AEROSPACE FEDERATION

ASTRA

AEROSPACE STANDARD

Integrated technical and lifecycle assurance

Aviation / Space / Defense / Future systems

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What the approval covers

Publisher acceptance authorises publication of this identified text. It does not constitute a completed committee ballot, technical field validation, operator accreditation or activation of every listed scope. Technical approval and actual scope-release records remain governed by Clauses 4, 31 and 61 and Annex P.

How to identify binding provisions

"Shall" states a requirement and "shall not" a prohibition. The designation at each annex heading identifies normative controls, informative material or a combination. Apply every triggered requirement within the adopted participation terms and the released technical profile. Informative values, diagrams and filled examples do not prescribe universal technical limits.

The edition date is retained as the publication-series identity. The release approval above records the current publisher instruction; it is not a retrospective record of technical, pilot or operational events. No committee decision number or signature is implied.

Quick-start guide

WHO IS THIS FOR? WHICH PROVISIONS APPLY? WHERE DO I START?

Start with one exact activity and outcome. Define the entity, actual performer, object, site, configuration, period and retained responsibilities under Clauses 0–2. Then use the route below; combine routes only when the claimed activities require them.

Your activity	Start here
F01 — Management systems and organisational assurance	AS.1 activity guide
F02 — Critical processes and identified products	AS.2 activity guide
F03 — Laboratory, calibration and inspection work	AS.3 activity guide
F04 — Education programmes and learner outcomes	AS.4 activity guide
F05 — Airports and aerodromes	AS.5 activity guide
F06 — Aircraft maintenance and technical services	AS.6 activity guide
F07 — Ground operations and aviation support services	AS.7 activity guide
F08 — Carbon, environment and climate assurance	AS.8 activity guide

Space, aviation, defense and digital interfaces

Use AS.9–AS.12 in addition to the selected family. Space is not a ninth family. Select all relevant technical duties and all-space domains rather than applying unrelated chapters to every applicant.

Follow one complete evidence trail

Scope → approved criteria → competent execution → valid evidence → findings and correction → independent decision → continuing status. Use Annex AT for filled synthetic records and Annex AU for the specialist-review and real-pilot protocol.

The full triggered provisions, not this navigator, control the decision. No score compensates for a mandatory FAIL or HOLD. Annex AL gives the explicit acceptance rules.

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Clause and annex identifiers remain the stable references. All entries below link to their current locations. Annexes AS–AU are informative application aids.

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0 Purpose, reading route and status

ASTRA — AEROSPACE STANDARD connects Aerospace Federation programme governance with integrated technical and lifecycle assurance across aviation, space, defense and connected industry. Clauses 0–31 establish programme controls; Clauses 32–80 establish technical, space-domain and deterministic acceptance controls. Distinct objects and outcome classes remain separately evaluated.

0.1 Intended use

This standard establishes requirements for the AF ASTRA scheme owner, accrediting and assessment operators, applicants and holders, according to the responsibilities assigned to each. Its purpose is reproducible, impartial and technically justified evaluation, not the accumulation of certificates. Programme membership, commercial relationships and operational capability shall remain distinguishable. The reader shall establish the applicable family, object, legal entity, site, technical profile and decision type before selecting requirements. A programme-wide rule applies to its responsible function; it shall not automatically impose the whole operating system on an individual candidate or a single test customer.

Required evidence: Applicability record; responsible-function map; selected family, object and profile.

0.2 How to assemble the applicable requirements

Use Clauses 1–4 for boundary and authority, Clauses 5–10 for organisational and evidence controls, Clauses 11–16 for assessment, Clauses 17–25 for the selected family or provider, and Clauses 26–31 for governance and future methods. Apply every triggered technical requirement in Clauses 32–80 and every relevant normative annex. Clause 62 and Annex AL define explicit acceptance logic. Annex AK establishes space-domain applicability; Annex AM gives checked synthetic calculations; Annex AN contains decision diagrams; Annex AO defines mandatory parameter schedules. Compatible requirements accumulate. A shorter form, commercial proposal or local checklist shall not remove an applicable condition.

Required evidence: Case requirement index; profile version; normative-annex selection.

0.3 Normative language and examples

Shall expresses a requirement, shall not a prohibition, should a recommendation and may permission. Requirements apply to the responsible function within adopted participation terms and the applicable released profile. Examples, assumed values, suggested project codes and worked calculations remain informative where identified. A normative requirement to retain specified information does not make a filled example an authentic operating record. Equivalent records and digital formats may be used when the required information, relationships, approvals and history are preserved.

Required evidence: Consistent interpretation; identified example data; equivalent-record mapping.

0.4 Edition and operational effectivity

The programme name is AF ASTRA. The standard identifier is AF ASTRA-100:2026 and the controlled-document code is AF-AST-STD-001. The display title is ASTRA — AEROSPACE STANDARD. The edition identity is FIRST EDITION, 30 September 2026. Publisher release approval is recorded on the publication-status page. Technical approval, institutional adoption, operator appointment and individual scope activation retain their separate authenticated records under Clauses 4, 31 and 61. No live outcome shall be issued for a scope whose activation conditions remain unmet.

Required evidence: Publication master; actual approval and effectivity; scope-release register.

0.5 Relationship to the existing AF system

AF ASTRA establishes the eight-family assurance architecture. AF 9100:2026 remains a separate management-system standard. AF-CON-001 governs institutional authority, and AF-SR-001 governs the common scheme framework within its adopted scope. This standard makes programme-specific controls explicit without silently amending those instruments. Annex N identifies their compatibility interfaces. Any wider use of accreditation terminology requires the formal higher-instrument review described there before public use.

Required evidence: Compatibility review; unchanged publication baselines; approved transition decisions.

1 Scope, programme families and assessment boundaries

1.1 Sector and lifecycle coverage

The programme may cover civil and military aviation; space systems and operations; land, maritime, air, space and associated defense industry; heavy and advanced industry; and vehicles, equipment and services used for defense, aerospace support or space exploration. It encompasses research, design, manufacture, integration, test, supply, operation, maintenance, modification and retirement where a released profile exists. The sector description is a development remit, not an assertion that AF or any assessor possesses every listed capability. Sensitive and hazardous work shall be limited to authorised specialists and lawful evidence arrangements.

Required evidence: Sector and lifecycle scope; released-profile check; authorised access arrangements.

1.2 Eight-family structure

The eight families are F01 Management Systems Assurance; F02 Critical Processes and Products; F03 Testing and Inspection; F04 Education Programmes; F05 Airports and Aerodromes; F06 Aircraft Maintenance and Technical Services; F07 Ground Operations and Aviation Support Services; and F08 Carbon, Environment and Climate Assurance. Annex A defines their boundaries and links. Family labels organise scope selection and do not establish certificate types. Individual methods, disciplines, aircraft types, service stations or environmental modules shall not be counted as additional programme families.

Required evidence: Family catalogue; deduplication record; outcome class for each application.

1.3 Object and responsibility tuple

Each application shall identify the responsible legal entity, actual performer, object type, family and module, sites and remote functions, configuration or programme version, lifecycle role, applicable period, criticality, profile and exclusions. Products, services, processes, people, supplier scopes, educational programmes, assessment providers and environmental statements are separate objects. A combined dossier may share evidence but shall provide a separate conclusion and status history for each claimed object. Where a duty is outsourced, the record shall identify both the performer and the organisation retaining accountability.

Required evidence: Complete scope tuple; separate requested outcomes; actual-performer map.

1.4 Group, site and interface limitations

Group governance evidence may be reused after its relevance and local implementation are demonstrated. It shall not grant unexamined competence to every subsidiary, airport, station, faculty, workshop or laboratory. Scope schedules shall distinguish a headquarters function from operational delivery. An airport outcome does not include independent tenants by default; an MRO outcome does not include its training centre or all internal test methods automatically. Shared premises, a common owner or one purchasing contract shall not erase those boundaries.

Required evidence: Entity/site hierarchy; interface agreements; scope-specific coverage and decisions.

1.5 Activity-based applicability

The applicant shall make a reasoned applicability decision for every common and family requirement. Non-applicability requires the actual activity and retained responsibility to be absent, without undermining a claimed outcome. Small size, another certificate, customer nomination or outsourcing alone does not justify exclusion. A provider that changes from distribution to repair, or from laboratory testing to product certification, shall reassess its scope before making the broader claim. Technical reviewers shall approve material exclusions and record the supporting evidence.

Required evidence: Approved applicability matrix; technical rationale; review triggers and version history.

1.6 Out-of-scope and emerging activities

Heliports, vertiports, spaceports, specialist air-navigation activities, novel fuels, human spaceflight and restricted defense applications require dedicated criteria and verified technical coverage before activation. Their inclusion in the portfolio does not permit operation under a conventional airport or generic service profile. A request outside the released catalogue may enter a development or expression-of-interest register, not an implied live accreditation route. Airline flight operations remain outside F07 unless a separate profile and lawful delivery arrangement are expressly released.

Required evidence: Development request; scope exclusion; dedicated supplement and release decision.

2 Definitions, outcome classes and interpretive controls

2.1 Accreditation and competence

Accreditation within the current AF framework is an independently decided attestation that a conformity-assessment body is competent, impartial and consistently operated for specified assessment activities. Competence concerns demonstrated ability to perform a defined task and reach valid conclusions, including recognising limitations. A broad sector title, legal registration, quality manual or equipment list does not demonstrate competence. The accredited scope shall identify activity, object or method family, range or conditions, location, resources and limitations sufficient to prevent a misleading interpretation.

Required evidence: Technical competence scope; witnessed performance; independent accreditation decision.

2.2 Recognition, qualification and certification

Recognition records that a specified institutional, educational, operational or service capability meets its approved criteria. Qualification records a demonstrated task, process or supply capability under defined conditions. Certification records conformity of a stated product, service, process, system or person to specified requirements. The relevant record shall name the result actually reached. None of these labels is interchangeable with accreditation of the body producing the result, membership, attendance, an award, a professional licence or a public operating permission.

Required evidence: Outcome classification; exact criterion set; approved statement and limitations.

2.3 Verification and validation

Verification of a statement examines whether its historical information and assertions are supported for the declared boundary and period. Validation examines the reasonableness of assumptions, methods and prospective claims for an intended future use; it does not establish that a forecast will occur. Laboratory method validation is a separate technical activity demonstrating method fitness. The engagement shall state which meaning applies. A favourable review of a transition plan shall not be published as an achieved emissions reduction, and an accredited verifier is not automatically the holder of a verified environmental claim.

Required evidence: Engagement objective; statement identity; historical/prospective classification; bounded conclusion.

2.4 Programme name and public designations

AF ASTRA may be described as an accreditation and assurance programme. An individual outcome shall use its precise class from Annex A. Under the present protected AF instruments, educational and operational applicants use the relevant programme or capability recognition route unless an expressly adopted higher-instrument change permits a different qualified designation. The programme name shall not be abbreviated in a way that implies every participant is accredited. No certificate or registry flag shall apply an expanded accreditation title merely because it appeared in an earlier planning heading.

Required evidence: Permitted-claims register; terminology clearance; applicable authorisation for any changed title.

2.5 Evidence, witnessing and technical profile

Evidence is information capable of competent verification and relevant to a stated condition. Witnessing is attributable observation of representative work under known conditions, including necessary setup, execution and conclusion. A technical profile is a controlled definition of the object, intended use, requirements, methods, acceptance rules, limitations and continuing controls. A curated presentation is not equivalent to an end-to-end witness unless its representativeness is justified. Hashes, signatures, video and artificial-intelligence summaries can support integrity or access but do not prove that the original observation is correct.

Required evidence: Profile; evidence-purpose links; witness identity and limitations; provenance records.

2.6 Requirement status and uncertainty

Requirement conclusions shall distinguish conforming, nonconforming, approved non-applicability and not yet demonstrated. Evidence status shall separately distinguish planned, received, reviewed, accepted for a purpose, rejected, superseded and unavailable. An indeterminate measurement or inaccessible essential record shall not be changed to non-applicable merely to close a checklist. Confidence in a model, coverage of an uncertainty interval, probability of detection and percentage of completed checklist rows are different quantities and shall not be reported as interchangeable assurance scores.

Required evidence: Controlled status dictionary; recorded transitions; uncertainty and decision interpretation.

3 Institutional governance and retained responsibility

3.1 Scheme ownership and constitutional authority

Aerospace Federation owns the programme rule set and controls its publication, development, authorised use and registry architecture within its actual rights and powers. The Presidential Council remains the corporate Board of Directors; the President leads implementation within recorded authority. Programme councils, technical groups and case panels are functional arrangements, not new corporate boards. Their mandates shall identify decisions they may make, resources, oversight and limits. This standard shall not alter committee election, leadership succession or constitutional voting rules.

Required evidence: Programme charter; verified delegations; functional-body mandates.

3.2 Accrediting and delivery entities

The legal entity making an accreditation decision shall be identified separately from the applicant body and from the entity providing the assessment services being accredited. It shall not accredit itself or its own assessment operation, including through nominal reciprocal arrangements. It shall not also deliver the conformity-assessment services it accredits or applicant-specific consultancy compromising that accreditation. Related training, sector engagement and shared administration shall be assessed for actual influence, finances, access and ownership, with a genuinely independent arrangement where separation is necessary.

Required evidence: Legal delivery model; related-activity analysis; independent oversight and liability arrangements.

3.3 Technical committees and programme stewardship

Permanent voting committee offices shall follow the AF constitutional election arrangements. Competent working groups may develop technical proposals without acquiring permanent office or case-decision authority. Each active family shall have a responsible technical owner and a maintained work programme. Representation shall be balanced sufficiently to expose relevant operator, supplier, professional, education and public-interest concerns. No dominant commercial group shall control acceptance criteria to exclude competitors without a defensible technical need.

Required evidence: Committee charter; competence and balance review; technical work programme; recorded objections.

3.4 Case separation and decision panels

Evaluation, independent review, decision and appeal shall be assigned through explicit role checks. Final accreditation grants, renewals, extensions and contested adverse decisions shall use three independent authorised panel members: all three participate and at least two support the reasoned outcome, with every mandatory technical gate met. A technical reviewer may serve on that panel only when independent of evaluation and separately authorised. Other outcome classes use the independent authority specified in the released profile. A majority vote cannot resolve missing essential technical evidence by preference.

Required evidence: Assignment matrix; independent review; three-person participation and votes; gate record.

3.5 Commercial and leadership boundaries

Leadership may allocate resources, require procedural correction, commission independent investigation and close an unsafe programme within its powers. It shall not order a favourable technical result, remove a justified finding for commercial reasons, substitute an applicant-selected assessor or condition remuneration on grants. Membership, funding, sponsorship, investments and training income shall be excluded from technical decision criteria. Programme managers shall report attempts to influence decisions through the protected integrity route.

Required evidence: Financial separation; influence log; independent escalation; outcome-neutral remuneration.

3.6 Liability, continuity and accountability

Each operator shall maintain resources and arrangements for its actual liabilities, including suitable insurance or justified equivalent provision where appropriate. It shall remain responsible for outsourced technical work and its final decisions. Exit or insolvency planning shall protect holders, pending cases, records, status information and lawful transfer. An agreement assigning tasks to a contractor shall not be used to disclaim obligations retained by the issuer or to obscure who is answerable for an incorrect conclusion.

Required evidence: Liability assessment; financial capacity; continuity/closure plan; retained-responsibility clauses.

4 Rule development, technical profiles and programme activation

4.1 Development request and feasibility

A new profile shall start from a defined sector need, intended beneficiaries, output type, failure consequences and available evidence. The technical owner shall assess whether a new profile is necessary or an existing one can cover the activity without scope distortion. The development record shall consider feasibility, access, resources, conflicts, proportionate burden and the capability required of evaluators. A catalogue entry or market demand alone is not approval of a method or authority to solicit formal applications.

Required evidence: Development brief; duplicate-scope review; feasibility and resource decision.

4.2 Profile content and acceptance criteria

Every released profile shall contain the fields in Annex C: exact scope, prerequisites, measurable or defined attribute criteria, methods, sampling, uncertainty, essential controls, competence, sites, witnessing, decision rules, duration, surveillance, records and permissible claims. Criterion limits shall be derived from the actual technical and obligation basis. They shall be fixed before results are evaluated. There shall be no universal tolerance, environmental test load, staff ratio, curriculum credit total or carbon threshold invented to cover unrelated applications.

Required evidence: Complete approved profile; criterion-to-method map; acceptance rationale.

4.3 Consultation and technical approval

Substantive requirements shall receive at least 60 calendar days of public consultation before final technical approval through the applicable AF process. Material comments and dissent shall receive recorded dispositions. Final normative committee approval requires substantive yes-or-no participation by at least two thirds of eligible voting members and affirmative votes from at least two thirds of those substantive votes, rounded upward. Material new requirements introduced after consultation shall undergo further review or consultation proportionate to their effect. Actual records shall be retained; preparation does not retrospectively establish consultation.

Required evidence: Notice; comments and dispositions; eligible roll; substantive vote and approval records.

4.4 Pilot evaluation and method challenge

Before release, the operator shall exercise representative normal and adverse cases, including an undefined scope, inaccessible evidence, a failed critical requirement, a conflict, a rejected result, a status change, an appeal and a recovery failure. Technical pilots shall examine criterion clarity, discrimination, burden, evaluator agreement and evidence sufficiency. Participants shall be told the restricted pilot purpose. Synthetic cases shall be labelled. A pilot participation letter shall not be a live accreditation, certification or recognition result.

Required evidence: Pilot plan; authentic or clearly synthetic cases; findings; verified correction and limitations.

4.5 Activation gate and scope release

A scope becomes available only after the independent technical readiness check and authorised institutional activation described in Annex P. Confirm lawful operator identity, complete profile, competent teams and decision authority, executed terms, working evidence and registry systems, remedies, resources and continuity. Release shall identify exact available scopes and unavailable supplements. A partially ready portfolio may open only the independently complete profiles; unrelated incomplete development projects need not block that release. No profile shall borrow an unverified capability from a future programme.

Required evidence: Scope-release checklist; readiness evidence; authorised effective date; published boundaries.

4.6 Interpretation and controlled evolution

A controlled interpretation may explain an existing condition but shall not change a threshold, expand a claim, waive competence or convert missing evidence into a pass. Such changes require formal normative version and prospectively defined transition. Review active rules at least every three years and sooner after serious incidents, method failures or material technological change. Retain earlier criteria and decisions. An urgent factual safety communication may protect users but shall not be disguised as an unconsulted new accreditation requirement.

Required evidence: Interpretation register; change classification; transition assessment; version archive.

5 Common organisational capability and management controls

5.1 Identity, obligations and accountability

An applicant shall establish its legal identity, ownership or controlling relationships, actual operating locations, responsible managers and relevant permissions. It shall maintain an obligation register identifying applicable legal duties, contracts, approved technical information, expiry conditions and responsible owners. The assessment shall verify implementation within the declared scope rather than accepting a general compliance declaration. Conflicts between obligations shall be referred to competent authorities and affected work held where needed. Actual evidence providers shall remain identifiable in protected records.

Required evidence: Legal identity; permissions; responsibility matrix; current obligation register.

5.2 Process architecture and controlled work

The organisation shall define processes, inputs, outputs, interfaces, competence, resources and acceptance conditions needed for its claimed capability. Procedures shall be accessible and current where work occurs, including shifts, remote teams and subcontractors. Combined documents are acceptable when responsibilities and controls remain clear. The effectiveness of the system shall be demonstrated through actual work and outcome records. An approved manual without an implemented process shall not satisfy the claim.

Required evidence: Process map; current instructions; actual delivery trails; interface controls.

5.3 Risk, safety and opportunity

Risk assessment shall address credible consequences, exposure, uncertainty, dependencies, human performance and common causes. The organisation shall identify essential protective controls and assign residual-risk acceptance to an appropriately competent authority. A multiplied ordinal score shall not be treated as a physical probability or used to downgrade an unassessed severe consequence. Opportunities for improvement shall be planned separately with measurable benefit and safeguards. Emergency decisions shall remain attributable and shall not authorise violation of binding safety requirements.

Required evidence: Hazard/risk register; critical controls; accepted limitations; opportunity plan.

5.4 Change, configuration and retained knowledge

Material changes to people, methods, equipment, software, facilities, tasks, suppliers and legal control shall receive a documented impact review before dependent use. Baseline, approval, effectivity, training, verification and affected earlier outputs shall be recorded. The organisation shall maintain sufficient knowledge to support long-life services and technical evidence after personnel turnover. A renamed product, migrated database or replacement software version shall not silently inherit the demonstrated capability of its predecessor.

Required evidence: Change record; as-operated baseline; knowledge-transfer evidence; reassessment decision.

5.5 External provision and sub-tier responsibility

Outsourced work shall have defined technical scope, actual performer, location, qualification, acceptance, evidence access, notification, records and exit conditions. Critical obligations shall reach the lowest relevant performer with acknowledgement and verification. The commissioning organisation retains its assigned acceptance and oversight duties. A subcontractor certificate shall be checked for authenticity, method, site and current status and treated as relevant evidence, not a substitute for fitness for the actual task. Unapproved substitutions shall trigger hold and review.

Required evidence: Supplier scope and status; flow-down; sub-tier acknowledgement; actual work verification.

5.6 Continuity, events and learning

Continuity plans shall address loss of key staff, utilities, premises, suppliers, information and authority. Exercises shall test recovery and integrity, not only document availability. Occurrences, complaints and nonconforming work shall be traced to affected people, outputs and shared causes. Corrective action shall address both occurrence and escape and be checked for effectiveness under representative conditions. Good performance statistics shall not conceal missing critical controls or suppress necessary reporting.

Required evidence: Continuity exercise; event-to-output trace; corrective effectiveness; lessons implemented.

6 Impartiality, ethical conduct and fair access

6.1 Institutional and personal conflicts

The operator shall review financial, ownership, employment, advisory, family, close personal and adversarial relationships at institutional and case levels. Declaration is an input to control, not the control itself. Where a material threat cannot be effectively managed, the individual or entity shall decline or be replaced. For independent third-party evaluation, review and decision, relevant employment or consultancy for the applicant within the preceding 24 months excludes assignment; older relationships remain subject to risk review.

Required evidence: Live conflict register; prior-work screening; independent disposition and assignment restrictions.

6.2 Participation and equal treatment

Access shall be based on published eligibility and actual technical capability, not membership, sponsor status, nationality or enterprise size alone. Necessary legal restrictions and objective capacity limits shall be applied consistently. Fees and scheduling shall be disclosed before commitment. Reasonable accessibility and language arrangements shall preserve the competence and evidence being assessed. Financial support or fee waivers shall not reduce technical criteria or purchase an outcome.

Required evidence: Eligibility rules; accommodation decisions; fee/capacity terms; equal-treatment checks.

6.3 Consultancy, learning and evaluation

General explanation of a requirement and non-client-specific education may be offered through controlled arrangements. A person who designs an applicant's system, corrective solution or technical method shall not independently certify that same work. The operator shall distinguish teaching from examination and independent decision. Training attendance shall not be represented as competence, and purchasing a particular course shall not be required where verified equivalent preparation is acceptable under the profile.

Required evidence: Service boundaries; training/evaluation separation; assignment conflict checks.

6.4 Integrity of records and professional behaviour

Personnel shall report actual observations, retain adverse evidence, correct errors transparently and decline work beyond their competence. They shall reject fabricated logs, manipulated results, outcome-linked benefits, corrupt payments and private lobbying. A suspected fabrication shall trigger evidence preservation, impartial investigation and protection of affected decisions; suspicion alone is not a final finding of misconduct. Public allegations and confidential case evidence shall be handled through authorised channels.

Required evidence: Conduct undertakings; protected original data; investigation and correction history.

6.5 Independent oversight

The oversight function shall have protected access to unedited results, conflict information, trends and resources needed to challenge programme management. It shall report material unresolved threats to a disinterested constitutional route. Implicated officers shall not select their own investigator or control the evidence made available. Oversight may recommend restrictions, reassessment or governance correction; it shall not replace competent case findings with a preferred commercial result.

Required evidence: Oversight mandate; access and budget; independent reports; resolved or escalated threats.

7 Personnel competence, authorisation and continuing practice

7.1 Function-specific competence

The operator shall define separate competence requirements for application review, audit leadership, specialist evaluation, sampling, laboratory sign-off, independent review, decisions and appeals. Profiles shall state technical fields, methods, criticality, language, professional judgement, evidence interpretation and access permissions. A person may hold several roles only when separately qualified and case independence remains valid. No generic aerospace assessor designation shall imply mastery of all eight families.

Required evidence: Role profiles; technical authorisation matrix; case coverage check.

7.2 Entry evidence and demonstration

Minimum assessment-role requirements are set out in Annex D. Verified experience, programme learning, mentored work, knowledge evaluation and observed practical performance shall be assessed together. Numerical minima do not replace demonstrated competence. Specialist non-audit assessors shall demonstrate the actual discipline and assessment task; they are not required to pretend that laboratory or educational evaluation is an organisational audit. Where the work uses AF 9100, its relevant assessor and personnel requirements remain controlling.

