the actual input manifest, source versions, calculation version, unit checks, independent recomputation, expected/observed boundary results, limitations and decision authority. Do not overwrite the teaching inputs as though they were operational data.

## AM.Q02 Inclusive limits and four distinct measurement outcomes

Source: ASTRA Annex AM, Q02, page 201. All numerical inputs in this example are synthetic.

PASS:  $y - U \geq L$  AND  $y + U \leq H$

FAIL:  $y + U < L$  OR  $y - U > H$

Otherwise: HOLD; invalid evidence also results in HOLD

### Variables and units

L and H are inclusive specification limits; y is a corrected result; U is a non-negative expanded uncertainty with stated coverage.

### Example inputs

Synthetic specification [49.970, 50.030] mm; U=0.004 mm. Results y=50.024, 50.028, 50.036 and 50.026 mm.

### Calculation and checks

1.  $50.024 \pm 0.004 \rightarrow [50.020, 50.028]$  mm: PASS.
2.  $50.028 \pm 0.004 \rightarrow [50.024, 50.032]$  mm: HOLD, interval overlaps the upper limit.
3.  $50.036 \pm 0.004 \rightarrow [50.032, 50.040]$  mm: FAIL, interval entirely above the limit.
4.  $50.026 \pm 0.004 \rightarrow [50.022, 50.030]$  mm: PASS; equality is inside the inclusive upper bound.

Decision interpretation: Neither the overlapping interval nor an invalid run is rounded into acceptance. N/A is an applicability decision, not a measurement outcome.

Validity limits: Use actual endpoints for asymmetric intervals. For an upper-only limit, PASS requires the upper endpoint at or below the limit and FAIL the lower endpoint above it. A coverage interval is not automatically a probability that this particular item conforms.

ASTRA connections: Annex G; 62.3–62.5; 77.6

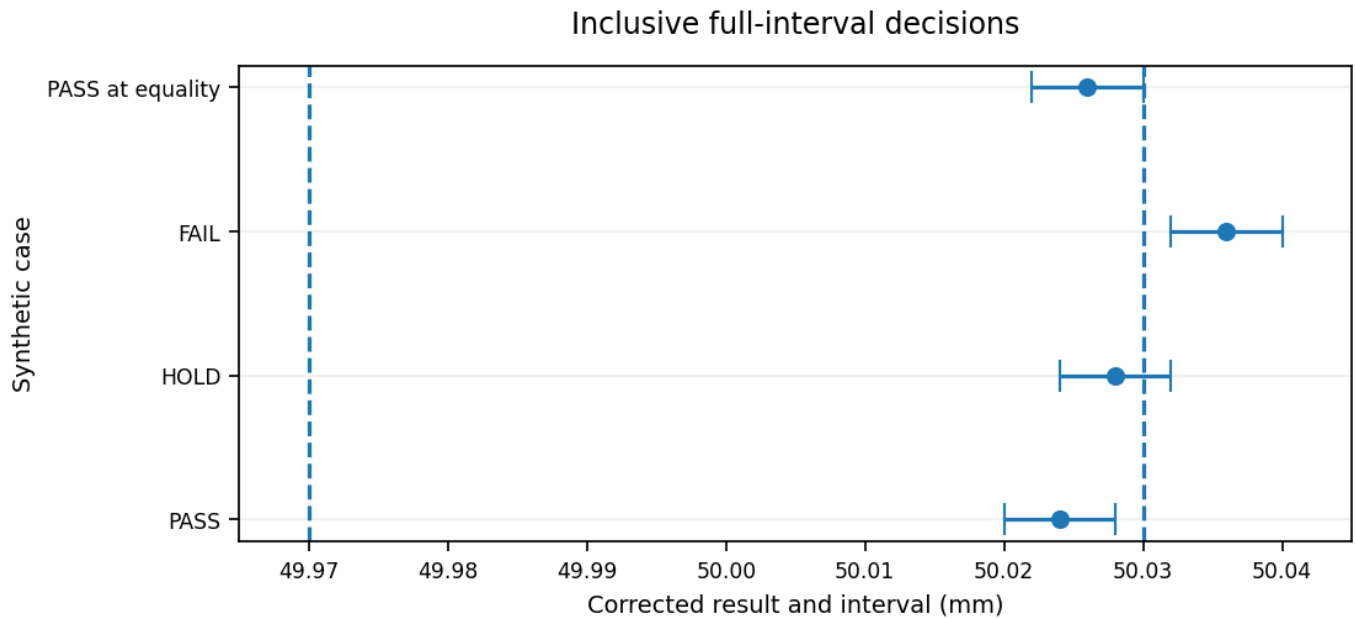


Figure Q02 – Synthetic visualisation. The axes and stated scenario define the quantity; no graph is an accreditation score, approved operating envelope or evidence of a real mission.