Required evidence: Verified history; learning records; mentored cases; observed demonstration and decision.

7.3 Essential steps and assessment security

Knowledge and practical criteria shall be fixed before candidate evaluation. Every predesignated essential safety, integrity and independence step shall be passed; component scores shall not be averaged to conceal failure. Equivalent reassessment shall follow evidenced remediation and preserve earlier attempts. Examination questions, scenarios, identity checks and scoring shall be secured and validated. An automated score or AI recommendation shall not be the sole authority for a practical competence decision.

Required evidence: Assessment blueprint; component/essential-step results; secured attempts; independent authorisation.

7.4 Initial assessor population

Where no established ASTRA assessor population exists, at least two independent competent professionals shall assess each candidate against the stated role and technical criteria. Their own competence and conflicts shall be documented. Comparable prior work may satisfy specified experience elements only after verification; programme knowledge, witnessed performance and independence shall not be waived. Honorary titles, reciprocal self-approval and attendance at an introductory meeting shall not create assessor authority.

Required evidence: Initial-panel qualifications; equivalence map; witnessed task; remaining scope restrictions.

7.5 Maintenance and inactivity

Maintain relevant development, current practice and observed performance at the intervals in Annex D. Review poor reports, inconsistent decisions, complaints, new technologies and changes in methods as well as activity counts. Failure to meet the applicable role minimum shall suspend independent role use until reviewed supervised reactivation. An individual shall notify limitations and request support rather than accept a task outside the authorised scope. Restoration does not erase earlier affected-work concerns.

Required evidence: Practice/development logs; witnessed reviews; suspension and reactivation; prior-work assessment.

7.6 Applicant personnel and task authority

Applicants shall demonstrate competence of people whose work affects the claimed capability, including contractors, temporary workers and local station personnel. Employers shall issue actual task authorisations defining scope, equipment, supervision and review conditions. A professional credential, external course or programme recognition is only part of the evidence; it does not itself authorise aircraft release, restricted testing or every task in a facility. Changes and inactivity shall trigger review before independent work resumes.

Required evidence: Task analysis; verified competence; employer authorisations; changed-task review.

8 Facilities, equipment and metrological assurance

8.1 Facility suitability and environmental control

Work locations shall support the actual method, product, learner or service conditions. Identify and monitor relevant temperature, contamination, vibration, electromagnetic, access, lighting, space and utility constraints. Separate incompatible activities and protect articles and records. Temporary, mobile, customer-owned and remote facilities shall meet the same relevant suitability conditions. An adverse environmental excursion shall be linked to the work it could affect and shall not be closed merely by restoring room conditions.

Required evidence: Facility scope; environmental limits and logs; excursion/affected-work review.

8.2 Equipment identity and fitness

Equipment, software-controlled instruments, fixtures, tools and reference artefacts shall be uniquely identified and suitable for the required range, resolution, accuracy, uncertainty and duty. Verify acceptance before first use, after repair or configuration change, and when validity is questioned. Records shall include version, location, maintenance, checks, restrictions and status. Calendar calibration alone shall not establish fitness for every method or specimen. Out-of-service equipment shall be prevented from supporting an authorised result.

Required evidence: Equipment register; acceptance and checks; method suitability; restricted-use controls.

8.3 Traceability and calibration

Measurement results shall have a technically appropriate documented connection to accepted reference quantities or justified reference bases, with uncertainty contributions and competent calibration evidence. Verify the actual service range and result, not only the provider's logo. Where direct reference traceability is not technically possible, document the alternative reference, method validation and limitations. Do not claim metrological traceability from an unverified manufacturer declaration or a broken chain of comparisons.

Required evidence: Calibration chain; certificates/results; uncertainty contributions; justified alternative basis.

8.4 Intermediate checks and due dates

The responsible technical person shall set calibration and verification intervals using use, drift, environment, history, consequence and applicable requirements. Conduct intermediate checks where needed to detect loss of capability between calibrations. A due date shall not be extended retrospectively because capacity is unavailable. Any prospective interval change requires recorded technical evidence and approval. Checks shall challenge actual measuring functions rather than merely confirm that the equipment powers on.

Required evidence: Interval rationale; intermediate checks; prospective approved changes; actual-use status.

8.5 Adverse equipment findings

When equipment is damaged, out of tolerance, misconfigured or otherwise suspect, stop affected use and determine the last demonstrated valid state. Review prior results, associated lots, decisions and recipients, using the likely error mechanism and uncertainty. Recalibration restores equipment evidence only after acceptance; it does not by itself establish the validity of prior work. Amend or withdraw reports and notify affected parties when their conclusions are no longer supported.

Required evidence: Quarantine; look-back interval; impacted results; corrected reports and notifications.

8.6 Consumables, materials and reference items

Control receipt, identity, condition, shelf or out-time, storage, preparation and permitted reuse of materials, standards, test specimens and consumables. Establish suitability and homogeneity/stability where reference items support method validity. Prevent contamination, substitution and expired material use. Externally supplied reference values shall be reviewed for intended use and uncertainty; a nominal value with unknown provenance shall not support an unjustified calibration or conformity conclusion.

Required evidence: Material/reference register; custody; validity and expiry; suitability review.

9 Methods, uncertainty and validity of technical results

9.1 Method selection and contract fit

Before work, select a method suitable for the actual object, property, range, operating conditions and intended decision. Resolve contradictory or obsolete customer instructions and disclose methods outside demonstrated capability. The method shall define preparation, setup, execution, data treatment, acceptance and limitations sufficiently for competent reproducibility. A familiar method name shall not establish fitness for a new material, geometry, low-level concentration, digital system or service context.

Required evidence: Reviewed method request; authorised procedure; scope/range suitability; resolved ambiguities.

9.2 Verification and validation

Verify established methods in the actual implementation. Validate new, non-standard or materially modified methods for the intended use, addressing relevant bias, precision, selectivity, sensitivity, range, robustness and uncertainty. Establish acceptance criteria before validation data are assessed. Retain failed trials and restrictions. Method transfer between sites, instruments, software or personnel requires evidence that material performance remains valid; a shared procedure number does not demonstrate successful transfer.

Required evidence: Validation/verification plan; raw results; acceptance analysis; transfer and limitation records.

9.3 Sampling and specimen integrity

When sampling is within scope, establish the population, selection method, sample size, locations, conditions, randomisation where relevant, transport and preparation. Address sampling contributions to uncertainty and limitations of inference. A result from a client-selected item shall identify that boundary. Sample identity and chain of custody shall survive splitting, pooling, consumption and subcontracting. Reject or condition work on unsuitable specimens before interpreting the result as representative.

Required evidence: Sampling plan; population and selection; custody; deviations and restricted inference.

9.4 Measurement model and uncertainty

Evaluate uncertainty appropriate to the reported result and decision. Identify measurand, significant corrections, input distributions, sensitivity coefficients, dependence, sample preparation and environmental effects. The calculation shall distinguish standard and expanded uncertainty, coverage factor, units and coverage interpretation. Known material bias shall be corrected or explicitly handled through an approved model, not hidden in a convenient uncertainty allowance. A result shall not inherit an uncertainty copied from an unrelated calibration capability.

Required evidence: Uncertainty budget; corrections; covariance; units; coverage and applicability justification.

9.5 Decision rules and boundary results

Agree the decision rule before evaluation and record its treatment of false acceptance, false rejection, uncertainty and criticality. Annex G sets the full-interval rule and alternative-rule controls. Conformity demonstrated, nonconformity demonstrated and indeterminate are separate outcomes under that rule. Indeterminate work remains held from acceptance pending valid disposition. Repeating observations until one passes, rounding a borderline value into compliance or changing the specification after seeing the result is not a valid resolution.

Required evidence: Pre-agreed rule; unrounded inputs; outcome; hold and authorised disposition.

9.6 Continuing validity and comparisons

Maintain a planned programme of internal controls and independent or interlaboratory comparison appropriate to each significant technical field. Participation alone is not satisfactory performance. Investigate adverse results, assign causes and assess prior reports. Where a suitable comparison is unavailable or impracticable, approve a technically justified alternative with evidence of challenge and limitations; lack of participation opportunity shall not be described as external proof of competence. Review coverage as methods and volumes change.

Required evidence: Validity-monitoring plan; comparison results; justified alternatives; adverse-result actions.

9.7 Technical reporting and amendments

Reports shall identify issuer, client, actual item, scope, method/version, conditions, dates, results, units, uncertainty where needed, deviations, decision rule, conclusion, limitations and authorised signatory. Identify subcontracted results and opinions separately. A report shall not imply that untested characteristics or future production were examined. Amendments shall preserve the original, state the reason and affected conclusion, and reach recipients who relied on an incorrect result.

Required evidence: Attributable report; raw-data linkage; subcontracted-result identity; amendment and recipient log.

10 Information, confidentiality and trusted digital evidence

10.1 Records and provenance

Records shall connect each requirement to actual work, configuration, performer, method, data, review and decision. Maintain unique identifiers, units, time basis, versions, status and change history. Corrections shall preserve the earlier information and reasons. Evidence shall remain distinguishable from forecasts, simulations and generated text. An imported record shall be checked for completeness and semantic mapping; a readable file without its essential relationships is not a complete transferred dossier.

Required evidence: Evidence index; version/provenance; change audit trail; migration checks.

10.2 Confidentiality, personal data and controlled technology

Collect only information needed for the authorised purpose and apply suitable access, transfer, retention and disposal controls. Agree legally sufficient confidential review of proprietary or restricted evidence. Public registry fields shall be separated from protected technical and personal records. A security or secrecy restriction shall not lead to a favourable conclusion based on inaccessible essential evidence. Use authorised reviewers, a bounded scope or refusal when adequate lawful review cannot be achieved.

Required evidence: Data classification; permissions; secure review; retained evidence and public-field separation.

10.3 Digital tools and calculations

Validate decision-support tools, spreadsheets, interfaces and automated scoring against their intended use. Test correct, boundary, missing, invalid and prohibited states, including expired authority, a mismatched configuration and an open critical finding. Control versions, formula changes, permissions and deployments. Formula accuracy does not establish input truth or model suitability. The accountable user shall verify the actual dataset and limitation before relying on a computed result.

Required evidence: Tool inventory; known-answer/prohibited-case tests; version approval; input review.

10.4 Artificial intelligence and generated material

AI may assist search, classification, drafting and anomaly identification only within an approved use, data boundary and human review. Material conclusions shall retain verifiable underlying evidence; generated citations, transcripts, images or observations shall not be passed off as authentic records. Evaluate data rights, bias, failure modes, confidentiality and model changes. An automated system shall not independently grant, renew, suspend or restore an ASTRA outcome. The authorised decision maker remains accountable.

Required evidence: Approved AI use; validated limitations; verified outputs; human decision and audit trail.

10.5 Remote access and live evidence

Before remote assessment, verify identity, connection security, permissions, camera or sensor adequacy, observation continuity and independent selection of evidence. Record interruptions, inaccessible areas and substitutions. Prerecorded material shall be identified and shall not be represented as live observation. Where physical or practical capability cannot be established remotely, arrange on-site or appropriately controlled witnessed work. Remote convenience shall not reduce scope coverage, time, competence or critical observation.

Required evidence: Remote suitability review; consent/access; live-session record; supplementary coverage.

10.6 Recovery, retention and closure

Maintain protected backups and test restoration of data, identity, configuration links and current status. Meeting recovery-time objectives does not establish restored evidence integrity. Retain assessment and decision evidence for at least seven years after the last relevant decision, or longer when justified by applicable obligations, service life or a hold; reconcile any legally required alternative handling without concealing the decision basis. Separate unnecessary personal copies and dispose of them under approved controls.

Required evidence: Restore/integrity tests; retention basis; legal holds; secure disposal and closure transfer.

11 Application, eligibility and participation agreements

11.1 Expression of interest and formal application

The Secretariat may receive expressions of interest for unreleased scopes but shall label them as development enquiries. A formal application shall state the requested outcome, available technical profile, legal applicant, authorised representative, sites, affiliations, object, methods, configurations and prior relevant results. Receipt does not establish eligibility, acceptance of scope, accreditation or authority to use marks. Administrative completeness shall be distinguished from technical readiness.

Required evidence: Enquiry/application classification; representative authority; scope request; dated receipt.

11.2 Technical and impartiality review

Before commitment, verify that the programme is active for the requested scope, the operator is authorised, necessary evaluators and independent decision resources are available, evidence access is feasible and conflicts can be controlled. Resolve unclear methods or outcome terminology before quoting an evaluable scope. Decline or defer work outside real capability; do not accept fees for an assessment whose essential method has not yet been defined without clearly separate development terms.

Required evidence: Admission review; resource/conflict check; accepted, deferred or refused scope with reasons.

11.3 Existing evidence and reuse

Review prior reports, approvals and certificates for authenticity, issuer competence, actual method, site, period, conditions and configuration. Identify precisely which requirement and decision use they support and what remains to be evaluated. Include adverse results and restrictions. Another outcome shall not be declared equivalent solely from a similar title or scope label. Evidence reuse may reduce repeated document requests but cannot remove necessary local implementation, witnessing or independent decision.

Required evidence: Reuse matrix; authenticity/scope checks; residual gaps; controlled access to original evidence.

11.4 Binding terms and holder duties

The agreement shall identify parties, versions, exact services, evidence and access obligations, fees, limitations, independence, reporting, witnessing, subcontracting, liability, confidentiality, marks, registry publication, surveillance, remedies, termination and records. The holder shall provide materially complete information, maintain conformity, report changes, permit agreed oversight and cease prohibited claims. Governing law and dispute terms require competent selection for the actual relationship; no universal legal jurisdiction is created by this standard.

Required evidence: Executed participation terms; scope schedule; actual authorised signatories.

11.5 Authorisation to act for AF

An external organisation acting for AF in accreditation, certification, delegated recognition or scheme operation shall hold prior written permission and an executed binding Cooperation and Authorization MoU with its actual technical and territorial scope. Competence evaluation, operating permission and the individual applicant outcome are separate decisions. Ordinary applicants and members are not required to enter that operator agreement merely to participate. Onward delegation is prohibited unless expressly authorised and technically controlled.

Required evidence: Competence decision; written approval; executed MoU; controlled delegation and scope.

11.6 Fees, corrections and withdrawal

Disclose charges, travel, testing, surveillance, reassessment, cancellation and refund conditions before commitment. Permit reasonable correction of administrative omissions without inventing earlier technical evidence. Application withdrawal shall preserve material findings, confidentiality and safety duties. A fee dispute shall follow its fair administrative process and shall not be misclassified as technical incompetence. No payment, refund, renewal booking or withdrawal may alter the historical decision or hide an expired status.

Required evidence: Transparent terms; correction/withdrawal history; financial separation; preserved findings.

12 Assessment planning, coverage and resources

12.1 Planning from scope and consequence

The plan shall begin with the requested object and requirement set, not a fixed commercial duration. Identify legal entities, technical methods, actual performers, sites, shifts, programme delivery modes, configurations, prior findings, changes and critical interfaces. Select representative routine and adverse work and assign specialists for every material domain. Define what evidence can support each conclusion and where sampling cannot establish the full claim.

Required evidence: Approved scope-led plan; coverage matrix; technical assignments; sample rationale.

12.2 Sites and stations

For initial and renewal operational-capability or CAB scopes, establish direct evidence at every included operating site, station or delivery location. Common governance evidence can be shared but local capability shall be demonstrated. Use physical visits where necessary work cannot be validly observed remotely. Surveillance sampling of genuinely homogeneous low-consequence activities requires an approved profile, justified eligibility, rotation and expansion triggers; no generic headquarters sample grants all stations. AF 9100 organisational cases retain the specific site rules of that standard.

Required evidence: Site-by-activity coverage; remote/on-site rationale; rotation and ineligible-site controls.

12.3 Method-family witnessing

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.

12.4 Time and productive work

Use an activity-based work breakdown for non-organisational assessments, with necessary preparation, observation, data review, sites, shifts and rework. One evaluator-day is eight productive evaluation hours. Travel, breaks, sales, report preparation, translation delay and independent review/decision are separate resources. Do not count a trainee as a fully productive assessor or double-count two observers performing the same task without distinct technical work. AF 9100 organisational time remains governed by its Annex AC. Annex F provides a planning method and examples, not universal technical durations.

Required evidence: Task/time matrix; separate resources; actual productive time; approved additions.

12.5 Multifamily coordination

Coordinate visits and common evidence requests when the same applicant uses several families. Preserve each profile, specialist, finding impact, review and outcome. Record which shared control was evaluated, for what scope and by whom. Calculate any efficiency from demonstrably shared work rather than an arbitrary bundled discount on necessary technical observation. A finding in a common control shall trigger review of every dependent outcome, with restrictions limited only where unaffected scope is independently established.

Required evidence: Integrated schedule; shared-work allocation; separate conclusions; cross-scope finding impact.

12.6 Plan approval and changes

The lead and competent technical reviewer shall accept the plan before execution. Inform the applicant of scope, access, timing, witnesses and safety arrangements without allowing selective favourable evidence. Changes during work shall retain the original plan, reason, impact and approved replacement. Where capability, access or time is inadequate, add work, restrict the request or defer the conclusion. A report shall disclose actual coverage rather than reproduce the planned coverage as though it occurred.

Required evidence: Plan approval; applicant notice; deviations; completed-versus-planned coverage.

13 Assessment execution and evidence evaluation

13.1 Opening, safety and access confirmation

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

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

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

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.

13.5 Closing and report

Communicate evidence-based findings, affected scope, immediate protection and the distinction between team recommendation and final decision. Acknowledge factual corrections without erasing valid adverse evidence. Issue the final evaluation report within 14 calendar days of evaluation closure; exceptional delay shall be explained without moving an already notified finding clock. The report shall state actual time, methods, samples, sites, witnesses, criteria, limitations, findings and recommendation.

Required evidence: Closing record; findings and original notification dates; final actual-coverage report.

14 Nonconformity, protection and corrective action

14.1 Finding formulation and classification

A finding shall identify the exact requirement and version, objective evidence, gap, affected object/site/period and classification rationale. Use critical, major, minor and observation categories as defined in Annex G. An observation is not a substitute for a demonstrated failure. Several local failures may together establish systemic breakdown. Determine technical containment separately from administrative grade so that an immediate hazard is not delayed by debate over wording.

Required evidence: Requirement–evidence–gap record; classification; extent and protective decision.

14.2 Immediate protection and notifications

Upon a credible critical concern, the responsible organisation shall protect people and affected work immediately, preserve evidence and notify required recipients. A holder shall notify its operator within 24 hours of awareness; earlier applicable duties remain. On a substantiated critical concern, the operator shall suspend the affected status or impose an effective evaluated restriction within 24 hours. An independent duty function with a pre-existing mandate may act urgently, followed by prompt independent review.

Required evidence: Awareness and action times; containment; notification/acknowledgement; status decision.

14.3 Occurrence, escape and systemic extent

The organisation shall determine why the problem occurred and why existing controls did not prevent or detect it. Identify affected and potentially affected outputs, sites, learners, reports, suppliers and configurations, including those already delivered. Test causal explanations with evidence. Training, a revised procedure or blaming an operator alone is not sufficient where workflow, capacity, interface, equipment or management conditions contributed. Preserve rejected hypotheses and material uncertainty.

Required evidence: Population trace; tested causes; occurrence/escape controls; systemic review.

14.4 Plans, closure and effectiveness

Submit a corrective-action plan within 30 calendar days of finding notification. Verify major closure within 60 days and minor closure within 90 days, while immediate protection remains separate. Define effectiveness criteria and observation exposure before closing. Review changes for unintended effects. A new finding number, changed owner, amended report or rescheduled plan shall not restart the original clock. Missed deadlines trigger the affected status action in Annex H, not an automatic extension.

Required evidence: Accepted plan; original due dates; implementation and effectiveness evidence; verified closure.

14.5 Existing status and new grants

Initial grants, renewals and extensions require closure of every in-scope nonconformity. An existing status may continue with a local minor only after adequate protection, reviewed cause and extent, accepted plan and a reasoned independent conclusion that essential controls remain intact. A major compromising ongoing conformity requires suspension, unless an independently demonstrated unaffected scope can be restricted. A future promise of correction is not present competence.

Required evidence: Independent continuation/restriction rationale; closed findings for grant; current protection.

14.6 Recurrence and invalid prior decisions

Recurrent failure or ineffective action shall reopen the causal and extent review and may require wider suspension, re-evaluation of personnel or version of methods. If prior reports or decisions relied on invalid evidence, identify recipients and correct their status and conclusions proportionately. Record what was known at each actual date. Later good evidence shall not be backdated to make an unsupported earlier approval appear valid.

Required evidence: Reopened analysis; affected historical decisions; communication; truthful status history.

15 Independent review and final decisions

15.1 Review dossier

The independent reviewer shall examine the exact scope and profile, lawful authority, assessor competence, conflicts, coverage, method validity, evidence, uncertainty, findings, corrections, limitations and proposed claim. All essential records shall be accessible through authorised means. Return incomplete or inconsistent files for correction rather than infer missing results. Evidence reuse shall remain traceable to its original scope and limitations. The reviewed dossier shall be versioned so that the decision can later be reconstructed.

Required evidence: Independent review checklist; versioned dossier; unresolved issues and returned files.

15.2 Positive-decision gate

A positive grant, renewal or extension requires valid scope, all applicable criteria fulfilled, adequate evidence, closed in-scope nonconformities, sufficient independent competence and actual authority. Required operating and mark permissions shall be effective before the associated claim is used. This is a conjunction of conditions, not a weighted score. A genuinely bounded unaffected scope may be granted only after independent evaluation; it shall not conceal a systemic deficiency or imply success in the refused scope.

Required evidence: Completed gate; exact granted/refused boundary; authority and permission checks.

15.3 Panel and dissent

Apply the three-member accreditation panel rule in Clause 3.4. Members shall receive adequate records and competent technical support and shall not delegate votes. Record attendance, conflicts, affirmative/adverse votes, abstentions, reasons and technical dissent. A two-to-one outcome is possible only when every mandatory gate is substantiated; unresolved essential technical uncertainty requires hold or further work. The chair has no casting vote that can replace absent technical evidence or an ineligible member.

Required evidence: Panel record; all-member participation; technical dissent resolution; actual decision.

15.4 Permitted outcomes and conditions

Decisions may grant, refuse, maintain, restrict, suspend, restore, renew, extend, correct or withdraw a stated result. Conditions attached to a valid outcome shall define its actual operating boundary and continuing obligations, not postpone unmet mandatory criteria. Pre-assessment, applicant and pilot status are not provisional conformity certificates. A lawful product concession remains an explicitly bounded technical disposition and does not waive the requirements for an ASTRA attestation.

Required evidence: Reasoned outcome; bounded conditions; applicant notice; separated concession record.

15.5 Decision date and communication

Record the actual decision date, issue date, effectivity, expiry or instance boundary, criteria version, responsible issuer and signatory. Notify the applicant of reasons, scope, continuing duties and remedy route. Public status shall match the decision and be updated within two calendar days of a status change, while urgent holder notice is immediate. An invoice date, ceremonial date, signature-image insertion or document reprint shall not become a fictitious conformity date.

Required evidence: Authenticated decision; notice; issue/expiry fields; timely registry instruction.

16 Surveillance, renewal and status control

16.1 Duration and basis

Ongoing ASTRA recognition, qualification, certification or CAB accreditation under this common framework shall have a maximum 24-month period from the independent conformity decision, subject to a shorter profile interval and continued fulfilment. AF 9100 cases retain their controlling provisions. An instance result identifies its lot, serial, event, test or historical statement and does not acquire a universal two-year technical validity. Credential duration never extends an equipment life limit, calibration, statutory authorisation or qualified process window.

Required evidence: Ongoing/instance classification; exact dates; linked technical limits.

16.2 Surveillance frequency and coverage

Complete ongoing surveillance at intervals no greater than 12 months, reduced to six months for high-consequence, materially novel or significant competence/integrity exposure. Apply the AF 9100 C0–C3 rules when that standard is used. Mixed scopes follow the shortest triggered interval unless genuinely separated. Reassess actual operation, technical witnessing, changes, adverse results and controls; a document check or booked visit alone is not completed surveillance. Missing required completion triggers affected suspension.

Required evidence: Risk-based timetable; completed technical coverage; changed-scope review; overdue action.

16.3 Material change and notification

Planned changes shall be notified early enough for required prior review and before using an expanded claim. Unplanned non-critical material changes shall be notified within five calendar days after awareness; critical concerns follow the 24-hour rule. Evaluate ownership, responsible entity, location, methods, key personnel, digital platforms, aircraft/task capability, educational delivery and environmental boundaries. An unchanged commercial name shall not conceal a different technical basis.

Required evidence: Change notification; impact; prior approval; updated scope and evidence.

16.4 Renewal and interruption

Plan renewal sufficiently early to complete evaluation, closure, independent review and decision before expiry; initiation at least 90 days beforehand is recommended, not a guarantee. If the renewal decision occurs after expiry, a visible gap remains and the new status starts no earlier than the actual decision. Relevant prior work may inform the review but not substitute for current demonstrated capability. No payment or appeal automatically extends validity.

Required evidence: Renewal plan; current evidence; closed findings; actual dates and disclosed gap.

16.5 Suspension, restoration and withdrawal

A suspension shall state scope, reason, prohibited claims, required actions and a resolution deadline no later than 90 days from the decision. Restore only after verified correction, affected-output review and a valid current basis; otherwise restrict to independently unaffected scope or withdraw. Repeated administrative resets are prohibited. Restoration without full renewal preserves the original expiry and does not validate the suspended interval. Technical containment and reporting continue independently of certificate administration.

Required evidence: Status notices; verified restoration; unaffected-scope rationale; historical continuity.

16.6 Transfer and cessation

A receiving operator shall verify authenticity, scope, criteria, decision history, findings, surveillance, authority and technical evidence before accepting a transfer, and perform additional evaluation where necessary. Suspended or unsupported status cannot be made valid by changing issuer. Operator cessation shall preserve records, pending remedies, current status, holder communication and lawful access. Transfer of files does not itself transfer accreditation, AF operating authority or a wider technical scope.

Required evidence: Transfer review; additional work; continuity agreement; accurate issuer/status history.

17 F01 — Management Systems Assurance

F01 evaluates the management and assurance system for its declared organisational scope. It does not substitute for the technical capability evaluations in the other families.

17.1 System profiles

The applicant shall identify design and production, maintenance, distribution or other released organisational profiles, together with the actual activities and retained responsibilities. Where AF 9100:2026 conformity is claimed, its complete applicable core, technical modules and normative annexes shall be assessed. Existing good controls may be reused when they fulfil the actual requirement. An alternative system document or ASTRA participation alone shall not be represented as AF 9100 conformity.

Required evidence: Organisational profile; AF 9100 applicability where claimed; implementation evidence.

17.2 Readiness and implementation

Before initial independent organisational assessment, complete an internal audit of the applicable scope and management review, with adequate actual operating records. Readiness examines the definition and functioning of the system; implementation evaluation tests its processes and outputs. There is no invented mandatory history of backdated records. A new organisation may proceed when sufficient authentic evidence exists, but a plan to operate is not evidence of completed operation.

Required evidence: Internal audit; management review; actual readiness and implementation trails.

17.3 Design, production and distribution interfaces

A build-to-print scope shall identify the actual design authority, supplied-data control, manufacturing-process design and escalation of errors. A distribution scope shall demonstrate authenticity, storage, life status, split-lot traceability and required customer evidence. A production scope shall demonstrate controlled configuration, source qualification, critical characteristics and authorised release. Excluding own product design shall not remove controls over errors, changes or outsourced design responsibilities retained by contract.

Required evidence: Activity-specific trails; authority boundaries; source and configuration evidence.

17.4 Independent organisational outcome

The assessor shall test both vertical product/service trails and systemic governance, including resources, competence, changes, feedback and corrective effectiveness. Use the applicable organisational time and site minima. The independent conclusion shall identify entity, sites, profile and system boundary. It shall not imply approval of every delivered product, laboratory method, maintenance task, employee or service station. Any technical capability claim requires its own relevant family evidence and decision.

Required evidence: System evaluation; time/site evidence; independent ORG result; separate technical scopes.

18 F02 — Critical Processes and Products

F02 establishes scope-specific qualification and conformity controls for critical manufacturing processes and identified products. NDT and materials testing are assessed through F03 and are not duplicate F02 programmes.

18.1 Process or product object

The application shall distinguish a qualified process from a conforming product configuration, family, lot or serial. A process scope shall identify site, equipment, material/geometry range, essential variables and outputs. A product scope shall identify technical requirements, intended use, configuration, production basis, acceptance and support. Combined evaluation is permissible only with separate criteria and conclusions. A machine approval shall not become approval of every process run or product made using it.

Required evidence: Process/product scope; technical profile; distinct decision boundary.

18.2 Qualification plan

Before unrestricted use, demonstrate the proposed process under representative conditions and justified extremes. The plan shall identify material sources, geometry, equipment, personnel, software, environment, repetitions, measurements and acceptance criteria. Retain failed and excluded runs and their technical disposition. Qualification by similarity shall identify differences, mechanisms and why retained evidence bounds them. A generic supplier capability declaration or a single favourable prototype shall not replace a technically complete qualification.

Required evidence: Qualification matrix; representative trials; failed-run history; approved process window.

18.3 Essential variables and point-of-use control

Identify variables and combinations capable of affecting hidden or critical properties, including preparation and post-processing. Define authorised ranges, monitoring, alarms, hold points, personnel and reaction plans. Record actual variables against each run and output identity. A requirement to maintain an approved window shall not be replaced by an average result that hides an excursion. Critical software recipes, machine programmes and tooling shall have controlled identity and change approval.

Required evidence: Essential-variable register; controlled instructions; run records; excursion detection.

18.4 Materials, genealogy and authenticity

Demonstrate traceability of material, feedstock, consumables and components to actual products and process runs. Control mixing, splitting, blending, reuse, condition, shelf/out-time and source changes. Validate digital genealogy and reconcile quantities. A certificate of origin is not proof of every required material property. Suspect or counterfeit input shall be isolated, investigated and traced through affected output before a conformity claim is maintained.

Required evidence: Material genealogy; quantity balance; input suitability; suspect-output trace.

18.5 First article and production readiness

Account for all applicable characteristics of a production-representative article using actual results, current data, material evidence, qualified processes and controlled software. A partial first article requires a justified changed/unchanged characteristic analysis. Production readiness shall additionally address resources, measurement capability, operators, suppliers, process stability and unresolved risks. One conforming article shall not replace ongoing controls or establish capability for untested variants.

Required evidence: Characteristic accountability; actual route; partial/full rationale; readiness decision.

18.6 Capability and monitoring

Distinguish process stability, statistical capability and individual-output acceptance. Statistical indices require suitable data, subgrouping, measurement capability and a justified model. Do not pool incompatible configurations to improve an index or recalculate limits merely to conceal a drift. For low-volume or one-off work, use a technically justified combination of qualification and individual verification rather than an unsupported capability claim. The profile shall define the actual criteria, not a universal index threshold.

Required evidence: Study design; model/stability review; monitoring; justified low-volume alternative.

18.7 Excursion, change and requalification

After an excursion, identify the potentially affected interval and outputs from the last valid state. Additional inspection is acceptable only when capable of detecting the effect; a superficial pass cannot erase an inherently hidden defect mechanism. Changes to site, material, geometry, equipment, software, personnel or post-processing shall trigger requalification review. Receiving capability shall be demonstrated before transfer. Release restrictions remain until the required evidence and approvals are restored.

Required evidence: Affected population; technical disposition; change impact; full/partial requalification.

18.8 Product release and continuing claim

Product release shall use the agreed technical criteria and instance evidence independently of the organisation's system status. An ongoing family claim requires controlled production, surveillance, change notification and field feedback. A one-time test shall not authorise indefinite output. Labels shall state the exact scope and required restrictions. Safety or mission claims, including suitability for space or defense applications, require the corresponding application-specific evidence and approvals.

Required evidence: Unit/lot acceptance; family surveillance; approved labels; in-service feedback and limitations.

19 F03 — Laboratory, calibration and inspection competence

The initial architecture identifies NDT and materials testing. Other provider activities remain separately profiled and released. The following competence requirements apply to each relevant activity, including in-house and external providers according to the declared relationship.

19.1 Detailed technical scope

The laboratory or inspection body shall define method families, materials/items, measured properties, ranges, conditions, sites, mobile activities and limitations. Calibration scopes shall state measurement quantities and demonstrated uncertainty capability. Inspection scopes shall state object, stage, criteria and independence relationship. An unrestricted description such as all aerospace tests is insufficient. Flexible scope shall be bounded prospectively and shall not authorise a new measurement principle, site or technical field without competence review.

Required evidence: Method/range/site schedule; relationship declaration; controlled flexibility limits.

19.2 Responsible technical management

Appoint technical managers and authorised signatories with demonstrated competence for their actual methods and conclusions. Record who approves methods, performs work, interprets results, releases reports and evaluates complaints. Shared staff shall have manageable workloads and substitution arrangements. Independence required by the claimed result shall be demonstrated structurally and in practice. Laboratory staff shall be able to stop work and refuse an unsupported result without commercial retaliation.

Required evidence: Technical appointments; signatory scope; workload/deputies; stop-work authority.

19.3 Method performance and detection

Demonstrate method suitability for relevant defect mechanisms or measurands, specimen preparation, surfaces, geometry, matrix effects, interference, access and environmental conditions. For qualitative inspection, evaluate false-positive and false-negative behaviour where material. Detection capability shall be tied to technique, task, equipment and person. A successful reference check on an easy artefact shall not prove the ability to detect every relevant defect in an installed structure.

Required evidence: Method validation; challenge specimens; detection limitations; authorised interpretation.

19.4 NDT-specific competence

NDT work shall identify technique, material/product sector, equipment, procedure and acceptance basis, with qualified task personnel and technical supervision. Establish training, experience, practical demonstrations, vision or physical requirements only where justified by the task, periodic re-examination and employer authorisation. Industrial qualification shall not be equated with a general personnel badge. Hazardous-source use requires separate lawful authorisation and safe operating arrangements; this standard supplies no source-handling or exposure instructions.

Required evidence: NDT role/technique matrix; practical evidence; employer authority; controlled safety permissions.

19.5 Materials and destructive testing

Control sampling location, specimen geometry, orientation, machining/preparation, conditioning and traceability to parent material. Demonstrate relevant apparatus performance, rate/control conditions, data acquisition and result processing. Record invalid tests, fractures or anomalies and the reason for any retest. Chemical and physical methods shall address relevant contamination, blank, recovery, reference-material and calibration effects. A result shall be limited to the actual specimen and justified population inference.

Required evidence: Specimen-parent links; conditions; raw data; validity and retest disposition.

19.6 Calibration and reference capability

Calibration shall report the actual quantity, range, method, conditions, result, corrections and uncertainty with suitable traceability. Scope capability shall be supported by a technically complete uncertainty budget and demonstrated implementation. Where an external calibration supports another method, verify that its uncertainty and range are sufficient for the intended use. A scope schedule shall not advertise a smaller uncertainty than the body can actually achieve under the stated conditions.

Required evidence: Calibration scope; uncertainty evidence; reference chain; demonstrated capability.

19.7 Sampling and customer-supplied items

Contract review shall establish who sampled the item and which population is represented. At receipt, verify identity, condition, deviations, quantity and requested work. Resolve unsuitable or ambiguous items before work; where proceeding is justified, state limitations in the result. Maintain storage, preparation, transport, consumption and disposal records. A customer's unverified description shall be clearly identified rather than silently adopted as a laboratory observation.

Required evidence: Receipt and custody; sampling responsibility; deviations; report limitations.

19.8 Inspection relationships

Identify whether inspection is independent third-party activity or is performed within a declared ownership, design, production or service relationship. Assess the risks and required separation for the actual claim; do not imply third-party independence when it is absent. Separate inspected-work responsibility from inspection judgement sufficiently to meet the agreed independence requirement. Internal inspection may support technical evidence, but it shall not be relabelled as an independent certification of that work.

Required evidence: Relationship analysis; independence controls; accurately worded report and scope.

19.9 Inspection judgement and remote methods

Inspection procedures shall specify acceptance criteria, technique, access, sampling, instruments, records and the competence needed for judgement. Record inaccessible features and limitations of visual, remote or automated methods. Drone imagery, digital scans and AI classification shall be validated for their intended inspection purpose. Absence of an observed defect does not demonstrate absence of a defect outside the method's detection or access capability. Escalate uncertain classifications before release.

Required evidence: Inspection plan; method validity; access/detection limits; reviewed judgement.

19.10 Comparisons and validity programme

For each significant technical field, define risk-based reference checks, blind or duplicate work, comparison participation and other validity controls. Before granting a new scope, examine available satisfactory comparison evidence or an independently accepted alternative that directly challenges the claimed ability. No arbitrary score shall compensate for unresolved poor performance. Record investigation, affected historical work and successful corrective verification. Programme enrolment alone shall not be counted as a satisfactory result.

Required evidence: Validity coverage map; comparison/alternative results; investigations; restored capability.

19.11 Nonconforming laboratory or inspection work

A designated person shall evaluate the significance of nonconforming work, stop or restrict it, assess prior results, notify affected clients where necessary and authorise resumption only after correction is demonstrated. The response shall address method, equipment, personnel, environment and data mechanisms. A corrected report shall identify what changed and why. Do not erase an adverse report merely because a new sample gives a better result.

Required evidence: Nonconforming-work record; prior-report assessment; amended reports; resumption authority.

19.12 Technical witnessing for accreditation

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.

20 F04 — Education programmes and demonstrated learning

This family evaluates a named programme, discipline, qualification level, curriculum version, delivery location and delivery mode. The compatible present outcome is programme recognition; any expanded accreditation designation follows Annex N before use.

20.1 Programme identity and lawful standing

Record the provider, programme and award names, discipline, entry route, qualification level, language, mode, campuses, partner delivery and authority to offer the stated award. The programme name shall match learner records and public information. A recognised programme does not make every programme of the institution recognised and does not licence its graduates. Short courses, vocational pathways, degrees and professional development shall not use the same undisclosed evaluation boundary.

Required evidence: Programme/award identity; delivery map; legal standing; consistent public information.

20.2 Educational purpose and stakeholder need

Define the intended professional or further-learning purpose and the capabilities expected at completion, in terms appropriate to the discipline and level. Review relevance with learners, educators, employers, professional practitioners and other affected groups without surrendering academic judgement to a single sponsor. Distinguish longer-term graduate aims from assessable completion outcomes. Keep the rationale and changes traceable to evidence rather than marketing language.

Required evidence: Educational-purpose statement; stakeholder review; outcome rationale; controlled versions.

20.3 Learning outcomes and curriculum alignment

Map each required learning outcome to learning activities, prerequisites, assessment opportunities, direct evidence and an accountable academic owner. Annex J provides adaptable evidence dimensions rather than a universal prescribed curriculum. The approved discipline profile shall define the actual knowledge, design, analysis, experimentation, digital, ethical and practical depth and its workload basis. Credits, contact hours or attendance alone shall not establish outcome attainment.

Required evidence: Outcome–curriculum–assessment map; level/workload rationale; direct assessment evidence.

20.4 Admissions, progression and completion

Use transparent entry requirements, recognition of prior learning, transfer-credit review, academic advice and progression decisions. Demonstrate that every completion route meets the programme's published outcomes and award requirements, including partner and distance routes. Record exceptions and their academically authorised basis. Sample authentic learner work and completion records across relevant routes; do not infer all graduates' attainment from one showcase project or selected top-performing learner.

Required evidence: Admission/credit decisions; progression; completion checks; representative learner sample.

20.5 Assessment validity and academic integrity

Assessment methods shall test the intended knowledge and practical skills at the required level. Set rubrics, essential steps, identity and authenticity checks, moderation and resit rules before use. Preserve failed attempts and due process. AI-assisted and remote assessments shall demonstrate that the learner, rather than an unverified tool or substitute person, possesses the competence. Reasonable adjustments shall preserve the construct being assessed and protect personal information.

Required evidence: Assessment design; moderation; authentic work; essential-step results; integrity/remedy records.

20.6 Educators and technical supervision

Demonstrate that academic and practical staff have suitable disciplinary knowledge, teaching and assessment competence, recent professional development and adequate time. Technical tasks require supervision appropriate to consequence and learner experience. Visiting staff and placement supervisors shall have defined responsibility and observed performance. Faculty titles alone do not establish competence in every specialist module. The programme shall maintain continuity when a key instructor or assessor leaves.

Required evidence: Staff competence/workload; supervision; external-teacher controls; continuity plan.

20.7 Learning resources and safe practical work

Provide facilities, equipment, software, library/information access and learner support adequate for all delivery locations and modes. Practical activities shall have safe methods, competent supervision and verified apparatus. Simulation or remote laboratories may support learning where educational equivalence is demonstrated, but shall not replace essential hands-on outcomes without a valid profile basis. Learners shall receive accessible guidance, feedback and a fair complaints route.

Required evidence: Resource sufficiency; practical safety; simulation validity; learner support and access.

20.8 Attainment, improvement and closure of the loop

Evaluate attainment using relevant direct and indirect evidence, defined populations, rubrics and denominators. Examine weak outcomes, completion barriers, subgroup or delivery-mode differences and feedback. Assign improvement actions, implement them and demonstrate their effect on subsequent representative work. A meeting, survey or action list alone is not a completed improvement loop. Do not average a failed essential practical outcome into an overall pass.

Required evidence: Attainment analysis; improvement decision; implemented action; follow-up evidence.

20.9 Initial operating evidence and readiness only

A full programme outcome shall be based on authentic completed delivery and assessment evidence, normally at least one complete cohort for the claimed completion route, sufficient to evaluate all applicable outcomes. Where this evidence does not yet exist, the operator may issue only a clearly bounded developmental readiness report, with no live recognition or accreditation claim. The profile shall define suitable evidence for individualised or very low-volume programmes without inventing graduates or records.

Required evidence: Completed delivery evidence; cohort/route coverage; readiness limitations; honest public status.

20.10 Change, teach-out and continuing learner protection

Review changes to curriculum, award level, campuses, online platforms, partners and major staff/resources before extending the recognised scope. Continuing oversight shall address actual outcomes and learners, not only unchanged syllabi. Closure or loss of programme status requires clear communication, record preservation, transfer or teach-out arrangements and accurate historical status. Do not retroactively remove a learner's authentic academic work or imply a professional licence from the programme result.

Required evidence: Change approval; continuing outcome review; teach-out/transfer; historical records.

21 F05 — Airports, aerodromes and operational interfaces

The evaluation object is the identified operator and aerodrome with its declared infrastructure and responsibilities. An ASTRA outcome is not an airport operating licence or a blanket approval of tenants and service providers.

21.1 Aerodrome scope and operating basis

Record the legal operator, airport or aerodrome, boundaries, runways, terminals, operating characteristics, permissions, shared responsibilities and outsourced services. Establish the actual infrastructure and operational basis with controlled limitations and current information. Group-level governance shall not replace site capability. Heliports, vertiports, spaceports and mixed civil/military interfaces need dedicated supplements and competent authority review before an ASTRA claim includes them.

Required evidence: Aerodrome scope; permissions; infrastructure/operating baseline; separately gated supplements.

21.2 Safety management and change

Identify airport hazards, operational changes, occurrences and interfaces using a functioning safety process with accountable decisions and follow-through. Include construction, new aircraft or equipment, traffic patterns, staff changes, temporary works, contractors and abnormal weather. Assess cumulative and interface effects before use. Staff and providers shall have an accessible reporting and stop/escalation route. Absence of reported incidents shall not be treated as proof that risks are controlled.

Required evidence: Safety/change records; occurrence learning; interface risk; verified mitigations.

21.3 Airside condition and operational information

Maintain inspection and defect-management controls for movement areas, pavements, markings, signs, lighting, surface condition, foreign objects, wildlife interfaces and obstacles within responsibility. Link inspection results to timely operational information, restrictions, repair and verified restoration. Day, night and adverse-condition capability shall be evaluated when included in the scope. Technical limits and notification duties belong to the approved airport-specific basis; this core supplies no universal runway dimensions or response thresholds.

Required evidence: Airside inspections; defects/restrictions; notices; restored condition and task coverage.

21.4 Emergency readiness and coordinated response

Maintain a coordinated emergency plan with actual responsible services, communications, access, equipment, competence, exercises and corrective follow-up. Evaluate the interfaces for rescue, fire, medical support, disruption, severe weather and continuity within the operator's scope. Safe exercises shall demonstrate coordination and known limitations; a signed agreement alone does not prove availability. An ASTRA assessor shall not direct live tactical response or assume public emergency authority.

Required evidence: Emergency agreements; availability/competence; exercises; deficiencies and verified action.

21.5 Passenger, terminal and baggage services

Control passenger information, accessibility assistance, flows, baggage interfaces, service recovery, sanitation, public areas and relevant contractor performance. Define service measures with time windows, populations and exclusions, while preserving safety priorities. Assess delivery during peak and disrupted conditions rather than only quiet periods. A terminal contractor's failure shall be evaluated against both its responsibility and the airport's retained interface controls.

Required evidence: Service definition; actual performance; accessibility; contractor interface and recovery evidence.

21.6 Security, digital systems and utilities

Evaluate authorised access governance, supplier interfaces, sensitive information, operational technology, essential utilities, cyber resilience and recovery. Verify that critical service changes do not create uncontrolled operational dependencies. Protect tactical security information through competent authorised review. A cyber or access-system certificate for another scope shall not prove the airport's actual deployment. Restored digital availability requires integrity and operational acceptance before dependent use.

Required evidence: Access/utility responsibilities; digital baseline; recovery/integrity tests; authorised review.

21.7 Tenants, construction and common interfaces

Assign responsibilities with handlers, fuel providers, airlines, maintenance organisations, cargo operators, navigation support and construction contractors. Shared controls shall state ownership, handovers, notification, monitoring and escalation. Track construction handover and temporary restrictions before operational use. Each independently claimed provider capability retains its own assessment and scope. Annex K supports interface records; a common landlord relationship does not merge technical authorisation or liability.

Required evidence: Interface register; handovers; construction acceptance; independently scoped provider evidence.

21.8 Environmental integration and continuing capability

Meet applicable local environmental controls within the airport capability scope. Enhanced carbon inventories, reductions, resilience and supply claims shall use the selected F08 module and its own boundary. Maintain surveillance of actual airport functions, material changes, significant incidents and corrective effectiveness. Publish only the named aerodrome, responsible operator, evaluated functions and limitations. No claim shall imply that all flights using the airport share its environmental outcome.

Required evidence: Environmental interface; F08 statement linkage; site surveillance; accurate scope statement.

22 F06 — Aircraft maintenance and technical services

F06 uses a common organisational core and separately defined facility, aircraft/engine/component and task modules. Statutory maintenance approval, design privileges and individual release authority remain distinct.

22.1 Capability list and technical boundaries

The scope shall identify legal entity, facility or line station, aircraft/engine/APU/component family, maintenance task, limitations and release interfaces. Distinguish line, base, engine/APU, component, structures/cabin/modification embodiment, technical asset support and storage/end-of-life work. A brand-wide claim shall not replace the actual capability list. New capability requires verified data, people, tooling, facilities, parts and acceptance arrangements before work is accepted within the claimed scope.

Required evidence: Facility/type/task matrix; actual permissions; new-capability readiness and limitations.

22.2 Current data and maintenance planning

Use current applicable technical data and actual item configuration, history, life limits and work scope. Work packages shall identify task sequence, hold points, inspection independence, resources, customer inputs, repair approvals and completion evidence. Resolve ambiguous or missing instructions before dependent work. Embodying an approved modification does not confer design approval; engineering advice and continuing-airworthiness support shall be scoped separately from hands-on maintenance.

Required evidence: Current-data verification; work package; design/support interface; resolved instructions.

22.3 People, fatigue and task authorisation

Verify competence and actual task authority for certifying staff, technicians, inspectors, planners, contractors and temporary personnel. Assess fatigue, workload, supervision, shift transitions, communication, interruptions and repeated error conditions. Staff shall recognise tasks outside their authorisation and escalate without production pressure. An ASTRA personnel credential is not a statutory maintenance licence or the employer's release authorisation. Independent checks shall be genuinely independent of the relevant performed work.

Required evidence: Role/task authorisations; human-factor controls; handovers; independent checks.

22.4 Tools, parts and life status

Control tool availability, calibration, equipment configuration, parts authenticity, eligibility, storage, shelf life and life-limited histories. Reconcile removed and installed components and temporary devices. Missing life history or an unverified certificate shall trigger a technical hold, not a presumed life reset. External test results, NDT and special-process records shall connect to the actual item and task and use the relevant F03/F02 competence evidence.

Required evidence: Tool/part records; life status; remove/install trace; linked technical-method evidence.

22.5 Execution, errors and interrupted work

Capture attributable task completion, measurements, inspection results, deviations and authorised dispositions. Mark unfinished work and control handover, access, tool inventory and restoration of protective features. After an error or interruption, determine affected tasks and independent verification needs before continuation. A signature shall not be added later to make an unobserved task appear contemporaneously completed. Rework and repeat tests shall retain the original failure and changed configuration.

Required evidence: Task records; interruption/handover; error disposition; repeat evidence and configuration.

22.6 Release and customer handover

Before release, verify completed requirements, approved repairs/deviations, required independent checks, final configuration, restored protections, life status and remaining limitations. The actual authorised person shall issue the appropriate release and customer information within their privileges. ASTRA capability recognition shall not be used as a replacement maintenance release. Receiving parties shall obtain records necessary for safe continued support, with acknowledgement where required.

Required evidence: Final review; actual release authority; maintenance result; handover and restrictions.