Local replay record: retain the actual input manifest, source versions, calculation version, unit checks, independent recomputation, expected/observed boundary results, limitations and decision authority. Do not overwrite the teaching inputs as though they were operational data.

## AM.Q06 Random detection sample size

Source: ASTRA Annex AM, Q06, page 205. All numerical inputs in this example are synthetic.

$$P(\text{at least one detection}) = 1 - (1-p)^n$$

$$n_{\min} = \text{ceil}[\ln(1-C)/\ln(1-p)]$$

### Variables and units

$p$  is a fixed issue probability per independent representative observation;  $C$  is the selected target detection probability;  $n$  is a positive integer.

### Example inputs

Synthetic  $p=0.10$  and  $C=0.95$ .

### Calculation and checks

- $\ln(0.05)/\ln(0.90) = 28.433158...$ ; round upward to  $n=29$ .
- $P(\text{detection at } n=29) = 1 - 0.9^{29} = 0.9528987130$ .
- At  $n=28$ ,  $P = 0.9476652367$ , below the specified target.

Decision interpretation: 29 is the minimum integer sample for the stated independent model; the demonstration does not certify 95% conformity.

Validity limits: This calculation is invalid for unexamined dependence, changing  $p$ , biased selection or a judgemental sample represented as random. Detection is also conditional on an effective observation method.