22.7 Technical asset support and continuity

Planning, reliability analysis, fleet/lease transitions, records review and aircraft-on-ground support shall state advisory responsibility, data quality, turnaround objectives and escalation. Advice affecting safety or configuration shall be technically reviewed and recorded. Remote advice shall verify asset identity, conditions and authority. A restored support portal or commercially expedited part shall not close missing technical eligibility or life evidence. Preserve support records during source or operator changes.

Required evidence: Service profile; reviewed advice; data quality; AOG/transition and continuity records.

22.8 Storage, dismantling and end of life

Define preservation, periodic checks, environmental constraints and return-to-service evidence for stored articles. Controlled dismantling shall preserve component identity and determine eligibility from actual history and approved processes, not appearance alone. Prevent scrap and restricted items from re-entering service. Address hazardous inventories, confidential data, records, material recovery and continuing obligations. A successful bench test does not automatically make a removed part serviceable for every installation.

Required evidence: Preservation plan; condition/history; dismantling trace; disposition and record handover.

23 F07 — Ground operations and aviation support services

The nine G01–G09 tracks are service-scope modules, not additional programme families. Headquarters controls and station implementation are separately evaluated.

23.1 Provider, station and service definition

The applicant shall identify headquarters, legal entities, stations, service tracks, actual tasks, equipment, contracted responsibilities and subcontractors. Each included station shall demonstrate local implementation, trained staff, usable instructions, equipment suitability and interface competence. Common manuals may be reused only with a verified local-variation record. An FBO or digital-platform package shall not conceal the organisations actually performing underlying services.

Required evidence: Provider/station register; task scope; local variations; actual-performer interfaces.

23.2 G01 — Handling and turnaround

For declared passenger, baggage, accessibility, ramp, load-control, aircraft-movement or de-/anti-icing interfaces, define responsibilities, competent roles, equipment compatibility, handovers, hold points and exception reporting. Verify representative work safely and include peak, disrupted and shift-change conditions. Technical operating limits shall come from current applicable data. This programme does not provide pushback, loading or de-icing recipes and does not confer aircrew operational authority.

Required evidence: Turnaround/service plan; training/authorisations; representative records; discrepancies and handovers.

23.3 G02 — Cargo, mail and specialist logistics

Control shipment acceptance, identification, security interfaces, custody, storage, build-up/breakdown, special handling, temperature/time constraints and release. Dangerous-goods tasks require verified role competence and actual permissions. Monitor custody and environmental excursions through subcontractors and transfers. A logistics certification shall not validate unknown contents or authorise a prohibited shipment. Corrective action shall identify affected consignments and downstream recipients.

Required evidence: Cargo scope; acceptance/custody; special handling; excursion/recipient trace.

23.4 G03 — Fuel and energy services

Define storage, source verification, quality control, transfer, delivery and aircraft/ground interface responsibilities for each declared fuel or energy service. Control contamination, identity, sampling, equipment, staff competence and abnormal conditions through approved technical procedures. Record supplied quantity, source and relevant batch or transaction links. Emerging fuels, electrical architectures or hydrogen-related services require separate capability and safety supplements; conventional fuel scope does not establish competence for them.

Required evidence: Service/product identity; traceable quality controls; equipment/personnel; separate novel-energy approval.

23.5 G04 — Ground equipment and technical facilities

Define the maintenance and operational support scope for ground equipment, charging, bridges, baggage systems, technical utilities and related assets. Demonstrate compatibility with supported aircraft and tasks, inspection, planned maintenance, protective functions, isolation governance and competent release. Temporary repairs and bypasses require bounded technical approval and restoration. Digital monitoring shall be validated for the failure mechanism and shall not replace mandatory physical checks without an approved basis.

Required evidence: Asset/task capability; compatibility; maintenance and protection checks; controlled temporary conditions.

23.6 G05 — Catering, cabin and sanitation

Control catering integrity, cleaning, water/lavatory services, cabin supplies and hygienic handling within the declared tasks. Establish appropriate contamination prevention, segregation, temperature/time control where relevant, chemical suitability, equipment condition and traceable delivery. Staff shall understand cross-contamination and aircraft compatibility. A general quality system shall not substitute for task-specific food, water or sanitation obligations and incident response.

Required evidence: Service boundaries; hygiene and compatibility controls; delivery trace; incident and corrective records.

23.7 G06 — FBO and business-aviation support

Describe the actual fixed-base service package, including passenger/crew support, parking and handling coordination, property care, communications and dependencies. Underlying G01–G05 activities shall be evaluated for their own scopes where claimed. A coordinator shall verify provider capability and handovers and shall not claim direct performance of services it only arranges. Confidentiality, accessible service, emergency communication and disruptions shall be addressed.

Required evidence: FBO package; direct/arranged distinction; qualified dependencies; handover and recovery.

23.8 G07 — Flight and air-navigation support

Dispatch/flight-support, communications, navigation, surveillance and meteorological services shall each have a dedicated competence and permissions profile. Define data origin, timeliness, integrity, operational authority, validation, change control, fallbacks and coordination. Verify exact service boundaries and prevent advice from being presented as a public air-navigation or airline operating approval. Necessary specialist technical criteria shall be completed before the relevant service is admitted.

Required evidence: Specialist profile; data/authority chain; actual permissions; fallback and coordination evidence.

23.9 G08 — Digital and operational systems

Define software/services, users, interfaces, configuration, performance, cybersecurity, data ownership, external platforms and operational dependencies. Validate actual delivery and safe fallback when data are wrong, late or absent, not only when the application is available. Control updates, AI-assisted decisions, access, recovery and service termination. A platform result shall not grant competence to all integrated service providers or certify every output generated by the software.

Required evidence: Digital service profile; outcome tests; security/recovery; provider and update boundaries.

23.10 G09 — Specialist security services

Evaluate provider identity, authorised activities, staff suitability where lawfully required, competence, training, controlled information, equipment suitability and operational interfaces. Evidence access shall be restricted to authorised reviewers with sufficient technical understanding. Do not publish sensitive tactical methods or transfer public security powers through an ASTRA credential. An inaccessible essential capability shall be excluded or held rather than accepted from an unsupported statement.

Required evidence: Authorised scope; role competence; protected performance evidence; exact claim limits.

23.11 Local variation and continuing network control

Station variations shall identify customer data, infrastructure, language, equipment, staffing, climate, operating hours and local obligations affecting service. Monitor incident, delay, damage, complaint and control-performance information with defined denominators. Systemic headquarters failures require review across dependent stations; a local failure requires justified extent analysis, not automatic concealment by deleting that station. Additions and material changes require demonstrated capability before claim extension.

Required evidence: Local-variation file; network indicators; systemic/local extent; new-station decision.

24 F08 — Carbon, environment and climate assurance

F08 is cross-cutting. Organisational environmental capability, a verified or validated statement, and accreditation of its verifier remain separate outcomes.

24.1 Engagement and statement boundary

Identify the responsible entity, assets/sites, reporting period, intended users, statement, methodology, criteria and required form of assurance. Separate capability evaluation from statement verification and prospective validation. Approve the boundary, exclusions, materiality approach, data access and reporting conditions before evaluation. An airport operator's inventory is not automatically the inventory of every aircraft, tenant or service provider connected to it.

Required evidence: Engagement record; exact statement; boundary and period; agreed assurance objective.

24.2 C01 — Inventory and data

Identify direct emissions, purchased-energy emissions and relevant value-chain categories with consistent CO2-equivalent treatment where applicable. Retain activity data, factors, units, versions, allocation, estimates, gaps and uncertainty. Explain excluded categories and shared sources. Trace material figures to actual meters, transactions or justified estimation models. A factor supplied for another geography, fuel, year or lifecycle boundary shall not be adopted without a suitability review.

Required evidence: Inventory model; activity/factor evidence; category and boundary rationale; data-quality assessment.

24.3 C02 — Reduction and transition

Verify historical reductions against a controlled comparable baseline and disclose structural changes, method changes, output mix and recalculation. Separate absolute and intensity changes and distinguish operational reduction from removal, compensation and avoided emissions. A future transition plan shall state assumptions, milestones, finance/resource dependencies, uncertainties and monitoring. Validation of that plan is not verification of achieved reduction and shall not be labelled as a net-zero achievement.

Required evidence: Baseline/recalculation; comparable actual results; transition assumptions; separate conclusion types.

24.4 C03 — Energy and circular resources

Define energy, water, waste, hazardous-material, repair, reuse and recovery indicators with boundaries, denominators and measurement methods. Track material flows and avoid counting internal recirculation repeatedly as new recovered output. Evaluate environmental improvements alongside product eligibility, life history, safety and contamination. A recycled-content or recovery percentage does not establish fitness of a critical part for reuse. Statements shall identify technical and environmental limitations separately.

Required evidence: Resource flow; measurement basis; repair/reuse eligibility; bounded environmental statements.

24.5 C04 — Local environment

Evaluate local air, noise, discharges, spills and biodiversity interfaces using appropriate location, baseline, sampling and approved methods. Address seasonal/operational variability, receptors, source attribution and uncertainty where relevant. A reduction in one metric shall not conceal an increased material effect elsewhere. Operational controls and incident response shall remain active irrespective of a favourable inventory. Specialist permissions and technical criteria shall be established for each claimed local-environment conclusion.

Required evidence: Local methods; sampling and receptors; baseline/uncertainty; operational controls and incidents.

24.6 C05 — Climate resilience

Assess relevant heat, flood, storm, wildfire, water-stress or other physical-risk scenarios across asset life and service dependencies. Explain scenario choice, time horizon, vulnerabilities, uncertainty and adaptation decisions. Exercise continuity and verify critical protective measures against the stated basis. A scenario study is not proof that an asset will survive every future climate condition. Update assumptions after material evidence or infrastructure change.

Required evidence: Scenario/vulnerability assessment; adaptation decisions; exercises; limits and review triggers.

24.7 C06 — Low-carbon energy and supply claims

Trace fuel or energy provenance, chain of custody, transfers, conversion, allocation and contractual attributes. Distinguish physically delivered material from a separated contractual attribute. Check ownership, eligibility, retirement or cancellation where relevant and prevent duplicate allocation of an exclusive claim. A purchased credit or fuel invoice alone does not prove that the complete service is zero-emission. Publish the actual mechanism and limits of the claim.

Required evidence: Custody/attribute ledger; eligibility and allocation; exclusive-claim checks; transparent statement.

24.8 Materiality and assurance planning

Set quantitative and qualitative materiality for the intended users, statement and consequences before substantive work. Plan evidence accordingly and consider aggregation, bias, omissions and fraud indicators. There is no universal five-percent materiality or assurance percentage in this standard. Materiality does not authorise knowingly false reporting, omitted mandatory categories or ignoring a significant qualitative issue. Reasonable and limited assurance engagements shall have separately defined work and appropriately worded conclusions.

Required evidence: Materiality rationale; assurance level; strategic and evidence plan; aggregated/qualitative issues.

24.9 Verification execution and independent conclusion

Evaluate data controls and substantive evidence, challenge estimates, reconcile interfaces and sample material categories. Preserve identified misstatements and corrections with the original statement. The independent reviewer shall confirm sufficiency for the agreed assurance form. If residual misstatement or missing evidence prevents a supportable conclusion, require correction, qualify the conclusion within permitted rules, or decline it; do not issue an unqualified favourable statement to meet a reporting deadline.

Required evidence: Verification trail; misstatement register; revised statement; independent conclusion and limitations.

24.10 Overlap, claims and continuing change

Overlapping direct and value-chain inventories of different entities are not automatically erroneous, but portfolio aggregation and exclusive reduction claims shall avoid inappropriate double counting. Report gross quantities, reductions, removals and compensation separately. Later evidence invalidating a historical statement requires correction and recipient communication; an instance statement does not require an invented continuing validity period. Capability status follows its separate surveillance and change controls.

Required evidence: Overlap/aggregation analysis; separate totals; claim approval; historical correction and capability status.

25 Certification, verification and other assessment-provider activities

Provider activities supplement the programme family, not replace it. Testing or inspection competence does not automatically confer system, product or personnel certification, educational evaluation or environmental verification authority.

25.1 Activity-specific provider controls

A provider shall identify each assessment activity, legal responsibility, scheme/profile, methods, resources and final decision authority. Certification and verification bodies shall demonstrate their full application-to-decision process in addition to supporting technical evaluations. Personnel and external experts shall meet role-specific criteria. Requested activities lacking actual demonstration remain outside scope. The activity labels in Annex I are routing labels, not additional family counts or proof of external standing.

Required evidence: Provider activity schedule; legal/technical responsibility; complete representative process.

25.2 Management-system certification

System-certification activity shall use competent audit teams, scope review, appropriate readiness and implementation evaluation, validated time and site planning, findings, independent review and decision, and continuing surveillance. The certifying body shall retain final decision responsibility and control outsourced audit work. It shall not certify a system it designed or use a consultancy relationship to secure the result. An audit report or training certificate is not itself a management-system certificate.

Required evidence: Audit-route dossier; independence; final retained decision; surveillance.

25.3 Product, process and service certification

Define the relevant conformity model: instance evaluation or continuing family/service/process scope. Verify object identity, representative technical evidence, production or delivery controls where ongoing, sampling and decision rules. Separate qualification, routine acceptance and certification. The body shall demonstrate competence in the actual evaluation methods and scope, not rely on an organisational auditor alone. Labels and surveillance shall match the chosen model.

Required evidence: Technical model; representative evaluation; continuing controls; precise certification scope.

25.4 Personnel certification

Maintain a validated job/task profile, fair prerequisites, secure and representative knowledge/practical assessment, independent decision, credential scope, continued competence, renewal and appeal. Training and examination relationships shall not compromise independence. Essential practical failure blocks the relevant credential regardless of total score. Employer task authority and statutory privileges remain separate. Apply the relevant AF 9100 personnel provisions when that route is claimed; other profiles shall not silently alter them.

Required evidence: Role scheme; assessment validity/security; independent result; continuing competence and boundaries.

25.5 Validation and verification bodies

Demonstrate competence for the type of claim, sector, data, methodology, assurance level and intended use. Separate preparation of a client's statement from independent evaluation of it. Verify engagement acceptance, strategic analysis, risk and materiality, evidence plan, execution, misstatement resolution, independent review and conclusion. Preserve actual statement versions and communicate later material errors. Accreditation concerns the body's competence, not the truth of every statement it may issue.

Required evidence: Claim-specific competence; independent engagement trail; statement version; conclusion and correction.

25.6 Proficiency and reference-material activities

A body organising proficiency exercises or producing reference material requires a separately released technical profile. That profile shall cover competence, planning, assigned values or property characterisation, homogeneity/stability, uncertainty, participant/sample confidentiality, statistical methods, reporting and validity. These functions shall not be inferred from ordinary laboratory accreditation. Until the specialised profile and witnesses are complete, the catalogue shall show the requested activity as development, not granted scope.

Required evidence: Dedicated profile; characterisation/statistical basis; valid specialised witnessing; bounded status.

26 Future technology, restricted domains and continuous evidence

26.1 Novelty and bounded deployment

A materially novel activity shall have a defined use, technical owner, foreseeable failure mechanisms, evidence gaps and safe development boundary. Approval shall distinguish research demonstration, restricted pilot and operational capability. Additional evidence, independent challenge and monitoring shall address weak operating history. A promising technology readiness label does not authorise normal production or a broader accreditation claim. Missing critical performance shall remain an explicit gate rather than a future deliverable assumed complete.

Required evidence: Novelty dossier; restrictions; independent review; demonstrated release conditions.

26.2 AI, autonomy and adaptive changes

For an AI-enabled process or service, define intended domain, human authority, data lineage, evaluation sets, failure metrics, uncertainty, exclusions and fallback. Evaluate relevant difficult and rare cases separately rather than hiding them in aggregate accuracy. Changes to weights, preprocessing, sensors, thresholds or deployment conditions shall trigger impact review. Adaptation outside the approved envelope requires renewed assurance before a changed claim is used.

Required evidence: Model/data cards; scenario evidence; enforced limits; controlled change and fallback.

26.3 Digital twins and simulation

A model used as decision evidence shall identify the physical or operational target, version, validation domain, inputs, calibration, uncertainty and limitations. Demonstrate fidelity for the specific conclusion and sensitivity to relevant assumptions. A visual match or correct calculation does not establish physical validity. Maintain the relationship between actual and model configuration after change. Simulation may supplement evidence but shall not remove required physical or practical observation without a technically approved basis.

Required evidence: Model-credibility dossier; validation/sensitivity; configuration linkage; approved use boundary.

26.4 Remote, space and long-duration operation

For inaccessible, in-space or delayed-communication work, establish evidence acquisition, identity, configuration, time basis, telemetry validity, data loss, permitted remote actions and safe fallback. Explain what is directly observed, inferred or unknown. Independent review shall use appropriately authorised experts and retained records. No space suitability or completed end-of-life action shall be claimed from an unverified signal or terrestrial analogy alone. Mission-specific technical profiles remain prerequisites.

Required evidence: Remote assurance plan; telemetry provenance; inference limits; mission profile and decisions.

26.5 Continuous monitoring and machine-readable status

Continuous data may support surveillance only when the measured parameters, failure coverage, integrity, drift, missing-data response and responsible review are validated. Live dashboards do not automatically renew credentials or prove every requirement continuously. Machine-readable status shall match the authorised human decision, exact scope and history. A credential remains subject to expiry, changes, field evidence and remedies. Automated alerts may trigger protective review, not secretly issue new authority.

Required evidence: Monitoring validation; alert/action trail; authenticated status; human review and expiry controls.

26.6 Hazardous and controlled activities

Defense, energetic, radiation, hazardous testing and sensitive infrastructure activities shall use authorised personnel and lawful specialist procedures. This programme establishes accountability, competence, evidence, segregation and review requirements only; it provides no weapon construction, targeting, offensive cyber, hazardous-source handling or operational attack instructions. Confidentiality shall protect legitimate information while allowing sufficient independent review. If required access or safety capability is absent, the activity stays outside the live scope.

Required evidence: Permissions; specialist competence; safe evidence access; explicit exclusions and holds.

27 Complaints, appeals and protected reporting

27.1 Accessible intake and classification

Provide clear channels for complaints, appeals and protected integrity concerns, including anonymous concerns assessed on available evidence. A complaint concerns dissatisfaction or service failure; an appeal seeks reconsideration of a specified decision. A case may contain both and shall retain the first receipt date with linked issue records. Good-faith safety or integrity reporting shall not require payment, membership or a prescribed form. Accessible routes shall not weaken necessary identity checks for a personal decision appeal.

Required evidence: Intake record; issue classification; original receipt; accessible and protected channels.

27.2 Triage and protection

Acknowledge receipt within five calendar days where a response channel exists. Assess urgent safety, evidence integrity, confidentiality and retaliation concerns immediately without awaiting acknowledgement. Preserve original records and prevent implicated personnel from controlling the investigation. Protect the reporter's identity as lawfully possible while respecting fair response. An allegation alone is not a finding of misconduct, and inability to substantiate it is not proof of bad faith.

Required evidence: Triage; evidence hold; protection plan; independent assignment and fair response.

27.3 Appeal admission and independence

An appeal is normally submitted within 30 calendar days of notice of the contested decision; documented good cause may justify later admission. A three-person independent panel shall exclude the original evaluation, review, decision and materially implicated selectors. Obtain technical expertise relevant to the scope. The original decision maker may explain the record but shall not vote on the appeal. Ordinary programme appeals do not replace statutory remedies or arbitral procedures.

Required evidence: Admissibility; panel conflicts/competence; protected case file; participation boundaries.

27.4 Investigation, timing and remedy

Provide an initial substantive complaint response within 30 days and ordinarily determine a complaint or appeal within 60 days of receipt. Necessary exceptional extensions shall state reasons, a revised target and progress at least every 30 days; technical protection and expiry clocks remain active. Examine both original and new evidence and distinguish later changes from errors in the original basis. Uphold, correct, replace, withdraw or return for additional evaluation with reasons and exact status effect.

Required evidence: Investigation trail; party responses; reasoned outcome; communicated timing and remedies.

27.5 Systemic effects and non-retaliation

A substantiated concern shall trigger review of related reports, scopes, methods, personnel and previous decisions, not only the individual case. Implement correction and verify effectiveness. Do not retaliate through service denial, fees, assignments or confidentiality threats against good-faith reporting. A pending appeal does not automatically remove protection, restore a credential or extend validity. Public correction shall be proportionate and protect unnecessary personal and confidential information.

Required evidence: Related-case analysis; corrective action; retaliation review; accurate public/status correction.

28 Scope statements, marks and public registry

28.1 Mandatory scope content

Each outcome shall state holder and responsible issuer, unique identifier, exact class, family/module, criteria and version, evaluated object, site, technical activity, conditions/ranges, configuration or delivery version, period, decision/issue dates, status and restrictions. Identify ongoing expiry or instance boundary appropriately. The scope schedule forms part of the outcome and shall be available for verification without disclosing protected technical detail. Annex I supplies the minimum schema.

Required evidence: Decision-linked scope schedule; claim class; criteria/version; public/private split.

28.2 Truthful public wording

Public wording shall distinguish accredited assessment competence, recognised educational or operational capability, certified conformity and verified historical statements. A label shall not imply statutory approval, all-sector authority, guaranteed safety or recognition by an unevidenced third party. Group logos and commercial package titles shall not conceal excluded sites, tasks or programmes. Every claimed recognition or acceptance arrangement shall be supported by its actual written scope and current terms.

Required evidence: Approved claim; actual acceptance arrangement where claimed; limits clearly communicated.

28.3 AF marks and authorised use

Use only authorised AF artwork and approved scope-specific wording. Preserve shape, proportions, legibility and the required identifier; do not create an apparent new certification symbol or apply an organisational mark to imply product approval. Permission shall identify holder, purpose, media, period and restrictions. Suspension or withdrawal shall end affected current claims promptly. Historical factual statements shall state the actual period and status without presenting withdrawn authority as current.

Required evidence: Mark licence; approved artwork/use; monitoring; correction of misuse.

28.4 Registry states and authenticity

Maintain separate entity, application, profile, technical scope, decision, credential, authorisation and statement records. Public states shall distinguish active, restricted, suspended, expired, withdrawn and historical instance results. Applicant or pilot records shall not appear in a list of accredited holders. Validate signatures or other authentication, current status and permitted scope rather than treating a scanned certificate image as conclusive. Preserve corrections and prior states.

Required evidence: Validated registry; authenticated decision linkage; separate application/live status; history.

28.5 Registry security, correction and availability

Protect registry integrity through least-privilege access, attributable updates, version history and tested recovery. Update status within two calendar days of a decision and communicate urgent restrictions without waiting for a routine update. Correct misleading duplicates, stolen identities and altered certificates through controlled investigation. Provide an alternative verified status channel during outage without extending expiry. The existence of a digital record demonstrates a recorded decision, not universal technical truth.

Required evidence: Access/update logs; two-day control; recovery; corrected misuse and alternative verification.

29 Programme quality, independent review and public benefit

29.1 Internal audit

Audit every active programme process at least annually, with additional attention to risk, changes, complaints and poor performance. Auditors shall be competent and independent of their own work. Examine real application-to-outcome trails, rejected cases, technical witnessing, conflicts, calculations, status changes and corrective effectiveness. A self-assessment or management statement shall not be presented as independent accreditation of the programme itself.

Required evidence: Risk-based audit programme; independent auditors; actual trails; verified follow-up.

29.2 Management review and performance

Review programme performance and risk quarterly and conduct a formal management review at least annually. Inputs shall include technical reliability, impartiality, competence, resources, access, holder outcomes, adverse evidence, complaints, data, finances, emerging needs and prior actions. Outputs shall identify decisions, owners, resources, due dates and effectiveness. Commercial growth and certificate volume are not sufficient measures of programme quality or public benefit.

Required evidence: Review inputs/minutes; balanced measures; actions and effectiveness.

29.3 Independent accrediting-operator review

Before launch and at intervals no greater than 36 months, obtain an independent review of the accrediting operator's competence, impartiality, technical coverage, governance, decisions and actual implementation, with earlier review after serious concerns. The reviewers shall be competent and free of reciprocal self-approval. Their findings, limits and corrective results shall be recorded. This internal programme requirement does not itself establish membership of an external recognition arrangement or international acceptance.

Required evidence: Independent reviewers; operator evaluation; findings/closure; evidenced limits of standing.

29.4 Consistency and technical learning

Use anonymised case comparisons and calibrated exercises to test whether different competent teams reach compatible interpretations and decisions. Investigate material disagreement, including unclear criteria and evidence limitations. Do not force uniform outcomes when objects or evidence genuinely differ. Share lessons through controlled updates and training without exposing confidential information or changing requirements informally. Significant method weaknesses shall trigger review of affected past work.

Required evidence: Inter-evaluator exercises; disagreement analysis; lessons; affected-case correction.

29.5 Financial sustainability and public benefit

Maintain adequate resources for competent work, impartial oversight, remedies, data and continuity. Disclose applicable charges and avoid dependence on favourable decisions for financial survival. Evaluate access for smaller organisations and less-resourced participants while preserving technical minima. Report meaningful benefits and limitations using authentic evidence, not assumed sector-wide adoption. Safeguards for competition, controlled technology and conflicts apply to programme outreach as well as assessment.

Required evidence: Budget and independence review; accessible participation; actual benefit measures; lawful outreach.

30 Transitions, relationships and programme closure

30.1 Existing instruments and terminology

The eight-family architecture and ASTRA identity do not amend existing AF instruments by implication. Record compatibility of every proposed outcome with AF-CON-001, AF-SR-001 and any applicable AF technical standard. Present educational and operational recognition remains available under compatible profiles; a wider accreditation designation requires the explicit higher-instrument decisions identified in Annex N. Do not change AF 9100 or historical certificates merely to align a marketing label.

Required evidence: Compatibility decision; authorised terminology; separate amendment work where needed.

30.2 Controlled transition

For a new profile or substantive version, identify affected holders, evidence gaps, changed methods, competence, system updates, communications and effectivity. Set a technically justified transition that does not waive immediate safety duties. Preserve the basis of previous decisions and state when additional assessment is needed. Neither indefinite grandfathering nor automatic retrospective invalidation is presumed. A future requirement is not applied as though it had governed an earlier decision.

Required evidence: Transition plan; holder impact; competence/tool updates; actual effective versions.

30.3 Reliance and cooperation agreements

Any agreement to rely on another party's results shall identify parties, exact activities, acceptance conditions, competent evaluation, monitoring, territorial limits, confidentiality and withdrawal. Verify authenticity and fit for each actual use. Do not infer acceptance from an MoU title, shared event, commercial partnership or similar standard number. The party making an acceptance decision retains responsibility for that decision. Mutual familiarity is not independent competence evidence.

Required evidence: Executed bounded agreement; evidence checks; monitoring; truthful acceptance statements.

30.4 Scope withdrawal and learner/customer protection

Before closing a profile or provider operation, identify active holders, open cases, pending appeals, unresolved findings, learners, records, status, contracts and financial duties. Notify affected parties and arrange lawful transfer or teach-out as relevant. A closure shall not erase adverse evidence or imply continued authority. Preserve access to historical decisions and correction channels. If urgent cessation is required, prioritise protection and accurate communication while completing residual obligations.

Required evidence: Closure plan; affected-party notices; transfer/teach-out; retained records and remedies.

31 Records, adoption and implementation sequence

31.1 Minimum records and equivalent systems

The records in Annex M shall be created when their triggering activity applies. They may be combined in a database or controlled document if identities, required fields, relationships, signatures, access and history remain intact. Templates are capture tools, not completed evidence. The programme shall not invent applicants, calibration results, witnesses, student attainment, emissions figures, appointments or approvals. Blank fields shall remain visibly incomplete until authentic information is entered.

Required evidence: Record dictionary; equivalent-system mapping; genuine data and approvals.

31.2 Document hierarchy and phased development

The master documentation plan shall distinguish the published standard, issued operating documents and planned work. A planned document code does not establish that a file exists or a programme is ready. The standard and its applicable normative annexes state the core requirements; implementation documents translate them without adding unapproved duties. Each released technical profile shall have the complete operating and record set required for its scope before activation.

Required evidence: Document catalogue; actual file/version status; dependency and release checks.

31.3 Actual adoption record

Record the authenticated legal operator, technical approval, consultation completion, competent institutional adoption, signatories, effective date, applicable instruments and any necessary compatibility amendments. Keep edition date distinct from legal or operational effectivity. Uncompleted approval fields shall not be filled with assumed names or dates. Programme-wide adoption alone shall not activate every listed technical scope; each profile requires the independent readiness and scope decision in Annex P.

Required evidence: Authentic adoption; completed compatibility conditions; individual scope activation.

31.4 Implementation and verification

Implement in the following order: settle authority and permissible outcomes; release core operating controls; validate forms, tools and registry states; establish qualified teams and independent decision functions; complete technical profiles and checklists; conduct representative controlled pilots; close findings; and authorise exact live scopes. Annex Q assigns documentation work packages without imposing an invented calendar promise. Maintain an open-action register and verify that every active dependency is actually available.

Required evidence: Implementation programme; verified dependencies; pilot/closure; exact live-scope notice.

31.5 Review of this edition

Maintain a controlled master, version history, interpretation register and distribution record. Reassess suitability at least every three years and sooner after material safety, technical, legal or implementation evidence. Technical changes shall undergo the appropriate normative approval process; editorial changes shall preserve meaning. Retain the actual original and revised decision bases. Publication, arithmetic checks and visual review do not by themselves establish independent field validation or external recognition.

Required evidence: Maintenance programme; actual versions; controlled corrections; verified publication integrity.

32 Integrated lifecycle and mission assurance

Application: This clause applies to organisations responsible for a product, system, mission or service lifecycle, including integrators and organisations accepting work from several providers. It supplements the existing eight families; it does not create a ninth family or an unrestricted mission approval. Internal alignment: Clauses 1, 5, 18 and 26; AF 9100:2026 Clause 11.

32.1 Mission definition and accountable boundaries

The responsible organisation shall establish an approved mission or service concept describing intended beneficiaries, objectives, success conditions, operating environments, duration, interfaces and constraints. The concept shall distinguish mission success from protection of people, essential infrastructure and the environment when success is no longer achievable. Normal, degraded, emergency, maintenance and retirement conditions shall be considered. Every assumption supplied by another organisation shall have an owner and a means of verification. Commercial ambition or a planned demonstration shall not be recorded as an established operational capability.

Required evidence: Mission concept; responsibility boundary; scenario set; success and protective-state criteria; external-assumption register.

32.2 Lifecycle assurance plan

The assurance plan shall connect requirements, design, procurement, manufacturing, integration, verification, acceptance, operation, support and retirement. It shall identify activities that require independent challenge, critical characteristics, technical specialists, resources, records and decision authorities. The organisation shall update the plan when mission duration, operating conditions, suppliers or architecture change. Planning shall include failures during development and operation, not only the nominal delivery sequence. A supplier's assurance plan may provide inputs, but the integrator shall retain responsibility for the completeness of the integrated assurance argument.

Required evidence: Lifecycle assurance plan; interface allocation; critical-characteristic register; review and update history.

32.3 Gates and irreversible commitments

Each lifecycle gate shall have defined entry conditions, required technical evidence, unresolved-issue rules, independent review and an accountable exit decision. A gate may authorise limited further development without authorising production, operational deployment or an ASTRA outcome. Conditions shall identify permitted work, prohibited commitments, an owner and closure evidence. Before an irreversible action, the responsible authority shall explicitly review remaining uncertainty and recovery limitations. A schedule milestone, procurement expenditure or successful presentation shall not substitute for a technical gate decision.

Required evidence: Gate criteria; configuration-specific review dossier; decision and conditions; verified closure before dependent action.

32.4 Integrated assurance case

The organisation shall maintain an argument linking each material safety, performance and mission claim to requirements, assumptions, configuration, evidence and limitations. The case shall expose adverse evidence, competing explanations, common dependencies and unresolved uncertainty. It shall distinguish analysis, simulation, observed demonstration and service experience. Independent review shall challenge whether the evidence supports the actual claim rather than merely whether documents exist. An accepted component or qualified supplier shall not establish the acceptability of every integrated configuration or operational scenario.

Required evidence: Claim-evidence map; assumption and uncertainty records; counter-evidence; independent challenge; bounded conclusions.

32.5 Handover and long-life accountability

Handover shall reconcile the as-built or as-delivered configuration, accepted changes, operating instructions, competent personnel, support arrangements, restrictions and unresolved duties. The receiving organisation shall confirm usable access to the information necessary for its role. Long-life programmes shall address loss of suppliers, tools, software services and original expertise. Record transfer shall preserve meaning and history; it shall not be presented as transfer of regulatory privileges or an expanded conformity scope. Responsibilities for later defects and corrections shall remain identifiable after commercial completion.

Required evidence: Handover manifest; receiving acceptance; support and knowledge-preservation plan; continuing-duty allocation.

32.6 Through-life feedback and reassessment

The organisation shall connect incidents, maintenance findings, production changes, field data and user feedback to the original requirements and assurance case. Material new evidence shall trigger review of affected configurations and earlier conclusions. The review shall distinguish a changed operating context from an error in the original evidence. Restrictions, corrective actions and recipient communications shall be proportionate to the supported extent. An operational history without a reported failure shall not close a hazard that the monitoring system was unable to detect.

Required evidence: Feedback-to-configuration trace; affected-population review; updated case; corrective and communication records.

33 Systems engineering, configuration and interface integrity

Application: This clause applies where requirements are developed, allocated, changed or integrated across hardware, software, people and external services. Internal alignment: Clauses 5.4, 9, 10 and 18; AF 9100:2026 Clauses 11.1–11.8 and 12.8.

33.1 Requirement quality and allocation

Requirements shall be identifiable, verifiable, internally consistent and assigned to an accountable implementation and acceptance function. The organisation shall record the technical basis, intended use, units, tolerances where relevant, environment and consequence of failure. Derived requirements shall retain their relationship to parent needs and constraints. Ambiguous terms such as future-ready or aerospace-grade shall be translated into evaluable conditions before they are used for acceptance. Requirements that are not yet technically defined shall remain open and shall prevent the dependent positive conclusion.

Required evidence: Requirement baseline; allocation and rationale; verification method; unresolved-definition register.

33.2 Multidisciplinary interfaces

Interface definitions shall address relevant mechanical, structural, electrical, thermal, fluid, data, timing, human and organisational characteristics. They shall identify the provider and receiver, valid configurations, ownership, assumptions, error handling and change-notification duties. Integration reviews shall examine incompatible assumptions between individually acceptable subsystems. Units, coordinate frames, reference times and version conventions shall be explicit. Interface acceptance shall include abnormal inputs and loss of a supporting service where material to the intended use.

Required evidence: Interface-control baseline; owner acknowledgements; compatibility review; integrated verification and anomalies.

33.3 Configuration states and genealogy

The configuration system shall distinguish intended, designed, built, tested, delivered, installed and currently operated states. Each technical result shall identify the state actually evaluated, including relevant software, parameters, materials and modifications. Serial, batch, assembly and parent-child relationships shall survive splitting, replacement and repair. Configuration identity shall not be inferred from a commercial product name alone. Where a legacy baseline is incomplete, the organisation shall establish the uncertainty and necessary verification before extending the assurance claim.

Required evidence: Configuration register; as-built and as-operated records; genealogy; test-to-configuration links; legacy gap review.

33.4 Change impact and independence

A proposed change shall identify affected requirements, interfaces, hazards, qualification evidence, manufacturing controls, maintenance data, training and public claims. The review shall state which prior evidence remains valid and why, what becomes invalid and what new demonstration is required. The design or technical authority shall approve the technical disposition, while the independent conformity function separately determines any effect on ASTRA status. A document version, new software version or relocated process shall not automatically inherit its predecessor's evidence.

Required evidence: Before-and-after baseline; impact map; retained-evidence argument; new tests; separate technical and status decisions.

33.5 Engineering budgets and margins

Relevant mass, power, energy, thermal, structural, timing, memory, communication and consumable budgets shall have a baseline, owner, allocation, uncertainty treatment and review trigger. Margin definitions shall be consistent across subsystem and system levels so that the same reserve is not counted more than once. Cumulative changes and degraded conditions shall be reviewed. A positive arithmetic balance shall not establish physical adequacy where the underlying model, environmental assumption or failure scenario is unsupported.

Required evidence: Budget register; allocation and margin definitions; uncertainty; cumulative-change review; approved technical basis.

33.6 Verification closure and model limitations

The verification matrix shall link each requirement to an approved method, representative configuration, evidence and acceptance decision. Unverified interfaces and waived observations shall remain visible. A model shall be credible for the particular decision and conditions in which it is used; a visual match or successful numerical execution is insufficient. Extrapolation beyond validated conditions requires explicit justification and independent review. Verification closure shall not be declared by counting completed tests when a required function or failure condition remains unexamined.

Required evidence: Verification matrix; coverage and configuration review; model limitations; requirement-specific closure.

34 Aviation, unmanned systems and advanced air mobility

Application: This clause applies to aircraft, installed equipment, unmanned systems and advanced air-mobility activities within the declared responsibility. It establishes assurance controls, not flight permissions. Internal alignment: Clauses 1.6, 18, 22, 23 and 26; AF 9100:2026 Clause 15.

34.1 Approval and operational responsibility

The organisation shall identify the applicable design, production, maintenance and operational approval interfaces and the holders of those responsibilities. The technical profile shall define aircraft or equipment configuration, intended operation, environment, limitations and supporting obligations. ASTRA conformity shall not be described as an airworthiness certificate, flight clearance or operating licence. A change of operator, configuration or intended use shall trigger review of whether the existing evidence and permissions remain relevant.

Required evidence: Responsibility and permission matrix; aircraft/equipment profile; operating boundary; change review.

34.2 Installation and integrated compatibility

Equipment integration shall address mounting and loads, power quality, electromagnetic effects, thermal management, software and data interfaces, timing, access and human interaction as applicable. The organisation shall evaluate failure propagation and common resources, including assumptions about other installed systems. Component qualification shall be distinguished from installed-system demonstration. Modifications shall update affected maintenance data, spares, training and configuration records. Unassessed installation effects shall remain a limitation even where the component carries a valid separate conformity result.

Required evidence: Installation assessment; integrated test matrix; interface results; affected-support update records.

34.3 Complete unmanned-system boundary

An unmanned-system assurance case shall include the aircraft, control station, command links, navigation sources, remote personnel, software, external services and operating environment. It shall define the operational domain and the response to wrong, late, unavailable or unauthorised information. Safe responses to communication loss and degraded navigation shall be demonstrated under the approved technical basis. A remote pilot, geofence or automated protective function shall not be presumed effective without evidence for its relevant failure conditions.

Required evidence: System boundary; domain and dependency map; contingency validation; human-authority and link-loss evidence.

34.4 Advanced mobility and ground interfaces

Programmes using novel aircraft architectures shall demonstrate compatibility with the actual landing site, supporting infrastructure, energy service, passenger movement and emergency arrangements. The profile shall distinguish prototype demonstration from routine service capability. Ground operations, training and maintenance shall reflect the delivered architecture rather than assume conventional-aircraft equivalence. Evidence shall include representative disruptions and degraded support conditions. A vertiport or charging capability result shall not independently establish aircraft suitability or permission to conduct a passenger operation.

Required evidence: Aircraft-site interface dossier; support readiness; representative service validation; separate operational permissions.

34.5 Electric, hybrid and alternative-energy systems

The organisation shall examine coupled electrical, thermal, mechanical, chemical and control-system hazards for the actual energy architecture and duty cycle. It shall define supported operating and storage limits, degradation treatment, protection, isolation and emergency interfaces through competent technical work. Maintenance, ground support and responders shall receive controlled information relevant to their role. Environmental benefit and technical interchangeability are separate claims; a low-carbon supply statement shall not establish that a fuel or energy system is compatible with the aircraft.

Required evidence: Integrated energy-hazard case; qualified limits; support instructions; compatibility and claim separation.

34.6 Continued operation and configuration feedback

Continuing assurance shall connect operational anomalies, maintenance findings, updates, equipment substitutions and changes in the operating environment to affected aircraft configurations. The organisation shall preserve life and condition information and communicate restrictions through the actual responsible approval holders. Data-driven monitoring may support this process only within its validated detection boundary. A fleet-wide statistical improvement shall not justify continued use of a specific configuration with an unresolved essential control or unsupported maintenance release.

Required evidence: Fleet/configuration trace; occurrence and maintenance feedback; update approvals; actual release and restriction records.

35 Space systems and mission-environment assurance

Application: This clause applies to spacecraft, satellites, payloads, launch interfaces, ground systems and mission support. It does not supply universal flight loads, radiation limits or qualification recipes. Internal alignment: Clauses 9, 18, 19 and 26; AF 9100:2026 Clauses 14.1–14.5.

35.1 Mission architecture and dependencies

The organisation shall establish the mission architecture, lifecycle responsibilities, communication and support dependencies, expected duration and repairability assumptions. The assurance boundary shall include the interactions between payload, spacecraft platform, launch interface and ground segment. Commercial or rapid-development objectives shall not remove evidence needed for irreversible mission commitments. A technically successful subsystem shall not be described as a complete successful mission where ground, communications or end-of-life responsibilities remain unresolved.

Required evidence: Mission architecture; role and interface matrix; duration and support assumptions; integrated assurance plan.

35.2 Environment definition and tailoring

Relevant mechanical, acoustic, thermal, vacuum, radiation, charging, electromagnetic, contamination and material-degradation environments shall be identified from the intended mission. Qualification and acceptance strategies shall state their different purposes and the rationale for selected conditions. Test-article differences, fixture effects, cumulative exposure, limitations and potential over-test shall be reviewed. Tailoring shall preserve the required confidence in the actual application; a familiar terrestrial test or previous mission label shall not be used as an unexplained substitute.

Required evidence: Mission-environment specification; tailored verification matrix; article differences; exposure and limitation reviews.

35.3 Parts, materials and suitability

Parts and materials shall be selected using provenance, relevant performance evidence, mission consequence and susceptibility to the actual environment. The organisation shall examine whether screening, derating, additional qualification or protective design is needed under its approved technical basis. Commercial or heritage status alone shall neither establish nor rule out suitability. Changes of manufacturer, process, source or intended exposure shall be assessed. Missing lot or configuration information shall remain an explicit uncertainty rather than be replaced by a catalogue description.

Required evidence: Parts/materials assurance plan; suitability and provenance records; mission-specific qualification; change controls.

35.4 Contamination and cleanliness

Contamination control shall identify sensitive surfaces, assemblies, materials and operations and the relevant particulate, molecular or biological concerns. Requirements shall govern preparation, cleaning, storage, integration, transport and acceptance methods. Exposure history and deviations shall be linked to actual articles. Where planetary-protection obligations apply, the responsible organisation shall identify the actual requirements and permissions and retain verification evidence. An ASTRA statement of cleanliness shall not be presented as an independent authorisation for restricted planetary activities.

Required evidence: Contamination budget or criteria; sensitive-item register; handling records; measured acceptance and required permissions.

35.5 Ground segment and command assurance

Ground systems shall have controlled configurations, validated procedures and accountable command authority. The organisation shall address command origin, integrity, timing, compatibility and prevention of unintended actions. Readiness work shall include rehearsals, outages, handovers, anomaly response and limitations of telemetry. The absence of a received alarm shall not prove the absence of a hazardous state when communication or sensing is inadequate. Critical remote actions shall use the review and protective controls justified by consequence.

Required evidence: Ground baseline; command-authority records; rehearsal and outage evidence; telemetry interpretation limits.

35.6 Mission readiness and uncertainty acceptance

Before mission commitment, reconcile the delivered configuration, qualification results, open anomalies, ground readiness, operating procedures, available resources and end-of-life plan. Unresolved essential conditions shall block the dependent positive release. A permitted limited development decision shall state what remains prohibited. The accountable technical authority shall record residual uncertainty and limitations without claiming that every possible mission condition has been demonstrated. Subsequent evidence shall update the actual mission assurance case and relevant recipients.

Required evidence: Integrated readiness dossier; independent review; bounded decision; unresolved-duty and limitation register.

36 Launch, re-entry, reuse and spaceport interfaces

Application: This clause covers assurance of assigned launch, re-entry, reusable-system and spaceport interfaces. Hazardous operations require separate authorised specialist procedures. Internal alignment: Clauses 1.6, 21, 26 and 32; AF 9100:2026 Clauses 14 and 19.

36.1 Precise activity and authority

The profile shall identify the responsible legal entities, launch or re-entry service, site, vehicle or article, configuration, support equipment and relevant approval interfaces. The organisation shall distinguish vehicle design assurance, site capability, mission readiness and an individual operational permission. Contracts shall identify retained responsibilities across customers and subcontractors. No conventional-airport, generic laboratory or broad aerospace-system result shall automatically confer competence for launch or re-entry activities.

Required evidence: Exact activity/site profile; permissions; responsibility and interface agreements; distinct outcome boundaries.

36.2 Site, vehicle and payload compatibility

The organisation shall verify compatibility of the actual vehicle, payload, ground support, utilities, data exchange and handling interfaces. It shall examine the consequences of a changed payload, supporting system or operating condition on earlier evidence. The applicable technical authorities shall resolve inconsistent interface assumptions before dependent use. Acceptance shall be based on the actual configuration; the presence of an interface drawing or a previous successful operation shall not establish compatibility of a materially changed arrangement.

Required evidence: Configuration-specific interface matrix; reviewed changes; integration checks; unresolved-interface controls.

36.3 Readiness and hazardous-work separation

Operational readiness shall verify necessary people, equipment, approved technical data, protective functions, communication, emergency interfaces and stop authorities. Technical acceptance criteria and protective stop conditions shall be distinguished. The ASTRA assessment shall examine whether competent authorised organisations implement their controls, not direct a launch, set hazardous operating parameters or substitute for public safety decisions. Inaccessible essential evidence shall result in an appropriate scope restriction or hold rather than a presumption of safe capability.

Required evidence: Readiness review; current specialist procedures; protective-function evidence; lawful witnessing and approval boundaries.

36.4 Reuse and accumulated exposure

Reusable articles shall retain identity, configuration, prior flights or uses, maintenance, refurbishment, repairs and accumulated relevant exposure. The organisation shall define how the reuse decision is supported by inspection capability, life assessment and qualified repair or replacement. A successful prior mission shall not reset life or conceal damage. Unknown history shall remain a controlled uncertainty. New materials, repair methods or changed duties shall undergo technical review before previous qualification is relied upon.

Required evidence: Article history; exposure and condition record; inspection and repair evidence; configuration-specific reuse decision.

36.5 Recovery, re-entry and end-of-operation interfaces

The assurance plan shall identify the responsible parties for recovery, containment of residual hazards, custody, transport, environmental obligations and subsequent examination. Expected behaviour and evidence limitations shall be explicit where direct access is not possible. Disposal or recovery shall not be claimed complete from an unverified signal or an unchanged plan. The organisation shall retain actual completion evidence and communicate unsuccessful, partial or uncertain outcomes accurately to the relevant authorities and recipients.

Required evidence: Recovery/disposition responsibilities; actual status evidence; custody record; limitations and recipient communication.

36.6 Learning without automatic scope expansion

After each relevant operation or development event, review anomalies, interface deviations, protective actions and changes in the technical basis. Separate lessons about a particular configuration from claims about an entire vehicle or site family. A new payload class, service mode, site or re-entry concept shall require an assessed extension before an expanded ASTRA claim is used. Operational experience may support an equivalence argument, but shall not replace evidence for a new failure mechanism.

Required evidence: Post-event review; bounded experience argument; extension assessment; updated profile and readiness basis.

37 Orbital operations, servicing and in-space manufacturing

Application: This clause addresses evidence and responsibility for declared orbital activities, including operations, servicing, assembly and manufacturing. It does not prescribe manoeuvres or operational intervention procedures. Internal alignment: Clauses 26.3–26.6 and 32–35; AF 9100:2026 Clauses 14.4, 14.5 and 14.7.

37.1 Operational state and authority

The operator shall maintain the identity and configuration of the space asset, relevant operating states, authorised commands, current restrictions and responsible personnel. Handover between ground teams and external service providers shall preserve assumptions, unresolved anomalies and authority limits. Telemetry-derived state shall be distinguished from direct observation and unverified inference. Where the state necessary to support an action is unknown, the approved decision process shall retain the uncertainty and apply the protective boundary defined for the mission.

Required evidence: Asset/configuration record; command and duty authority; state confidence and limitations; handover evidence.

37.2 Tracking, coordination and environmental responsibility

The programme shall identify its applicable tracking, coordination, collision-information, debris-prevention and end-of-life responsibilities. Data sources, age, reference systems, uncertainty and dependency on other operators shall be recorded where material. The organisation shall not present a coordination message or nominal plan as proof that every external hazard is controlled. Changes in mission duration, orbit or support availability shall trigger review of the assurance case and remaining resources under the actual approval framework.

Required evidence: Responsibility register; data-provenance and uncertainty records; coordination evidence; updated end-of-life assessment.

37.3 Servicing and assembly boundaries

A servicing or assembly activity shall identify participating assets, interface configurations, ownership, consent, technical responsibilities and safe-state assumptions. The evidence plan shall address limited inspection access, communication delay, remote verification and the consequences of failure to complete the intended task. Prior acceptance of each separate asset shall not prove compatibility of their interaction. The organisation shall establish the basis on which completion, partial completion or an unverified result will be recorded and independently reviewed.

Required evidence: Authorised activity boundary; interface and consent records; remote verification plan; exact completion criteria.

37.4 In-space manufacturing and process evidence

Manufacturing in an inaccessible environment shall connect input material identity, process configuration, relevant environmental conditions, monitoring capability and output requirements. The organisation shall identify which properties are directly measured, inferred through a validated model or not observable. A terrestrial process qualification shall not automatically qualify in-space use. Monitoring data may replace a physical acceptance activity only when the equivalence is technically supported and prospectively approved for the defined product and process boundary.

Required evidence: Environment-specific qualification; material genealogy; sensor/model validity; output acceptance and observability limitations.