ASTRA connections: 9.3; Annex F.5; 55.3

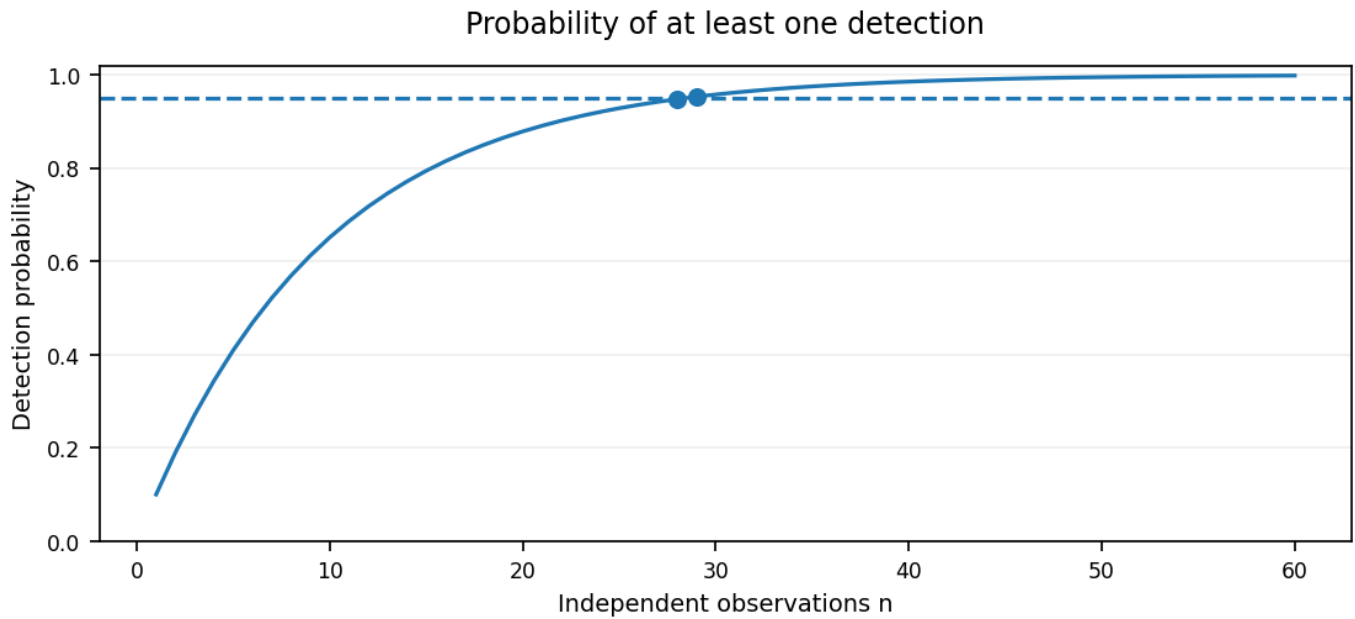


Figure Q06 – Synthetic visualisation. The axes and stated scenario define the quantity; no graph is an accreditation score, approved operating envelope or evidence of a real mission.

Local replay record: retain the actual input manifest, source versions, calculation version, unit checks, independent recomputation, expected/observed boundary results, limitations and decision authority. Do not overwrite the teaching inputs as though they were operational data.

## AM.Q07 Zero observed failures and an exact binomial bound

Source: ASTRA Annex AM, Q07, page 206. All numerical inputs in this example are synthetic.

$$p_{\text{upper}} = 1 - \alpha^{(1/n)}$$

$$n_{\text{min}} = \text{ceil}[\ln(\alpha) / \ln(1 - p_{\text{target}})]$$

### Variables and units

$\alpha$ =1-confidence; n is a prospectively fixed number of independent comparable binary trials; all n trials have zero observed failures.

### Example inputs

Synthetic one-sided confidence 95%, so  $\alpha=0.05$ . Examine  $n=30$  and a target upper failure probability of 0.01.

### Calculation and checks

- For  $n=30$ :  $p_{\text{upper}} = 1 - 0.05^{(1/30)} = 0.095033853 = 9.5033853\%$ .
- For  $p_{\text{target}}=0.01$ :  $\text{ceil}[\ln(0.05) / \ln(0.99)] = 299$ .
- For  $n=299$ :  $p_{\text{upper}} \approx 0.0099691468$ , below 1%.

**Decision interpretation:** Thirty successful trials do not demonstrate a failure probability below 1%. Under the specified model, 299 all-success trials are needed for that particular bound.

**Validity limits:** A statistical upper confidence bound is not proof of zero risk or total system safety. Nonrepresentative trials, changing configuration, adaptive stopping or unmodelled common causes invalidate this simple inference.