37.5 Remote changes and interruption

Software, command sequences, process parameters and operational procedures shall remain configuration controlled. The change review shall examine interruptions, partial execution, stale data, recovery and the technical feasibility of rollback. A returned communication link or successful software restart shall not by itself confirm that a physical process or asset state has been restored. The responsible authority shall reconcile what actually occurred before permitting dependent use or a completed-service claim.

Required evidence: Change and update dossier; interrupted-action records; reconciled physical/digital state; restoration authority.

37.6 Disposal and verifiable closure

End-of-life planning shall address foreseeable failure, remaining resources, support continuity and evidence of actual completion. The organisation shall preserve unresolved obligations and explain whether a final state is observed, inferred or unknown. Loss of contact shall not be labelled successful disposal without adequate evidence. Programme or provider closure shall identify a receiving custodian for necessary records and notifications. Public claims shall describe the bounded achievement rather than guarantee perpetual orbital safety or universal sustainability.

Required evidence: Disposal feasibility review; actual completion record; open-duty allocation; retained history and accurate public statement.

38 Lunar, planetary and remote-surface systems

Application: This clause applies to surface vehicles, robotic systems, infrastructure and exploration-support activities within the approved programme boundary. Internal alignment: Clauses 26 and 35–37; AF 9100:2026 Clauses 14.6–14.7.

38.1 Environment-specific mission concept

The organisation shall define the intended surface environment, mission duration, mobility or service objectives, communication constraints, energy dependencies and support assumptions. Requirements shall address conditions relevant to the actual mission, including dust or contamination, terrain interaction, thermal exposure and access limitations. Terrestrial vehicle or industrial qualification shall be treated as evidence with a stated boundary, not automatic proof of suitability. Unsupported assumptions shall remain open before any dependent technical or conformity decision.

Required evidence: Surface mission concept; environmental and dependency specification; applicability of terrestrial evidence; open assumptions.

38.2 Mobility and integrated resource assurance

A mobility-system assurance case shall connect structure, locomotion, power, thermal control, autonomy, sensing, communications and payload interfaces. The programme shall assess coupled resource demands and degradation across the planned mission rather than demonstrate each subsystem only in isolation. Requirements and margins shall identify uncertainty and credible loss of a supporting service. The organisation shall define the evidence needed for restricted operation and safe cessation when mission objectives can no longer be achieved.

Required evidence: Integrated resource budgets; interface validation; degraded-condition analysis; bounded operating and cessation criteria.

38.3 Remote autonomy and human intervention

The operational-domain definition shall specify the authority allocated to automation and remote personnel and the conditions under which human intervention is feasible. Communication delay, incomplete sensing and limited observation shall be included in validation. A nominal human-approval step shall not be treated as effective where there is insufficient time or information to act. Material adaptation outside the approved envelope shall require renewed assurance before the changed behaviour is relied upon.

Required evidence: Authority and intervention model; scenario validation; sensing limits; change and adaptation controls.

38.4 Surface infrastructure and resource activities

Infrastructure, construction, handling and resource-processing activities shall have defined ownership, technical boundaries, environmental assumptions and acceptance criteria. The organisation shall assess material properties, connection interfaces, inspection accessibility, maintenance and decommissioning within its actual responsibility. Demonstrating a laboratory process shall not establish deployment readiness of an integrated remote facility. Specialist permissions and environmental obligations remain separate from the ASTRA evaluation, and no resource-rights claim is created by this standard.

Required evidence: Infrastructure or process profile; representative qualification; interface evidence; permissions and end-of-life responsibilities.

38.5 Maintenance, retrieval and inaccessible evidence

The assurance strategy shall identify what can be maintained, inspected, retrieved or replaced and what must remain supported by remote evidence. Diagnostic and health-monitoring methods shall be validated for the relevant failure mechanisms and shall expose false-negative and missing-data limitations. Where a physical condition cannot be established, the remaining uncertainty shall be retained. An apparently normal telemetry stream shall not replace evidence of an unobservable critical property or an inaccessible required inspection.

Required evidence: Supportability and access analysis; diagnostic validation; inaccessible-property register; approved restrictions.

38.6 Responsible completion and knowledge preservation

The organisation shall maintain the mission record, materials and configuration history, command and data provenance, anomalies and final-state evidence. Closure shall address environmental and protection obligations, remaining hazardous inventories, long-term custody and the ability to interpret records after tool or staff changes. Scientific results, engineering demonstrations and operational capability claims shall be identified separately. A research success shall not be relabelled as a fully qualified production or service capability without its own evidence and decision.

Required evidence: Complete mission dossier; final-state limitations; record custody; separate research and conformity conclusions.

39 Human-system integration, crew and passenger protection

Application: This clause applies where the organisation's outputs affect operators, maintenance personnel, passengers, crew or people occupying aerospace environments. It sets engineering-assurance responsibilities, not medical treatment instructions. Internal alignment: Clauses 5.3, 7, 20–23 and 26; AF 9100:2026 Clauses 14.6 and 20.4–20.6.

39.1 Intended users and representative conditions

The organisation shall define the relevant users, tasks, environment, expected duration, physical access, communication and operational constraints. Human-system requirements shall consider capabilities, limitations and reasonably foreseeable behaviour. Validation shall use representative users and conditions where practicable and state the limitations of substitutes or simulation. A single expert operator or ideal-condition demonstration shall not establish usability for all intended users or emergency conditions.

Required evidence: User/task analysis; representative population and scenario rationale; validation results and limitations.

39.2 Workload, information and error recovery

Interfaces and procedures shall provide understandable status, priorities, warnings and recovery information appropriate to the task. The organisation shall evaluate workload, fatigue, interruption, handover, language and the ability to recover from foreseeable errors. A warning shall not be the sole mitigation where an essential design or protective control is required. Nominal response time shall be distinguished from the time demonstrated by actual users under representative workload and degraded-information conditions.

Required evidence: Interface requirements; workload and interruption studies; observed recovery; design and protective-control decisions.

39.3 Life-support and habitation responsibilities

Where life-support or habitation systems are within scope, responsibilities shall cover the integrated environment, consumables, monitoring, maintenance, degradation and emergency interfaces. The technical basis shall identify the expected occupancy and mission duration and the consequences of loss of a supporting function. The organisation shall obtain competent specialist review appropriate to consequence and actual legal obligations. User acceptance of risk shall not replace required technical controls, independent review or operational permission.

Required evidence: Life-support responsibility matrix; occupancy/duration basis; integrated verification; independent specialist review.

39.4 Emergency response and safe-return assumptions

The organisation shall identify emergency scenarios and the interfaces on which rescue, safe return, evacuation or continued protection depend. Agreements shall be supported by evidence of actual availability and compatible communication, equipment and competence. Exercises shall be safe and representative of the response being claimed. A signed cooperation document or an optimistic recovery time shall not establish effective emergency capability where a critical resource or external service remains unavailable.

Required evidence: Scenario and dependency analysis; resource availability; exercised interfaces; corrective follow-up and limitations.

39.5 Maintenance and worker protection

Work design shall address hazards affecting people and conformity, including access, lifting, hazardous energy, exposure, fatigue and restoration after intervention. Contractors and temporary personnel shall receive relevant task controls and supervision. The organisation shall preserve stop-work and escalation rights without retaliation. This standard does not replace a complete workplace safety framework; it requires the actual obligations and competent protective arrangements to be integrated with the claimed aerospace activity.

Required evidence: Work-risk interfaces; task authorisation; contractor controls; interruption and safe-restoration records.

39.6 Human authority in automated systems

Automation shall have explicit authority limits and an identified accountable organisation. Human oversight shall be evaluated for actual information, time, skill and ability to intervene, not simply the presence of a person in a process diagram. Training shall cover limitations, misleading outputs and degraded modes. Material changes in automation, tasks or user populations shall trigger reassessment. A favourable aggregate task-completion rate shall not compensate for a failed essential protective response.

Required evidence: Authority allocation; intervention validation; representative training and assessment; change review; essential-step results.

40 Defense, land, maritime and industrial assurance

Application: This clause applies to lawful assurance of defense-industry platforms, mission-support vehicles, maritime systems and associated heavy industry. It contains no weapon construction, targeting, tactical employment or offensive-cyber instructions. Internal alignment: Clauses 1, 5, 18, 19 and 26.6; AF 9100:2026 Clauses 16–17.

40.1 Contractual, technical and lawful boundaries

The organisation shall identify actual quality, safety, security, configuration, verification and support obligations and the parties entitled to accept the work. Contractual acceptance, mission-performance evidence and legal permission shall remain separate. Controlled or classified information shall be reviewed through authorised arrangements that still provide adequate independent evidence. An inaccessible essential record shall lead to a held or limited claim, not acceptance based solely on the authority or reputation of the submitting party.

Required evidence: Obligation and acceptance matrix; access authorisations; protected evidence strategy; exact scope and limitations.

40.2 Multi-domain integration

Air, land, maritime, space and connected digital systems shall be assessed for interface compatibility, environmental exposure, common dependencies and safe degraded behaviour. The organisation shall define safe states for training, storage, transport, maintenance and non-operational use. Individually accepted equipment shall not be assumed to form an acceptable integrated platform. Hazardous tests shall remain separately authorised, with competent specialists responsible for the applicable procedures and protective limits.

Required evidence: Multi-domain interfaces; integrated verification; safe-state definitions; separate hazardous-test authorisations.

40.3 Mission-support road and off-road vehicles

The profile shall define actual duty, load, terrain, climate, transport, support and occupant requirements. Integration of mission equipment shall examine effects on structure, stability, braking, steering, energy, thermal behaviour, visibility and maintenance where relevant. A commercial chassis or component result shall not establish suitability of the modified configuration. Civil-use and mission-specific obligations shall both be identified when they apply, without presenting ASTRA as a substitute vehicle approval.

Required evidence: Duty profile; configuration and integration assessment; representative qualification; maintenance and approval interfaces.

40.4 Maritime and underwater systems

The assurance basis shall identify relevant structural, corrosion, pressure, electrical, propulsion, watertight-integrity and human-system requirements. Critical boundaries, joints, coatings and machinery shall retain material, qualification, inspection and through-life condition evidence. Inspection accessibility and deterioration shall be addressed before installation or concealment. Applicable customer and competent-authority decisions remain separate from the ASTRA result. A surface-system qualification shall not establish suitability for a different submerged duty or pressure environment without technical justification.

Required evidence: Maritime duty basis; critical-boundary records; qualified fabrication and inspection; deterioration and access plan.

40.5 Heavy plant and industrial infrastructure

Industrial assets supporting aerospace or defense work shall have a defined design basis, operating limits, utilities, protective functions and lifecycle responsibilities. Fabrication, installation and commissioning shall distinguish completed construction from verified functional and integrated performance. Hidden work shall be inspected before it becomes inaccessible where required. Bypasses, temporary repairs and overrides shall have bounded authority and verified restoration. This standard is not a structural, pressure-system or nuclear design code.

Required evidence: Asset integrity dossier; as-built records; commissioning results; temporary-condition controls; applicable technical basis.

40.6 Controlled technology and long-life support

The organisation shall identify obligations for access, transfer, end use, publication and technical support through competent authorised review. Supply due diligence shall address provenance, unauthorised substitution, conflicts and misuse concerns. Long-life support shall preserve field configurations, repair data, software maintainability, diminishing sources and qualified substitutions. Cannibalisation or refurbishment shall retain prior life and origin; unknown history shall not be reset. Membership or an ASTRA credential does not authorise a controlled transfer.

Required evidence: Controlled-technology review; supplier due diligence; field-history and obsolescence plan; substitution and custody records.

41 Materials, advanced manufacture and critical processes

Application: This clause consolidates the existing F02 process scope with integrated production-route controls. The 22 retained process subjects are listed in Annex S and developed in Annex W; testing competence remains within F03. Internal alignment: Clause 18; AF 9100:2026 Clauses 18 and 25 and Annex L.

41.1 Material identity and technical suitability

The organisation shall define material composition or type, condition, relevant properties, processing history and acceptance evidence appropriate to intended use. Receipt, storage, shelf life, out-time, mixing, splitting and reuse shall preserve identity and suitability. Recycled or reclaimed content shall satisfy the same applicable technical requirements; an environmental benefit shall not replace qualification. A material certificate shall be linked to the actual supplied lot and reviewed for its technical relevance, not accepted solely because a certificate exists.

Required evidence: Material specification; lot genealogy; storage and out-time record; suitability and substitution decisions.

41.2 Integrated route and hidden characteristics

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.

41.3 Thermal, joining and surface processes

Thermal treatment, joining, brazing, soldering, chemical preparation, plating, conversion, spray, organic coating and mechanical surface enhancement shall have scope-specific qualified procedures. The organisation shall identify the actual equipment, materials, essential variables, monitoring, verification and requalification triggers. Changes affecting hidden properties shall receive competent technical review. This standard establishes the assurance payload; it does not supply universal treatment temperatures, chemical formulations, energy settings, joining parameters or acceptance limits.

Required evidence: Qualified procedure and window; equipment and personnel scope; actual process history; verified properties and change review.

41.4 Composites, bonding and additive manufacture

Composite and bonded products shall retain constituent identity, storage and out-time, surface preparation, lay-up or assembly, tooling, cure and inspection evidence. Additive work shall retain feedstock history, machine and software state, digital build identity, orientation, monitoring and post-processing. Qualification shall address the relevant product geometry and property variations. A qualified machine, material or sensor shall not approve every output. In-process monitoring may support acceptance only within a validated detection and decision boundary.

Required evidence: Constituent/build genealogy; qualified process envelope; representative property evidence; monitoring limitations; post-process acceptance.

41.5 Electronics, harnesses, optics and critical assembly

Assembly assurance shall control component suitability and authenticity, loaded configuration, interconnections, contamination-sensitive operations, fixtures, tools and essential checks. Concealed or irreversible steps shall retain contemporaneous evidence. The organisation shall distinguish visual workmanship, electrical or functional performance and system-level suitability. Rework and part substitution shall be technically reviewed and traceable. A successful bench test shall not establish compatibility with every installation, and a supplier's broad qualification shall not replace actual assembly-route evidence.

Required evidence: Assembly baseline; component and software identity; concealed-step records; functional results; reviewed rework and installation limits.

41.6 Production readiness, transfer and continuing control

Before routine production or transfer, verify process qualification, first-article characteristic accountability, measurement capability, workforce competence, source controls and actual receiving-site implementation. Separate process stability, capability indices and individual acceptance. Low-volume work shall use an appropriate evidence strategy rather than an unsupported statistical claim. After an excursion or change, trace affected populations from the last demonstrated valid state and establish what new evidence is necessary before unrestricted use resumes.

Required evidence: Production-readiness dossier; receiving capability; monitoring design; affected-population and requalification decisions.

42 Test, qualification and environmental verification

Application: This clause governs the selection and interpretation of aerospace verification activities. Annex T identifies 38 planning domains, not 38 new programme families or ready-to-use test methods. Internal alignment: Clauses 8–9, 12–13 and 19; AF 9100:2026 Clauses 11.6, 14.2 and Annex M.

42.1 Requirement-led test strategy

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.

42.2 Test tailoring and representativeness

Test conditions shall be derived from the actual technical and obligation basis. The organisation shall explain specimen geometry, material condition, mounting, fixtures, boundary conditions, input locations, operating modes and differences from the deployed article. Similarity arguments shall identify relevant differences and failure mechanisms. Tailoring, reduced exposure or substitution of analysis shall have prospective technical approval. No universal vibration level, temperature, radiation dose, acoustic spectrum or electromagnetic severity is imposed by this standard.

Required evidence: Tailoring rationale; environment definition; specimen and fixture review; approved deviations and retained limitations.

42.3 Combined environments and test sequence

The verification strategy shall evaluate whether environmental stresses interact and whether the order of exposure affects the conclusion. Cumulative damage, preconditioning, repairs, software changes and prior unsuccessful tests shall remain part of the article history. The organisation shall distinguish necessary qualification margin from unrepresentative over-test. Where separate tests cannot demonstrate a coupled effect, an additional integrated method or justified analysis shall be established. A passed individual test shall not automatically bound every combination of operating conditions.

Required evidence: Sequence and interaction analysis; article exposure history; cumulative-effect review; additional integrated evidence.

42.4 Data acquisition, uncertainty and protective limits

Instrumentation and software shall be suitable for the required range, bandwidth, accuracy, synchronisation and uncertainty. The organisation shall retain original data, transformations, calibration and configuration evidence. Technical acceptance and safety-stop criteria shall be specified separately. An interruption, missing channel or unexpected protective action shall be recorded and assessed before restart. Restoring the test setup shall not establish that the article remains representative or that the interrupted evidence supports the intended conclusion.

Required evidence: Measurement-chain dossier; raw data; uncertainty and timing; stop/restart records; article-validity review.

42.5 Failure, retest and independent judgement

Failed, invalid and indeterminate results shall remain identifiable with their original conditions. A retest shall follow an approved technical rationale and account for selection effects, changed articles, repairs and repeat exposure. The organisation shall not test repeatedly until a favourable result appears or revise acceptance criteria after seeing the data. The independent reviewer shall examine coverage, adverse evidence and limitations. Any product concession shall remain separate from a conformity claim that requires the original criterion to be fulfilled.

Required evidence: Failure and validity classification; retest rationale; original/revised configuration; independent acceptance or hold.

42.6 Laboratories and complete reports

Testing shall use demonstrated method-specific competence, suitable facilities, traceability and continuing-validity controls. Reports shall identify actual performer, article, method/version, conditions, deviations, results, uncertainty where relevant, decision rule and supported conclusion. Subcontracted data and opinions shall be distinguishable. A laboratory competence outcome does not approve every tested product, and an article qualification does not accredit the laboratory. The final report shall expose untested characteristics and restrictions on inference to a broader family.

Required evidence: Laboratory scope and validity; complete test report; subcontractor identity; independent review and limited inference.

43 Propulsion, electrification and hazardous-energy assurance

Application: This clause covers assurance responsibilities for energy generation, storage, conversion, distribution and propulsion. Actual hazardous procedures and technical limits belong to authorised specialists. Internal alignment: Clauses 5, 18, 19 and 26.6; AF 9100:2026 Clause 19.

43.1 Integrated energy boundary

The organisation shall define the complete energy-system boundary and the interactions among mechanical, electrical, thermal, chemical and control functions. Requirements shall cover transport, storage, charging or fuelling, operation, maintenance and end of life as applicable. Common dependencies and abnormal states shall be considered. Separate component results shall not establish integrated protection where failure can propagate across interfaces. Every critical limit and protective function shall have an approved technical basis and a method of verification.

Required evidence: Energy architecture; lifecycle hazard analysis; requirement and protection map; integrated verification.

43.2 Batteries and electrical storage

Battery assurance shall retain cell and module provenance, configuration, manufacturing consistency, protective controls, thermal management and actual operating history. Qualification shall address relevant degradation and credible abnormal conditions under the approved application basis. State estimates and health-monitoring outputs shall identify their model and uncertainty. Reuse or second-life use shall require a new suitability assessment without erasing prior history. An acceptable nominal capacity or successful functional check shall not establish complete safety or fitness for another duty cycle.

Required evidence: Storage-system baseline; provenance and life history; qualification; monitoring validation; reuse decision.

43.3 Hydrogen, fuels and chemical energy

The assurance case shall identify material compatibility, containment, supply quality, contamination, detection, protective isolation and emergency interfaces appropriate to the actual architecture. Supply-chain and ground-service responsibilities shall be explicit. Technical interchangeability shall be separately demonstrated from a sustainability or provenance claim. The organisation shall maintain current specialist procedures for hazardous work and verify the competence and permissions of actual performers. This standard does not prescribe fuel formulations, operating pressures or hazardous handling instructions.

Required evidence: Compatibility and containment basis; supply-quality evidence; competent authorised procedures; separate environmental claims.

43.4 Propulsion and rotating equipment

Propulsion and rotating machinery shall have controlled requirements for operating envelope, duty, life, materials, balance, lubrication, thermal behaviour and protection as relevant. Critical parts and process histories shall remain traceable. Changes to speed, load, controls, materials or installation shall be reviewed against qualification and life evidence. The organisation shall distinguish a development performance result from acceptance of a delivered configuration. This clause sets evidence and responsibility requirements rather than design parameters or performance optimisation instructions.

Required evidence: Duty and envelope basis; critical-part genealogy; qualification and acceptance; change and life-management records.

43.5 Ground support and emergency interfaces

Ground energy delivery, charging or fuelling equipment shall be compatible with the supported system and maintained in the verified configuration. Handover shall include relevant limitations, protective actions and incident information. The organisation shall evaluate common utilities, communication dependencies and restoration after interruption. Emergency arrangements shall be exercised safely with the actual responsible parties. Availability of energy or a connected interface alone shall not establish suitability for a particular aircraft, vehicle or space system.

Required evidence: Ground-system compatibility; service capability; protective-function checks; emergency and restoration evidence.

43.6 Qualification, change and release

The qualification dossier shall reconcile system requirements, component evidence, integrated behaviour, material histories, test limitations and support capability. Essential unresolved hazards or invalid evidence shall block the dependent positive decision. After a protective event, anomaly or material change, the organisation shall review affected articles and earlier conclusions. Resumption requires actual technical acceptance. An ASTRA status or a completed commercial delivery shall not substitute for the authorised release required for the specific energy system or operation.

Required evidence: Complete qualification dossier; independent review; anomaly impact; resumption and release authority.

44 Software, programmable hardware and digital engineering

Application: This clause applies to digital artefacts influencing products, manufacturing, inspection, maintenance, services or assurance decisions, including purchased, legacy and generated artefacts. Internal alignment: Clauses 10 and 26; AF 9100:2026 Clauses 12.1–12.3 and 12.7–12.9.

44.1 Lifecycle and architectural assurance

The organisation shall define requirements, architecture, implementation, integration, verification, release, maintenance and retirement for software and programmable hardware. Assurance depth and independence shall be matched to consequence and actual obligations. Architecture shall address interfaces, timing, resource limits, partitioning, fault containment and recovery where relevant. The absence of physical wear shall not be used to dismiss systematic defects, configuration errors, data corruption or environmental change. Purchased artefacts shall remain within the same assigned assurance responsibility.

Required evidence: Digital lifecycle plan; allocated requirements; architecture and consequence review; supplier responsibilities.

44.2 Source, build and loaded configuration

Source, generated code, logic, configuration, tools, dependencies and build instructions shall have controlled identities and attributable changes. The released artefact shall be linked to the reviewed baseline and the actual loaded target. Reproducibility shall be demonstrated where necessary for the intended assurance claim. Unapproved dependencies and embedded secrets shall be controlled. A software version label alone shall not establish which settings, data, model weights or external services influenced the delivered behaviour.

Required evidence: Source and review records; build/dependency manifest; artefact identity; loaded-configuration verification.

44.3 Verification and target representativeness

Verification shall address requirements, interfaces, boundaries, invalid inputs, timing, resource exhaustion, failure handling and regression. Coverage criteria shall be justified by the technical basis rather than an unexplained universal percentage. Differences between host, simulated and deployed execution shall be assessed. Uncovered behaviour, unresolved anomalies and tool limitations shall remain visible. Passing tests shall not establish completeness when the test set omits an essential condition or was not executed on a representative target.

Required evidence: Verification plan; traced test results; coverage and target-difference analysis; anomaly disposition.

44.4 Tool and generated-output reliance

Tools whose failure can create or conceal a defect shall be assessed for intended use, consequence and independent detection. Validation shall include known-answer, boundary, missing-input and prohibited-state cases. Generated calculations, code, technical statements and references shall receive competent verification before becoming controlled evidence. The organisation shall prevent unauthorised disclosure to external services. Neither successful tool execution nor a convincing generated explanation establishes the truth of the input, physical model or engineering conclusion.

Required evidence: Tool-risk and validation record; verified generated outputs; access controls; accountable technical approval.

44.5 Release and update integrity

A release shall identify approved functionality, configuration, dependencies, unresolved limitations, installation conditions and support obligations. Updates shall verify origin, integrity, compatibility and intended target before use. Interruption, failed installation, rollback and restoration shall be evaluated for the actual architecture. A security fix shall also be assessed for effects on timing, safety and qualification. The organisation shall not assume that changing a version number closes the original defect or retrospectively validates affected earlier outputs.

Required evidence: Release and update manifest; compatibility review; interrupted-update tests; rollback limits; affected-output decisions.

44.6 Long-term support and digital retirement

Long-life digital systems shall have a plan to preserve source or equivalent support access, build environments, licences, technical knowledge and records necessary for maintenance. Dependence on a cloud service or supplier shall be assessed before commitment. Migration, replacement or emulation shall preserve required behaviour and evidence meaning. Retirement shall address data custody, residual vulnerabilities, user notification and prevention of unauthorised reuse. Cryptographic signing alone shall not guarantee permanent readability or technical validity.

Required evidence: Support and obsolescence plan; access arrangements; migration tests; retirement and record-custody decisions.

45 Artificial intelligence, autonomy and human authority

Application: This clause applies when AI or adaptive behaviour affects an assured product, process, service or decision. It is not permission for unsupervised certification or operational deployment. Internal alignment: Clauses 10.4 and 26.1–26.2; AF 9100:2026 Clauses 12.4–12.7.

45.1 Intended use and prohibited use

Each AI use shall have an accountable owner, intended purpose, operational domain, affected decisions, permitted authority and prohibited applications. The organisation shall examine foreseeable harms, security exposure, human limitations and whether a simpler, more verifiable method can meet the need. Development and experimental uses shall be separated from released operational use. A vendor's capability claim or a benchmark result shall not establish the suitability of the deployed system for a high-consequence application.

Required evidence: AI use-case register; alternatives and consequence review; domain and authority limits; release boundary.

45.2 Data provenance and evaluation independence

Datasets shall retain collection sources, rights, versions, labelling methods, relevant populations, operating conditions and known limitations. Training, tuning and evaluation partitions shall prevent leakage or unjustified overlap. The organisation shall preserve difficult, rare and adverse conditions needed for the intended use. Synthetic data shall be identified and its representativeness justified. A large dataset or overall accuracy score shall not establish coverage of a materially different population, environment or critical failure scenario.

Required evidence: Dataset manifest; partition and labelling controls; scenario coverage; synthetic-data limitations; independent evaluation design.

45.3 Performance and uncertainty

Acceptance criteria shall be fixed before evaluation and define relevant errors, denominators, exposure, uncertainty and essential protective conditions. Results shall be examined by meaningful operating condition or subgroup rather than only in aggregate. False acceptance, missed detection, unavailable output and indeterminate behaviour shall be distinguishable. A model confidence score is not automatically a calibrated probability of correctness or a probability of safe operation. Material evidence gaps shall prevent the dependent positive conclusion.

Required evidence: Prospective performance criteria; stratified results; uncertainty and calibration review where relevant; essential-failure record.

45.4 Human oversight and safe fallback

The organisation shall demonstrate that responsible people have sufficient information, time, competence and technical ability to intervene. Fallback shall be feasible in the actual operating environment and shall not rely on a failed common resource without justification. Invalid, missing, adversarial or out-of-domain inputs shall be considered under the approved threat and hazard model. A nominal manual-override button or requirement to review every result shall not count as an effective control without representative evidence.

Required evidence: Oversight task analysis; intervention and fallback tests; abnormal-input response; validated operating restrictions.

45.5 Release, drift and bounded adaptation

Model weights, preprocessing, dependencies, thresholds, sensor configuration and deployment conditions shall form an identifiable released baseline. Monitoring shall define relevant drift, changed exposure, failure indicators and accountable response. Adaptation outside the approved envelope requires renewed impact review and verification before reliance. The organisation shall retain earlier versions and explain the validity of previous conclusions after a change. An autonomous improvement claim shall not remove the need to demonstrate continued fulfilment of essential requirements.

Required evidence: Model release card; drift and response plan; adaptation boundary; change approvals; retained historical baselines.

45.6 Assurance decisions remain attributable

AI may support search, document review, classification and anomaly detection within validated limitations. It shall not independently grant, renew, suspend or restore an ASTRA outcome. The authorised decision maker shall have access to verifiable source evidence, understand material limitations and record the reasoned decision. Generated transcripts, images or observations shall not be presented as authentic events. Independent reviewers shall challenge automation bias and the risk of several tools repeating the same unsupported source.

Required evidence: Approved decision-support use; source verification; human review and decision; generated-content identification; independence checks.

46 Digital twins, simulation and model credibility

Application: This clause applies when a model or simulation supports design, qualification, acceptance, maintenance or an assurance decision. Internal alignment: Clauses 9 and 26.3; AF 9100:2026 Clauses 11.6–11.7 and 12.8.

46.1 Decision purpose and model authority

Every relied-upon model shall identify its owner, decision purpose, physical or operational target, version, inputs, outputs and authorised use boundary. The organisation shall distinguish an illustrative model, an engineering prediction, a synchronised digital twin and an acceptance model. Visual realism or a common data format shall not establish technical credibility. A model validated for one output or range shall not automatically support a different decision, configuration or environment.

Required evidence: Model identity and purpose; authority and use limits; target/configuration association; versioned assumptions.

46.2 Verification, validation and uncertainty

The organisation shall verify the implementation and validate the model against relevant observations for the claimed use. It shall evaluate input quality, numerical effects, calibration, sensitivity, dependence and uncertainty as appropriate. Calibration and validation evidence shall be distinguishable. Material discrepancy shall be investigated rather than concealed through repeated tuning to the same evidence. The final conclusion shall state the limits of the demonstrated domain and the consequences of relying on extrapolation.

Required evidence: Verification and validation plan; independent comparison data; sensitivity and uncertainty; discrepancy and extrapolation review.

46.3 Twin synchronisation and stale state

A digital twin shall maintain a traceable association with the actual asset and identify the source and age of updates. The system shall detect relevant missing, stale, inconsistent or wrong-configuration information. Maintenance and replacement shall update both physical and model records without erasing prior states. The organisation shall define what decisions remain permissible when synchronisation is lost. A visually current dashboard shall not be treated as proof that the underlying configuration is current.

Required evidence: Asset-twin identity; update and timestamp controls; stale-state response; configuration reconciliation.

46.4 Replacement or reduction of physical work

Where modelling replaces or reduces physical testing, inspection or practical observation, the organisation shall provide a prospective equivalence argument. It shall address failure mechanisms, validated domain, uncertainty, independent review and the material properties or behaviours that remain unobserved. The actual technical and legal obligations shall be checked before removal of a required activity. Cost, speed or model convenience alone shall not justify a reduction in necessary evidence.

Required evidence: Test-replacement rationale; validated equivalence; residual physical evidence; approval and restrictions.

46.5 Model-based maintenance and remaining life

A predictive or remaining-life output shall identify the asset history, degradation mechanism, observable inputs, model assumptions and uncertainty. The organisation shall validate the output for the intended maintenance decision and retain mandatory inspection or life-limit obligations. Absence of an alert shall not establish integrity where the model cannot detect the relevant mechanism. A new duty, repair, missing history or changed sensor shall trigger reassessment before the model supports an extended use decision.

Required evidence: Asset-history linkage; degradation and model validity; uncertainty; interval/life decision; changed-duty review.

46.6 Reproducibility and independent access

The evidence dossier shall retain sufficient model definition, input data, parameter settings, tool version and execution records to reconstruct the conclusion. Proprietary restrictions shall be managed through authorised access without accepting an inaccessible essential model by reputation. Independent review shall address the engineering relevance as well as computational correctness. Export and migration shall preserve units, field meaning, relationships and known limitations. A successful file transfer shall not establish successful model transfer.

Required evidence: Reproducible execution package; lawful independent access; engineering review; semantic migration checks.

47 Cyber resilience, operational technology and secure updates

Application: This clause governs defensive assurance of systems and evidence. Security testing requires explicit authorisation and safe boundaries. Internal alignment: Clauses 10 and 26; AF 9100:2026 Clause 13.

47.1 Safety-security dependency analysis

The organisation shall identify assets, trust boundaries, suppliers, users and interfaces whose loss of integrity, availability, authenticity or confidentiality can affect assured outcomes. Threat and safety analyses shall be coordinated where protective measures can interfere with emergency or degraded operation. Engineering records, machine programmes, maintenance data and product updates shall be included, not only office systems. Assumptions about shared infrastructure and external services shall have named owners and demonstrable controls.

Required evidence: Asset and trust-boundary inventory; joint hazard/threat review; dependency ownership; approved protective controls.

47.2 Identity, access and privileged actions

Access shall follow verified identities, necessary privileges and actual roles. Human, machine and service identities shall be controlled throughout their lifecycle. Privileged release, maintenance and status actions shall have authentication and attribution appropriate to consequence. Emergency access shall be bounded, logged and reviewed. Shared credentials shall not obscure who performed an action. Changes in employment, supplier access or responsibilities shall promptly trigger the relevant permission review and removal.

Required evidence: Access and role matrix; identity lifecycle; privileged approvals; emergency logs; event-time authority checks.

47.3 Supply-chain and dependency integrity

The organisation shall maintain a relevant inventory of digital components and dependencies, their provenance, supported versions and channels for vulnerability information. Disposition shall consider actual exposure, exploitability, safety consequences and available protection. An inventory is not proof that every component is secure. Supplier changes, unsupported software and inaccessible update mechanisms shall trigger technical and continuity review. The organisation shall identify the actual party responsible for remediation and for informing affected users.

Required evidence: Dependency inventory; provenance; vulnerability assessment; support commitments; remediation and notification records.

47.4 Connected production and operational technology

Connected equipment shall protect authorised machine programmes, process parameters, monitoring data and essential functions. Segmentation, access, backup, monitoring and degraded operation shall be selected according to the actual process risk. Patches and security tools shall be assessed for compatibility with timing, safety and production qualification. When immediate change is inappropriate, a documented compensating-control decision shall have an owner, limits and review. Operational continuity shall not excuse unbounded unsupported risk acceptance.

Required evidence: Operational-technology architecture; authorised configuration; patch review; compensating controls; restoration tests.

47.5 Update trust and cryptographic transition

Updates shall verify origin, integrity, authority, compatibility and intended target configuration. The organisation shall control signing and other trust dependencies, key custody, expiry, revocation and migration. A future algorithm transition shall be planned according to product life and actual risk; this standard does not declare a particular algorithm universally suitable. Recovery and rollback shall not silently reintroduce an unacceptable vulnerability. Evidence-preservation needs shall be considered separately from live-system authentication.

Required evidence: Update trust model; key and certificate governance; interruption/rollback tests; migration and archival-validation plan.

47.6 Incident recovery and assured return

Incident handling shall preserve evidence, contain affected use, identify impacted products and decisions, notify responsible parties and control restoration. Returning a service to availability shall be separated from verifying its data and configuration integrity. Exercises shall test recovery objectives and the meaning of restored records. Missing original evidence shall remain a gap in the dependent conclusion. An incident closure shall include the actual technical return authority and follow-up actions, not only a completed support ticket.

Required evidence: Incident and affected-output record; integrity checks; recovery exercise; authorised return and continuing actions.

48 Supply networks, authenticity and obsolescence

Application: This clause applies to procurement, outsourced work, distribution and multi-tier support within the declared responsibility. Internal alignment: Clauses 5.5, 11.3, 18.4 and 30; AF 9100:2026 Clauses 21 and 27.

48.1 Critical suppliers and actual performers

The organisation shall identify suppliers and sub-tier performers according to the technical consequence of their outputs. The scope shall record what each party actually performs, where it operates, its competent personnel, process or method capability and necessary evidence access. A trading or coordinating organisation shall not claim direct performance of outsourced work. Shared ownership, customer nomination or another certificate shall not remove the commissioning organisation's retained acceptance and oversight responsibilities.

Required evidence: Supplier/performance map; criticality; exact capability checks; retained-responsibility and access records.

48.2 Flow-down and acknowledgement

Purchasing and subcontract terms shall transmit relevant specifications, configuration, quality and safety conditions, changes, inspection, evidence, notification and retention duties to the actual level of performance. The organisation shall verify acknowledgement and implementation, not only that standard terms were attached to a purchase order. Conflicting instructions shall be resolved before dependent work. Onward delegation and substitution shall be controlled, with technical acceptance distinct from commercial approval.

Required evidence: Requirement flow-down matrix; sub-tier acknowledgement; actual implementation checks; controlled substitution.

48.3 Provenance and counterfeit prevention

Inputs shall retain verifiable source, lot or serial identity, condition, life status and relevant conformity evidence. Suspect, altered or counterfeit items shall be segregated and traced through potentially affected outputs. Investigation shall preserve originals and avoid treating suspicion as a final misconduct finding before sufficient review. A visually convincing certificate, searchable identifier or supplier logo shall not establish authenticity. Source changes and exceptional procurement shall receive risk-based technical review.

Required evidence: Provenance and receipt records; authenticity checks; suspect-item containment; affected-output and investigation history.

48.4 Split, merge, logistics and storage

Material and part identity shall survive split lots, repackaging, kitting, pooling, return and transport. Quantities, units, ownership or custody and relevant environmental conditions shall reconcile. A quantity balance does not by itself prove correct identity or suitability. Shelf life, out-time, damage and transport excursions shall remain attached to the actual items. Customer-selected or supplied material shall be clearly identified, with limitations on the organisation's independent source claims.

Required evidence: Movement and genealogy record; quantity reconciliation; storage/transport conditions; excursion and eligibility decisions.

48.5 Diminishing sources and replacement evidence

The organisation shall plan for unavailable suppliers, obsolete parts, unsupported software and loss of technical knowledge. Replacement shall examine function, interfaces, materials, process differences, qualification and life evidence. A physically interchangeable part shall not automatically be technically equivalent. The review shall define retained evidence and additional demonstration before release. Support contracts and access arrangements shall be assessed for actual continuity, including the possibility of provider cessation or inaccessible digital tools.

Required evidence: Obsolescence register; substitution/equivalence argument; additional qualification; support and access plan.

48.6 Performance, transfer and exit

Supplier monitoring shall include adverse results, changes, delivery and technical performance using defined populations and denominators. A systemic failure shall trigger review of dependent sources and products, not merely reassignment to a new supplier. Transfers shall verify receiving capability and preserve open findings, technical restrictions and historical records. Exit shall identify remaining warranties, notifications, record custody and unresolved obligations. Changing a supplier or issuer shall not make unsupported evidence valid.

Required evidence: Supplier performance review; systemic extent; transfer acceptance; open-duty and custody records.

49 Maintenance, continuing assurance and asset evidence

Application: This clause extends F06 through-life integration without enlarging statutory maintenance or design privileges. Internal alignment: Clause 22; AF 9100:2026 Clauses 15.6 and 21.

49.1 Exact capability before accepting work

The maintenance organisation shall define the facility or station, aircraft, engine, component or asset family, actual tasks and limitations. New capability shall be demonstrated through current technical data, competent authorised people, suitable tools, parts, facilities, inspection and release arrangements. An organisation-wide result shall not cover an unassessed station or task. Advisory technical support, design work, training and laboratory testing shall retain their separate scope and evidence requirements.

Required evidence: Facility/type/task capability; new-capability dossier; actual permissions; separate service boundaries.

49.2 Work planning from the actual asset

Work packages shall be based on verified identity, configuration, history, applicable life limits and current authorised technical data. They shall identify task sequence, inspection independence, required measurements, parts, hold points and completion evidence. Ambiguous instructions or incomplete history shall be resolved or explicitly held before dependent use. A generic maintenance schedule or a commercially urgent request shall not replace an asset-specific technical and release basis.

Required evidence: Asset baseline; current-data check; task and hold-point plan; resolved-history and instruction gaps.

49.3 Execution, interruptions and human factors

The organisation shall record contemporaneous task performance, actual observations, deviations, rework and independent checks. Interrupted work and shift handovers shall retain unfinished conditions, removed protections, tools, parts and next actions. Fatigue, workload and communication shall be addressed in the actual work design. A later signature shall not make an unobserved step contemporaneous. Repeated tests shall retain earlier failures and changed configurations so that the final reviewer can reconstruct the actual work.

Required evidence: Attributable task records; interruption and handover log; independent checks; original and repeated evidence.

49.4 Parts eligibility and life history

Removed and installed parts shall retain origin, condition, life status, prior repair and configuration links. Missing history shall not be reset or inferred from a successful bench test. Parts recovered from storage or dismantling shall undergo the applicable eligibility process. Unserviceable and scrap items shall be controlled against unauthorised re-entry. External process or NDT evidence shall match the actual item, method, site and period on which the maintenance decision relies.

Required evidence: Removal/installation genealogy; eligibility review; life and repair record; linked process/test evidence; scrap controls.

49.5 Release, restrictions and receiving information

Final review shall verify completed requirements, independent inspections, authorised repairs or deviations, restored protective features, final configuration and remaining limitations. The authorised release function shall act within actual privileges. ASTRA recognition shall not replace the maintenance release. The receiving party shall obtain information needed for continued operation and support, including restrictions and unresolved duties. An invoice, service-completion percentage or portal status shall not be treated as the technical release instrument.

Required evidence: Final technical review; release authority; actual release record; receiving handover and limitations.

49.6 Condition monitoring and long-term support

Reliability analysis, remote diagnosis and predictive maintenance shall use valid data and models with a stated decision boundary. Changes in duty, missing history or insufficient detection shall trigger review. Mandatory inspections and life limits shall not be removed by a favourable trend without the required technical authority. Fleet, lease and provider transitions shall preserve actual configuration and historical restrictions. Support service restoration shall include evidence integrity, not only renewed portal availability.

Required evidence: Validated monitoring and analysis; interval/life decisions; asset transition records; support continuity and integrity checks.

50 Airports, vertiports and spaceport service integration

Application: This clause coordinates F05 with supporting F06, F07 and F08 activities. It does not merge independent operators or confer site licences. Internal alignment: Clauses 1.4–1.6, 21 and Annex K; AF 9100:2026 Clause 15.5.

50.1 Site-specific operating baseline

The operator shall define the actual site, infrastructure, permissions, operating characteristics, users, relevant conditions and responsibilities. The baseline shall distinguish conventional aerodromes, heliports, vertiports, spaceport interfaces and shared civil/military use. Each materially different activity needs an appropriate technical supplement and competent evaluation before inclusion. Group governance may be shared, but each site's delivery capability shall be demonstrated. The geographic presence of a tenant shall not place its entire operation inside the airport's ASTRA outcome.

Required evidence: Site and activity baseline; permissions; supplement applicability; operator/tenant boundary.

50.2 Infrastructure condition and usable information

Inspection and defect management shall connect actual airside, terminal, utility and technical-facility conditions to operational information, restrictions, repair and verified restoration. Relevant operating periods, adverse weather, peak loads and degraded states shall be considered. Current information shall reach the responsible users through controlled interfaces. A completed inspection checklist shall not prove that an observed defect was communicated, protected or corrected. Necessary site-specific technical thresholds belong to the approved operating basis.

Required evidence: Inspections; defect-to-restriction trace; actual notices; repair and restored-condition evidence.

50.3 Construction and operational change

Changes involving infrastructure, aircraft or vehicle interfaces, equipment, digital services, energy or operating patterns shall undergo integrated impact review before use. The review shall address temporary conditions, contractors, cumulative effects and interfaces with ongoing operations. Hidden work and protective functions shall be verified before concealment or handover where required. Commercial completion of construction shall be separated from technical acceptance and operational readiness of the receiving site.

Required evidence: Change and temporary-condition review; contractor interfaces; commissioning; receiving operational acceptance.

50.4 Coordinated emergency and continuity

The operator shall establish actual arrangements with relevant emergency and continuity providers, including communication, access, equipment, competence and availability. Safe exercises shall test coordinated performance and weaknesses, not only participation. Dependencies on utilities, digital services and specialist providers shall be examined. The ASTRA assessor shall evaluate the evidence of coordination without assuming command of public emergency functions. Unavailable essential response capacity shall remain a limitation in the affected scope.

Required evidence: Emergency/continuity responsibilities; availability; exercises; corrective closure; declared limitations.

50.5 Passenger, accessibility and service interfaces

The service system shall define passenger information, accessibility, baggage, public-area condition, sanitation and disruption-recovery duties within the operator's control. Measures shall use stated populations, time windows and exclusions without overriding safety priorities. Evidence shall include actual delivery under peak and disrupted conditions. Outsourced delivery shall retain the actual performer and the operator's coordination duties. A service rating shall not imply assessment of every independently operated airline or contractor.

Required evidence: Service and accessibility commitments; representative delivery records; contractor controls; incident and recovery evidence.

50.6 Integrated but separate outcomes

A combined assessment may share identity, governance, selected data and visits after relevance review. It shall retain separate technical profiles, local evidence, competence and independent outcomes for site capability, maintenance, handling and environmental statements. A common utility or data failure shall trigger review of every dependent scope. A favourable environmental result shall not compensate for an operational deficiency, and an airport inventory shall not be presented as the footprint of all flights using the site.

Required evidence: Cross-family evidence map; separate scope decisions; common-failure review; bounded public claims.

51 Ground operations, navigation support and network continuity

Application: This clause develops the existing G01–G09 service tracks without creating general airline-operating or public-security authority. Internal alignment: Clause 23; AF 9100:2026 Clauses 15.5 and 24.

51.1 Headquarters and actual station delivery

The provider shall identify headquarters controls, legal entities, stations, service tracks, actual performers and local variations. Each included station shall demonstrate suitable people, instructions, equipment, customer interfaces and permissions. Common manuals shall be translated into verified local implementation. A network name, booking platform or coordination contract shall not establish direct capability at every location. New stations and materially different services shall receive the required assessment before expanded claims are used.

Required evidence: Provider/station/service matrix; local-variation records; actual capability; extension decisions.

51.2 Turnaround and ground handling

Declared handling tasks shall have current technical data, competent roles, equipment compatibility, handover rules, hold points and exception reporting. Evidence shall represent relevant peak, disrupted and shift-change conditions. The provider shall preserve discrepancies and actual task completion rather than infer completion from an aircraft's departure. The standard does not supply loading, pushback or de-icing recipes. These operations remain governed by their applicable authorised technical procedures and operational responsibilities.

Required evidence: Task and interface plan; personnel authority; actual representative records; exception and receiving acknowledgements.

51.3 Cargo, energy and specialist support

Cargo, mail, fuel, energy, catering, cabin and sanitation services shall maintain the controls appropriate to their actual task. Identity, custody, contamination, time or temperature, equipment condition and release interfaces shall remain traceable. Hazardous or specialist tasks require relevant competence and permissions. A general quality-system result shall not establish every service capability. Environmental excursions and source defects shall be connected to affected consignments, deliveries or aircraft and communicated to responsible recipients.

Required evidence: Exact service scope; custody and condition; specialist authority; affected-delivery and notification records.

51.4 Flight and navigation-support data

Specialist support shall define data origin, transformation, units, reference systems, timestamps, timeliness, integrity and the user's permitted reliance. Wrong, missing, late and superseded information shall be included in validation. The organisation shall distinguish advice, data provision and actual operational authority. Availability alone shall not demonstrate correctness. Necessary dedicated criteria and permissions shall exist before a communications, navigation, surveillance or meteorological-support claim is admitted to the active scope.

Required evidence: Specialist profile; source-to-user data trace; timing and error-handling validation; actual permissions.

51.5 Digital platforms and protected security services

Digital service providers shall identify deployed configurations, dependencies, users, data rights, security, fallback and termination arrangements. Integrated third parties retain separate responsibility for their outputs. Specialist security evaluation shall protect sensitive operational information while enabling sufficient authorised evidence review. Neither platform connectivity nor an ASTRA credential transfers public security powers. An unavailable essential capability shall be held or excluded, not accepted on a broad corporate declaration.

Required evidence: Platform/service boundary; dependency and access controls; validated fallback; protected specialist review; precise claims.

51.6 Shared failure and service restoration

Network monitoring shall use defined incident, delay, damage, complaint and control-performance populations. A headquarters or shared-platform failure shall be traced across dependent stations. Restoration shall verify data and configuration integrity, local readiness, provider interfaces and receiving acknowledgement. Deleting an affected station from a dashboard shall not erase the historical failure or its systemic implications. Service availability and ASTRA status shall remain separately controlled by the relevant technical and independent authorities.

Required evidence: Network indicators; common-cause extent; local restoration checks; truthful history; separate service and status decisions.

52 Education, training and workforce knowledge

Application: This clause connects the existing F04 programme route to technical workforce development without converting education recognition into a professional licence. Internal alignment: Clauses 7 and 20 and Annexes D and J.

52.1 Programme and learner boundaries

The provider shall identify the actual programme, discipline, level, curriculum version, completion routes, delivery modes, campuses and partners. The intended educational or professional purpose shall be coherent with assessed outcomes. A recognised programme shall not imply recognition of every programme in the institution or authority for every graduate to perform restricted work. Short courses, vocational pathways, degree programmes and continuing development shall retain distinct boundaries and appropriate evidence requirements.

Required evidence: Programme profile; lawful award basis; delivery map; completion routes; accurate learner information.

52.2 Future skills with demonstrated outcomes

The curriculum shall address the knowledge and practical abilities required for its actual discipline and level, including relevant digital, analytical, systems, ethical and communication responsibilities. Future-technology content shall distinguish awareness from demonstrated practical capability. The provider shall map outcomes to instruction, assessment, direct learner evidence and accountable academic review. A fashionable topic, course title, contact-hour total or attendance record shall not establish attainment of a defined technical skill.

Required evidence: Outcome-curriculum-assessment map; level and workload rationale; authentic learner work; reviewed future-skill claims.

52.3 Practical learning and assessment integrity

Practical work shall use suitable equipment, current methods, safe supervision and representative tasks. Simulation or remote laboratories shall have a justified educational role and shall not replace essential hands-on competence without a valid basis. Assessment shall establish learner identity and authorship, including when AI tools are permitted. Rubrics, essential steps, moderation and resit rules shall be fixed in advance. Failed essential skills shall not be averaged into a completion decision.