ASTRA connections: 55.1–55.3; 62; 77

### Zero failures: one-sided 95% binomial bound

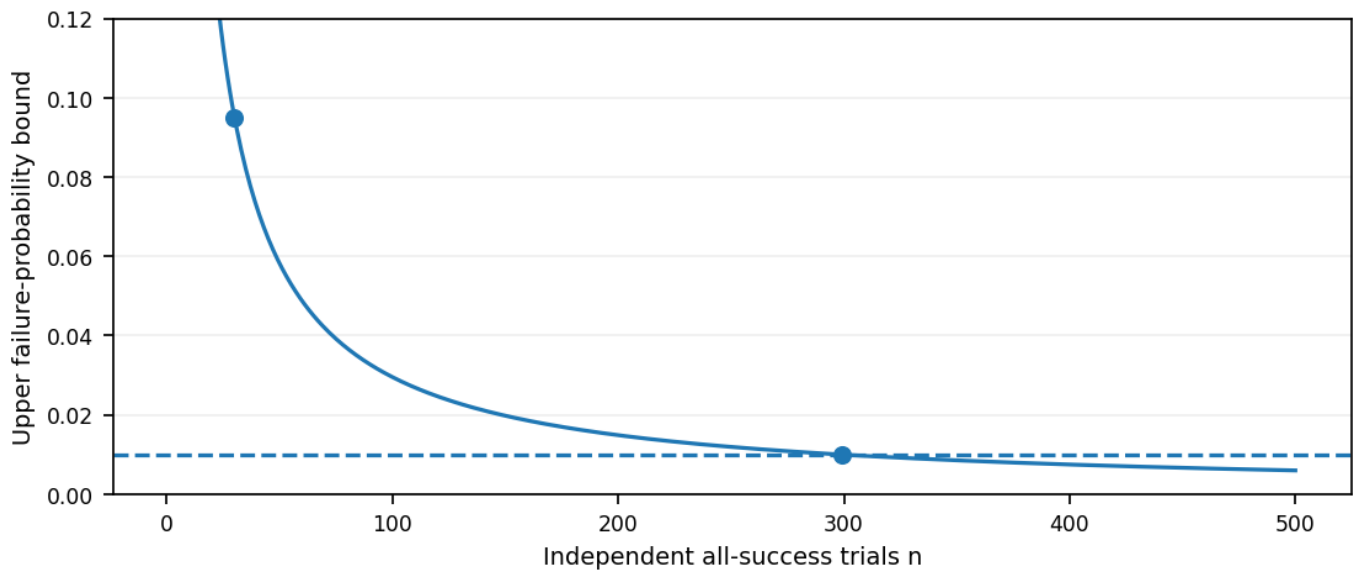


Figure Q07 — Synthetic visualisation. The axes and stated scenario define the quantity; no graph is an accreditation score, approved operating envelope or evidence of a real mission.

Local replay record: retain the actual input manifest, source versions, calculation version, unit checks, independent recomputation, expected/observed boundary results, limitations and decision authority. Do not overwrite the teaching inputs as though they were operational data.

## E8 Adverse cases and independent replay

| Challenge                                                                   | Expected handling                                                                                      | Evidence retained                                                                              |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| PR-009: Define the method family technically — required basis missing       | No unrelated technique is added because it shares a performer or report template.                      | Original input, unresolved value, affected requirement and scope; named action owner.          |
| PR-009: Review change and corrective retest — handover or review incomplete | A fresh favourable run does not validate earlier affected output or automatically extend method scope. | Expected and observed state; independent replay; correction/retest; receiving acknowledgement. |

Before local reliance, also select every relevant AP01–AP48 challenge in the core. Keep fictional tests isolated from live credentials, commands and recipients. For each test define the requirement, precondition, expected response, execution steps, actual observations, evidence, defect consequence, correction, retest and acceptance. This publication supplies test designs and examples, not completed local validation records.

# Appendix A – Controlling source requirements

The following text is reproduced from the supplied ASTRA FIRST EDITION. The clause identifier and page refer to that 248-page source. These excerpts and their evidence fields must be read with all triggered normative annexes. Newly authored implementation steps elsewhere in this document do not amend the core standard.

## 12.3 – Method-family witnessing

Source: AF-AST-STD-001, page 23.

Group methods only when common principles, equipment, competence, ranges and failure mechanisms justify representativeness. Witness each distinct method or capability family, including material extremes and high-consequence tasks. A single demonstration shall not cover unrelated techniques merely because one employee performs them. Include the whole relevant task from preparation and identity through data interpretation and reporting. Map any unobserved part to valid supplementary evidence or exclude it from the granted scope.

Required evidence: Witnessing plan; family grouping rationale; observed limits; supplementary evidence.

## 13.1 – Opening, safety and access confirmation

Source: AF-AST-STD-001, page 24.

At opening, confirm scope, participants, independence, permissions, safety constraints, confidentiality, technical limits and reporting arrangements. The lead shall stop or adapt activities that cannot be performed safely and lawfully. Assessment teams observe competence; they do not take operational control of aircraft, hazardous tests or restricted facilities merely by appointment. Explain how missing evidence, unexpected findings and confidential concerns will be handled without prejudging the outcome.

Required evidence: Opening record; actual team; access/safety confirmation; agreed escalation route.

## 13.2 – Implementation and vertical trails

Source: AF-AST-STD-001, page 24.

Combine document review, interviews, observation and actual results. Trace selected outputs backward through requirements, authorisation, resources, performer, method, materials and configuration, then forward through release, change and feedback. Include failed tests, rework, interruptions, complaints and previous adverse decisions where relevant. Sampling shall be expanded when inconsistencies suggest systemic issues. A signed checklist or assurance statement alone is not evidence that the underlying activity occurred.

Required evidence: End-to-end trails; selected populations; adverse cases; sample expansion and findings.

## 13.3 – Witness control

Source: AF-AST-STD-001, page 25.

Record the actual task, date, site, equipment, software, personnel, conditions, method version and acceptance basis. Observe essential steps directly where required and prevent coached performance from being misrepresented as routine independent work. Controlled simulation is acceptable only where the profile justifies its fidelity and restrictions. Live work shall not be made unsafe to create a demonstration. A missing essential observation requires supplementary evidence, reassessment or restricted scope, not a presumed pass.

Required evidence: Witness log; essential steps; simulation validity; unobserved-step disposition.

## 13.4 – Technical judgement and conflicting evidence

Source: AF-AST-STD-001, page 25.

Evaluate whether the evidence supports the specific conclusion under the known assumptions and limitations. Record contradictory results and alternative explanations. Resolve technical disagreement through competent independent review, not by seniority or majority preference outside expertise. An expert shall identify the boundary of advice and data reviewed. Inaccessible essential information, an invalid model or an uncontrolled configuration prevents the dependent positive conclusion even if other performance is strong.

Required evidence: Reasoned technical evaluation; counter-evidence; independent challenge; limitations and holds.

## 19.12 – Technical witnessing for accreditation

Source: AF-AST-STD-001, page 33.

The accrediting team shall witness representative activities for every distinct method family or inspection capability and examine a complete application-to-report trail. Include adverse work, authorised sign-off, uncertainty, outsourced results and subsequent controls. Similar-method grouping requires a written technical rationale. An organisational audit with no relevant technical observation is not a completed laboratory or inspection competence evaluation. The final scope shall match the actual demonstrated capability, locations and limitations.

Required evidence: Witness coverage; complete case trail; independent scope review; accreditation decision.

## 41.2 – Integrated route and hidden characteristics

Source: AF-AST-STD-001, page 62.

The production route shall identify every process stage, branch, handover and external performer that can affect a required characteristic. Essential variables shall include relevant preparation and downstream treatment, not only the main machine cycle. Qualification shall cover representative materials, geometry, equipment, software, personnel and environmental conditions. Final inspection shall not be assumed capable of detecting all latent process defects. The route shall preserve failed runs, rework and technical restrictions through product acceptance.

Required evidence: Route and dependency map; qualification matrix; essential variables; hidden-property rationale; original run history.

## 42.1 – Requirement-led test strategy

Source: AF-AST-STD-001, page 63.

The organisation shall select inspection, analysis, demonstration or testing according to the requirement and intended decision. The plan shall identify the actual article, configuration, environment, acceptance criterion, method, instrumentation, uncertainty, competent personnel and protective arrangements. Qualification, production acceptance, workmanship screening and research shall be distinguished. A catalogue of tests shall not be treated as a complete verification programme until every applicable requirement and material interface has an adequate method and evidence path.

Required evidence: Requirement-to-method matrix; test purpose; article/configuration identity; approved criteria and safety review.

## 58.3 – Vertical trails and shared failure

Source: AF-AST-STD-001, page 83.

Evaluation shall connect actual outputs backward to requirements, authority, sources, people, methods and configuration, and forward to release, support and feedback. Failed and interrupted work shall be represented. Findings in a shared calibration system, source, procedure or digital platform shall be traced to dependent scopes. Restriction to an unaffected subset requires independent evidence that the boundary is real. Removing a difficult item from the sample shall not resolve a systemic deficiency.

Required evidence: End-to-end trails; adverse-case sample; common-control dependency map; justified scope restrictions.

## 62.3 – Evidence validity before conformity

Source: AF-AST-STD-001, page 88.

The evaluator shall first determine whether evidence belongs to the correct object, configuration, period, method and authorised performer and whether it is usable for the intended inference. Only valid relevant evidence shall enter a conformity predicate. Rejected, corrupted, missing, unobservable or wrong-version evidence shall remain identified. Evidence may be valid and show failure; an invalid test is not a valid pass or a valid proof of product failure.

Verification: Check provenance, configuration, method capability, original data and uncertainty separately from result classification.

Acceptance / hold rule: Validity is established before PASS or FAIL is assigned; otherwise use HOLD with an explicit invalidity or evidence-gap reason.

## 64.5 – Heritage and similarity

Source: AF-AST-STD-001, page 92.

A heritage argument shall compare actual design, materials, manufacturing source, mission exposure, software, interfaces and life history. Identify unchanged evidence, invalidated evidence and new demonstration. Successful service of a related

design shall be accepted only for characteristics and mechanisms it actually supports. Lack of a recorded failure shall not prove performance of an unmonitored critical characteristic.

Verification: Review a difference matrix and trace each retained conclusion to applicable original evidence.

Acceptance / hold rule: Every material difference has a technical disposition and sufficient evidence before the new claim is accepted.

### **75.3 – Essential variables and remote monitoring**

Source: AF-AST-STD-001, page 114.

The qualified envelope shall identify influential variables, combinations, tolerances, monitoring performance and reaction rules. Retain actual variable histories, interruptions and sensor gaps by output identity. Remote telemetry shall support acceptance only for properties and mechanisms demonstrated to be observable or validly inferred. A successful process command does not prove the intended material transformation occurred.

Verification: Review representative qualification, sensor/model validation and raw production history.

Acceptance / hold rule: All required variables and output characteristics are supported; an unobservable essential property requires additional evidence or a restricted outcome.

### **77.2 – Campaign design and article pedigree**

Source: AF-AST-STD-001, page 118.

Define qualification articles, flight or service articles, specimens, representative differences, prior exposure, fixtures, operating modes and cumulative test sequence. Identify which conclusions may be transferred between articles and why. Failed tests, repairs and substitutions shall remain in the same historical chain.

Verification: Review specimen-to-product and test-to-configuration equivalence records.

Acceptance / hold rule: All material differences and accumulated effects are evaluated before evidence reuse; unrepresentative essential evidence is not accepted.

### **77.3 – Measurement and uncertainty readiness**

Source: AF-AST-STD-001, page 118.

Before execution, verify instrument identity, calibration, range, bandwidth, synchronisation, environment, software, raw-data retention and uncertainty suitability. Sensor placement and spatial coverage shall represent the characteristic being accepted. Protect the article and personnel through separately specified stop conditions.

Verification: Inspect the full measurement chain and execute relevant readiness checks.

Acceptance / hold rule: All required channels are valid for the intended inference; a missing, saturated or misconfigured critical channel prevents that acceptance.

### **77.7 – Retest and corrective verification**

Source: AF-AST-STD-001, page 119.

Retest shall follow an approved rationale, defined scope and representative configuration. It shall preserve the original failure and address causal, exposure and selection effects. Repeated trials until a pass occurs are not an acceptance strategy. Corrective verification shall include the original failure mode and relevant regression, not merely a new favourable measurement.

Verification: Review the retest authorisation, all attempts and failure-to-correction trace.

Acceptance / hold rule: The original deficiency and affected requirements are demonstrably resolved; otherwise the claim remains failed or held.

## Appendix B — Local adoption, validation and receiving acceptance

| Gate                   | Required evidence                                                                                                                    | Outcome when incomplete                          |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|
| Authority and identity | Actual operator, scoped mandate, permissible result class, named owner, independent decision and remedy functions.                   | No live scope release.                           |
| Requirement population | All applicable clauses and annexes mapped to child conditions, with reasons and independent approval for exclusions.                 | HOLD the affected conclusion.                    |
| Parameters and methods | Prospective values/attributes; technical basis; valid methods; representativeness; calibration, uncertainty and approved predicates. | No dependent acceptance.                         |
| People and evidence    | Current demonstrated competence; conflict clearance; original usable source evidence; actual configuration and event times.          | Reassign or obtain sufficient evidence.          |
| Local tools and tests  | Actual deployment tested with positive, boundary, missing, invalid and prohibited inputs; original failed cases retested.            | No consequential reliance on unaccepted tools.   |
| Independent closure    | Every mandatory requirement PASS, approved N/A, all in-scope nonconformities verified closed, panel rules where required.            | No grant, renewal or extension.                  |
| Claims and continuity  | Decision-linked scope/status; source history; genuine custody, receiving access, retention, urgent notices and terminal duties.      | Restrict publication or transfer until resolved. |

Record authentic approval and activation in AF-AST-FR-001 and AF-AST-SC-004 or an equivalent controlled record. The edition label is not an effective date for a particular case. Preserve historical decisions under their actual controlling basis; a newer document does not retroactively create missing competence or evidence. Source: Clauses 4, 31, 61, 62 and 80; Annexes P and AR.

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