Required evidence: Practical-task and safety plan; assessment blueprint; authenticity checks; observed essential steps; preserved attempts.

52.4 Instructors, placements and technical currency

Educators, laboratory staff and placement supervisors shall demonstrate relevant knowledge, teaching and assessment competence and current practice appropriate to their task. Workload and replacement arrangements shall sustain delivery. Industry placements shall identify the real supervisor, permitted tasks, safety controls and evidence of the learner's contribution. An employer endorsement or instructor title alone shall not demonstrate either learner attainment or the supervisor's competence in every specialist domain.

Required evidence: Staff role and currency records; placement agreement; supervision; direct learner contribution; continuity plan.

52.5 Attainment, improvement and learner protection

Programme conclusions shall rely on authentic delivery and assessment evidence for every claimed completion route. Where sufficient completed evidence is absent, only the permitted developmental readiness result shall be used. Improvement shall connect identified weakness, educational cause, action and subsequent comparable outcomes. Changes, closure or loss of status shall protect learner records, communication and teach-out or transfer. Survey satisfaction and a favourable cohort average shall not replace direct evidence of essential attainment.

Required evidence: Route/cohort attainment; improvement follow-up; readiness limitations; teach-out and historical-record protection.

53 Sustainability, climate and lifecycle stewardship

Application: This clause integrates F08 with technical and operational decisions. It does not create a universal green label or establish technical suitability from an environmental claim. Internal alignment: Clause 24 and Annex L; AF 9100:2026 Clause 20.

53.1 Declared lifecycle and material effects

The organisation shall define the product, asset, service or institutional boundary, functional unit, period and environmental responsibilities. It shall identify material upstream, operational and end-of-life effects relevant to that boundary. Data gaps, allocation, estimates and exclusions shall be transparent. A partial operational inventory shall not be presented as a full lifecycle footprint. Technical safety and quality requirements shall remain active during environmental improvement; an unassessed risk shall not be traded for a favourable metric.

Required evidence: Lifecycle boundary; materiality and category rationale; technical/environmental interface review; disclosed gaps.

53.2 Inventory and comparable reduction

Quantification shall retain actual activity data, suitable factors, units, versions, source quality, corrections and relevant uncertainty. Comparisons shall use a coherent baseline and address structural, methodological and output-mix changes. Absolute and intensity changes shall be reported separately where material. Gross emissions, direct reductions, removals, compensation and avoided emissions shall not be merged into an unexplained net result. Numerical examples in this standard are synthetic and are not real-world factors.

Required evidence: Inventory model; data and factor provenance; baseline/recalculation; separated quantities; uncertainty and claim review.

53.3 Energy attributes and circular resources

The organisation shall distinguish physical material or energy delivery from contractual attributes and identify ownership, eligibility, allocation and cancellation where applicable. Exclusive claims shall not be allocated twice. Material recovery, reuse, repair and circularity measures shall have defined flows and denominators. Internal recirculation shall not be counted repeatedly as new recovered output. Reused safety-critical inputs shall retain identity, life history and technical suitability independently of an environmental benefit.

Required evidence: Custody/attribute ledger; quantity and exclusive-claim checks; material-flow model; technical reuse eligibility.

53.4 Local effects and climate adaptation

Local air, noise, water, spills, biodiversity and climate-resilience conclusions shall use relevant locations, periods, scenarios, receptors, methods and uncertainty. Seasonal and operating variation shall be considered. The organisation shall distinguish a scenario assessment from proof of performance under every future condition. Adaptation decisions shall identify resources, protective measures, dependencies and verification. Changes in infrastructure or material evidence shall trigger review rather than reliance on a permanently unchanged resilience label.

Required evidence: Local-environment methods; scenario and vulnerability basis; adaptation actions; protective verification; review triggers.

53.5 Statements and independent conclusions

Capability recognition, historical verification, prospective validation and verifier accreditation shall remain distinct. Each engagement shall define the statement, criteria, intended users, assurance form, materiality and reporting boundary before substantive work. Errors, omissions, bias and residual uncertainty shall be evaluated independently. A favourable transition-plan review is not an achieved reduction. Later evidence invalidating a historical statement shall lead to appropriate correction and recipient communication without rewriting the original decision history.

Required evidence: Engagement terms; statement versions; misstatement and limitation record; independent conclusion; correction and notices.

54 Safety integration, emergencies and occurrence learning

Application: This clause supports the responsible organisation's safety and mission-assurance controls across all triggered families. It does not prescribe hazardous operational procedures. Internal alignment: Clauses 5.3, 5.6, 14, 21.4 and 26.6; AF 9100:2026 Clauses 11.5 and 19.5.

54.1 Hazards, assumptions and essential controls

Hazard analysis shall identify credible consequences, relevant exposure, uncertainty, common causes and human or organisational dependencies. The organisation shall select methods appropriate to the system and maintain the analysis as the configuration and context evolve. Essential protective controls shall be identifiable and verified. Multiplying ordinal severity and likelihood categories shall not be presented as a physical probability or used to hide an unassessed severe consequence.

Required evidence: Hazard log; analysis basis; essential-control map; uncertainty and independent technical challenge.

54.2 Stop authority and escalation

Responsible personnel shall be able to stop or restrict affected work when an essential protective condition is absent or credible serious concern arises. The organisation shall define who can authorise temporary protection, technical restart and independent status decisions. Those roles shall not be confused. Urgent action shall preserve evidence and comply with the existing notification clocks in Clause 14 and Annex H. Debate about finding classification shall not delay necessary protection.

Required evidence: Stop and duty mandates; actual concern/action times; protection; separate restart and status records.

54.3 Emergency capability and exercises

Emergency arrangements shall identify actual people, communication, equipment, access, external interfaces and limitations. Exercises shall be authorised, safe and representative of the capability being claimed. The organisation shall distinguish discussion-based review from demonstrated operational coordination. Findings shall have accountable correction and follow-up. A planned exercise or signed service agreement shall not count as completed evidence of capability where essential resources were not available or could not perform their assigned role.

Required evidence: Emergency plan; resource availability; exercise design and actual observations; verified corrective action.

54.4 Occurrence, escape and affected population

Investigation shall examine both why an event occurred and why existing controls failed to prevent or detect it. The organisation shall preserve original evidence, competing explanations and uncertainty. Population tracing shall include already delivered products, services, reports and decisions that share relevant causes. Replacing a person or issuing training shall not alone close a systemic weakness in work design, resources, interfaces or measurement. Later correction shall not be backdated to legitimise earlier unsupported work.

Required evidence: Occurrence/escape analysis; population and dependency trace; tested causes; historical impact and recipient action.

54.5 Learning and protected reporting

Reporting routes shall protect good-faith concerns and preserve fair response to allegations. The organisation shall evaluate weak signals, near misses, repeated local failures and suppressive incentives without equating allegation with established misconduct. Lessons shall be translated into verified changes in methods, interfaces, training or assurance criteria through the appropriate controlled process. A declining report count shall not be assumed to demonstrate improvement where reporting access or culture has deteriorated.

Required evidence: Protected intake; impartial investigation; reporting-quality review; implemented and verified lessons.

55 Reliability, availability, maintainability and asset life

Application: This clause governs the definition and use of performance and life claims. It sets no universal failure-rate, reliability or life-extension threshold. Internal alignment: Clauses 9, 18.6 and 26; AF 9100:2026 Clause 11.4.

55.1 Define the claim before the calculation

Every quantitative reliability or availability claim shall identify the population, configuration, operating domain, exposure, duration, failure definition and observation boundary. The organisation shall distinguish predictions, simulations, demonstrations and field observations. Availability shall state which downtime categories are included. A percentage without its denominator, conditions and exclusions shall not be used as acceptance evidence. A changed mission duration or duty shall trigger review of the claim and supporting assumptions.

Required evidence: Metric dictionary; configuration/population; exposure and failure definitions; actual model or observation basis.

55.2 Failure mechanisms and dependencies

The analysis shall consider applicable degradation, common causes, dormant failures, maintenance-induced defects, shared software and external-service dependencies. Independence assumptions shall be justified rather than selected for convenient arithmetic. The organisation shall identify mechanisms not represented by a chosen statistical model and provide complementary engineering evidence. Demonstrating each component independently shall not establish system reliability when common resources or interfaces can defeat several functions simultaneously.

Required evidence: Mechanism and dependency analysis; model assumptions; complementary verification; common-cause review.

55.3 Demonstration and inference limitations

Demonstration plans shall establish prospective acceptance rules, representativeness, sample selection, confidence and treatment of incomplete or failed trials. Rare-event claims shall not be inferred from insufficient routine testing without a defensible statistical and engineering basis. Repeated or dependent observations shall not be counted as independent opportunities without justification. Changes to the article or test conditions shall remain visible. Annex AG illustrates calculation logic using labelled synthetic data only.

Required evidence: Demonstration plan; actual exposure and failures; confidence and dependence basis; qualified inference.

55.4 Maintainability and support conditions

Maintainability shall consider diagnostic capability, access, tools, spares, skills, human error, restoration checks and relevant logistics. Timing results shall identify start and stop definitions and whether administrative or waiting time is excluded. A rapid repair under laboratory conditions shall not be presented as operational support performance without a justified comparison. The organisation shall demonstrate that protective features and the released configuration are restored after maintenance, not merely that the equipment starts again.

Required evidence: Support and repair task analysis; representative time observations; restoration checks; stated exclusions.

55.5 Life decisions and uncertainty

Life-limited and condition-dependent assets shall retain actual service, storage, repair and relevant exposure histories. Remaining-life conclusions shall identify the technical model, inspection capability, uncertainty and responsible authority. Missing history shall not be reset to zero, and a passed functional test shall not erase an unresolved degradation mechanism. Changes in duty, repair or material shall trigger review. ASTRA duration and surveillance dates do not extend the technical life of an item.

Required evidence: Life/exposure record; valid condition evidence; model and uncertainty; actual life decision and restrictions.

56 Digital registry, evidence relationships and portability

Application: This clause consolidates registry, controlled-record and recovery work. It supplements the existing record modules without requiring a particular software product. Internal alignment: Clauses 10, 28 and 31; Annexes M and O; ASTRA-IMP-12 and ASTRA-IMP-316.

56.1 Distinct entities and authoritative records

The information model shall distinguish organisations, people, profiles, applications, assignments, evidence, findings, decisions, credentials, permissions, appeals and status events. Each record shall have a unique identity, version, accountable origin, scope and relevant time basis. A case may support several outcomes, but the conclusion and history of each outcome shall remain separate. Copies and public projections shall identify their relationship to the authoritative source rather than become competing unexplained masters.

Required evidence: Entity dictionary; source-of-record map; relationships; scope and time conventions; controlled projections.

56.2 Evidence states and requirement conclusions

Evidence receipt, review, purpose-specific acceptance, rejection, supersession and unavailability shall remain distinct from conformity conclusions. A missing essential source shall not become non-applicable because a database field requires a value. Accepted evidence shall state the requirement and configuration it supports and its limitations. An imported identifier shall not be presumed to refer to the correct object or version. Contradictory evidence shall remain visible through the independent review process.

Required evidence: Evidence-purpose links; controlled state dictionary; missing/wrong-version checks; reasoned requirement conclusions.

56.3 Decision and publication safeguards

The workflow shall test valid scope, complete evidence, fulfilled criteria, closed findings, current competence, case independence and actual authority before publishing a positive outcome. Where a three-person panel is required, all eligible participation and votes shall be recorded. An automated check may flag or block a proposed instruction but shall not create the independent technical decision. Public information shall match the authorised decision and preserve restrictions, expiry and historical gaps.

Required evidence: Decision preflight; authentic decision instrument; panel record where required; public/private reconciliation.

56.4 Validation and prohibited cases

Local validation shall cover normal, boundary, missing, invalid and prohibited inputs in the actual deployment. Tests shall include open findings, expired authority, wrong profiles, broken evidence links, suspended status, duplicate imports and interrupted changes. Expected outcomes shall be defined from the controlling requirements before execution. Synthetic fixtures shall be isolated from live claims. Correction shall be followed by repetition of the original failed test and relevant regression, not merely an assurance that the code was changed.

Required evidence: Local validation baseline; expected/observed cases; defect and retest history; actual acceptance and limitations.

56.5 Export, migration and meaningful recovery

Transfer shall preserve readable evidence, identities, versions, field semantics, units, time zones, approvals, relationships and current and historical status. Reconciliation shall examine meaning as well as counts; equal file totals may conceal substitutions or missing links. Recovery shall distinguish availability from integrity and reconcile events after the selected recovery point. A sent archive is not accepted custody. The receiving function shall demonstrate usable access and acknowledge continuing duties before dependent cutover.

Required evidence: Export manifest; semantic reconciliation; preserved source; recovery integrity; receiving acceptance and custody.

57 Assessor qualification, consistency and operator review

Application: This clause integrates the foundation work on competent assessors, moderated judgement and independent operator oversight. Existing numerical minima remain unchanged. Internal alignment: Clauses 6–7 and 29; Annex D; ASTRA-IMP-10, ASTRA-IMP-13 and ASTRA-IMP-14.

57.1 Role-specific competence and scope

The operator shall map actual assessment tasks to verified discipline, method, language, consequence and judgement requirements. Audit leadership, technical evaluation, independent review, decisions and appeals shall remain separate authorisations. Learning attendance and numerical experience minima shall not replace observed ability. A person competent in one method or programme shall not be assigned unrestricted aerospace authority. The case plan shall identify necessary specialists and limits before accepting the work.

Required evidence: Task-to-role and person matrix; verified entry evidence; observed performance; bounded authorisation.

57.2 Initial cadre and equivalent prior work

Where an established assessor population is unavailable, the initial-candidate process in Clause 7.4 and Annex D shall apply. At least two independent competent professionals shall evaluate the relevant role and technical demonstration. Prior experience may satisfy specified elements only through an evidenced equivalence review. Programme knowledge, witnessed performance and independence shall not be waived. Founding status, honorary title or reciprocal approval shall not create an assessor credential.

Required evidence: Initial-panel competence/conflicts; criterion-by-criterion equivalence; witnessed task; independent qualification decision.

57.3 Practical assessment and maintained practice

Knowledge and practical criteria shall be defined before evaluation. Essential safety, integrity and independence steps shall be separately passed. Mentored work shall identify what the candidate actually performed and what remained supervised. Continuing development, recent practice, observed performance and review feedback shall maintain the authorisation. Unmet minima or loss of currency shall suspend independent role use until the required supervised reactivation. Later renewal shall not validate prior work performed outside authority.

Required evidence: Blueprint and attempts; mentored-work records; continuing practice; suspension/reactivation; historical impact review.

57.4 Consistency without coerced agreement

The programme shall use independent first responses to representative anonymised cases, followed by comparison of reasoning, evidence and outcome. Moderation shall distinguish unclear criteria, different facts, missing expertise and legitimate technical disagreement. A majority answer shall not become technical truth by itself. Quantitative agreement measures shall state their design and limitations and shall not be equated with correctness. Lessons affecting requirements shall follow controlled interpretation or version rather than informal instruction to produce uniform results.

Required evidence: Exercise design; independent responses; moderated reasoning; disagreement causes; controlled learning actions.

57.5 Independent accrediting-operator review

The independent operator review shall examine actual governance, competence, impartiality, technical methods, resources, case trails, decisions, remedies and registry integrity. Reviewers shall be genuinely independent and have adequate protected evidence access. The interval and pre-launch requirements in Clause 29.3 remain controlling. Review findings shall have verified correction and a bounded report. Completion of this internal programme review shall not be represented as external recognition or universal international acceptance.

Required evidence: Independent mandate and reviewers; actual case sampling; findings/closure; bounded report and continuing actions.

58 Integrated assessment, readiness and decision integrity

Application: This clause joins the common assessment process with the expanded technical modules. It does not reduce established gates or merge distinct outcome classes. Internal alignment: Clauses 11–16; Annexes C–I and P; ASTRA-IMP-11 and ASTRA-IMP-15.

58.1 One scope tuple for each conclusion

Before assessment, record the legal entity, actual performer, object, family/module, site, method or task, configuration, period, consequence, profile version and exclusions. Every requested conclusion shall have its own tuple and outcome class. Common evidence may be shared only after relevance review. An integrated proposal shall not become one unrestricted certificate. Unknown essential scope parameters shall be resolved before the programme accepts an evaluable live application.

Required evidence: Scope tuples; independent requested outcomes; profile completeness; justified evidence-reuse map.

58.2 Coverage and productive resources

The plan shall provide competent coverage of necessary sites, methods, shifts, delivery modes, configurations and adverse cases. Resources shall follow actual work, not a commercial target. The eight-hour evaluator-day and separate reporting/review resources remain governed by Clause 12.4; AF 9100 organisational rules apply only to their route. A trainee or second passive observer shall not be counted as additional productive technical coverage. Necessary omitted observations shall require more work or a restricted conclusion.

Required evidence: Work breakdown; person/task coverage; site/method witnesses; actual productive time and changes.

58.3 Vertical trails and shared failure

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.

58.4 Independent review and non-compensable gates

The decision dossier shall reconcile scope, authority, competence, independence, coverage, method validity, evidence, uncertainty, findings and claims. Positive grant, renewal or extension requires every applicable gate, including closure of all in-scope nonconformities. A favourable total score, environmental achievement or majority vote shall not supply missing technical evidence. Evaluation and final decision shall remain appropriately separated. The actual decision date shall not be replaced by a ceremony, invoice or file-generation date.

Required evidence: Versioned independent-review dossier; gate conjunction; panel participation; actual reasoned decision and claim.

58.5 Continuing status and real chronology

Surveillance, change, renewal, suspension, restoration and withdrawal shall preserve the controlling clocks in Clause 16 and Annex H. Booking an assessment is not its completion. Restoration does not extend original expiry without the required renewal or validate a suspended interval. Historical instance results shall retain their object and period rather than acquire a fictitious ongoing validity. Public status, urgent notices and protected case history shall remain consistent after every material event.

Required evidence: Authoritative cycle baseline; actual completions; status events; preserved gaps; notifications and public reconciliation.

59 Future technology and responsible innovation

Application: This clause provides a controlled path for emerging needs within the existing architecture. Development topics are not active scopes merely because they appear here. Internal alignment: Clauses 4 and 26; AF 9100:2026 Clause 20.6.

59.1 Need, benefit and foreseeable consequences

A development proposal shall state the problem, intended beneficiaries, expected benefit, foreseeable harm, affected people, technical owner and evidence gaps. It shall identify the existing family and object route or justify a separately governed architectural change. The review shall consider technical feasibility, safety, privacy, misuse, access and resources. A projected market or ambitious technology label shall not establish that the proposed method can produce a valid independent conclusion.

Required evidence: Development brief; family/object mapping; benefit and harm review; feasibility and evidence-gap assessment.

59.2 Distinguish research, pilot and operational use

Readiness descriptions shall identify what has actually been demonstrated, under which conditions and with what limitations. Research success, laboratory demonstration, restricted pilot, qualified process and operational service shall remain distinct states. Each transition shall have an evidence and authority gate. A prototype may proceed within a safe approved development boundary without a conformity claim. Operational deployment shall not be justified solely by completion of a research milestone.

Required evidence: Demonstration-state register; actual observations; transition criteria; bounded pilot and release decisions.

59.3 Emerging domains and evidence gaps

Candidate topics may include new propulsion and energy architectures, advanced materials, adaptive manufacturing, autonomous services, distributed space systems, remote habitation and evolving digital trust mechanisms. These are development directions, not forecasts of maturity or promised programme releases. The technical owner shall determine their specific hazards, dependencies, measurement needs, assessor competence and acceptance criteria. No universal test recipe or claim of future readiness shall replace a completed technical profile.

Required evidence: Topic-specific profile development; hazard and evidence analysis; competence feasibility; prospective acceptance basis.

59.4 Safe experimentation and independent challenge

Experimental work shall have authorised boundaries, competent specialists, protections, monitoring and stop conditions suitable for its consequence. The organisation shall state which actions are reversible and which create irreversible commitments. Independent challenge shall examine weak operating history, unobserved failure mechanisms and optimistic assumptions. Synthetic or simulated results shall be identified. A restricted experiment shall not silently expand into normal production or passenger, crew or public exposure without the relevant evidence and permissions.

Required evidence: Experiment authorisation; safety and observation plan; independent review; exact limitations and stop decisions.

59.5 Learning, consultation and controlled adoption

Pilot results shall be assessed for criterion clarity, technical discrimination, burden, repeatability of judgement and adverse outcomes. Material new requirements shall follow the consultation and approval process in Clause 4.3. Adoption shall state which profiles, people, tools and holders are affected and preserve previous decision bases. Horizon scanning shall inform a maintained development portfolio, but shall not be used to impose unconsulted requirements or advertise unavailable accreditation routes.

Required evidence: Pilot findings; reasoned versions; consultation and ballot records; transition plan; truthful availability catalogue.

60 Integrated roadmap and implementation architecture

Application: This clause consolidates the initial eight-work-package roadmap and later foundation work. Sequence may be adapted to actual dependencies; no fixed implementation calendar or automatic outcome is promised. Internal alignment: Clause 31, Annex Q, AF-AST-ML-001 and ASTRA-IMP-10–16.

60.1 Foundation and retained architecture

Implementation shall begin with the actual scheme owner, legal operator, responsibilities, permissible outcome names and controlled requirements. Preserve F01–F08 and the original code-to-subject relationships. The 68 retained technical development subjects and the 108-title base documentation architecture are organising inventories, not measures of competence or proof of activation. A separate programme family shall not be created merely because a technical topic needs more detailed guidance or a dedicated local profile.

Required evidence: Authority and compatibility review; retained architecture; controlled source inventory; development versus activation status.

60.2 Common operating system and competent people

Establish the common processes for application, scope, impartiality, resources, evidence, findings, decisions, remedies, records and continuity. Assign real accountable owners and evaluate people for their actual roles. The foundational assessor, profile, registry, operator-review, consistency, surveillance and publication workpacks may support implementation without replacing the core requirements. A prepared form or completed training session shall not establish that the corresponding operational process has been implemented and independently verified.

Required evidence: Working process owners; competent role assignments; authentic operating trails; validated records and controls.

60.3 Family and technical-profile development

Develop each family route against its exact objects, sites, methods, levels and service conditions. F03 provider competence, F04 education, F05–F07 operations, F08 statements and F01/F02 system/process work may progress in parallel when dependencies are met. The application schedule shall complete measurable or defined attribute criteria, methods, uncertainty, witnesses, independence, duration and permissible claims. Missing essential parameters keep the particular profile in development without preventing unrelated complete profiles from progressing.

Required evidence: Completed Annex C payload; family-specific criteria; application schedule; technical and independent completeness review.

60.4 Integrated pilots and local system acceptance

Before live scope release, perform representative technical and workflow pilots and verify correction of blocking findings. Test actual source access, assessment coverage, adverse results, conflicts, independent decisions, public claims and recovery. Local system validation shall test the actual deployment, not only a reference workbook. Synthetic cases support logic checks but shall not be represented as genuine applicants or field validation. Readiness conclusions shall state precisely which capabilities have been demonstrated.

Required evidence: Pilot plans and executed evidence; findings/retests; local validation; bounded readiness report.

60.5 Controlled launch, surveillance and evolution

Launch shall identify exact active profiles, authorised operators, competent resources, terms, public claims and operational effectivity. Scope availability shall follow real release decisions. Continuing review shall monitor technical validity, independence, changes, outcomes, access and resources rather than certificate volume alone. The programme shall maintain usable historical records, controlled version and responsible closure. A later expansion shall preserve earlier code meanings and undergo its own compatibility, technical and activation review.

Required evidence: Actual activation; public availability; surveillance and independent review; version /transition and closure records.

61 Edition control, adoption and publication integrity

NORMATIVE REQUIREMENTS

Application: This clause controls publication identity, authorised distribution, applicable requirement status and the distinction between document release and operational scope activation.

Accountable functions: Standards Secretariat; institutional publication authority; independent technical readiness reviewer.

61.1 Publication identity

The display title shall be ASTRA with AEROSPACE STANDARD directly beneath it. The standard identifier shall remain AF ASTRA-100:2026 and the document code AF-AST-STD-001. The displayed edition shall be FIRST EDITION and the displayed publication date 30 September 2026. These labels shall not be substituted for an actual technical approval, contract effectivity, operational permission or conformity-decision date.

Verification: Compare cover, identity page, headers, metadata and controlled publication record.

Acceptance / hold rule: Identity fields agree. A publication date alone provides no evidence of adoption or operational authority.

61.2 Integrated requirements and status distinctions

Clauses 0–80 and Annexes A–AR form the integrated requirement and guidance framework. The status stated at each annex heading identifies its normative controls and informative material. Publisher acceptance authorises release of the text; technical adoption, method validation, operating authority and individual scope activation remain separately evidenced. Informative application guides, worked records and pilot guidance in Annexes AS–AU explain the existing requirements and do not introduce additional programme families or waive a mandatory gate.

Verification: Review the publication-status record, annex designations and the actual technical adoption and activation dossier.

Acceptance / hold rule: Publication, technical adoption, field validation and operational activation are recorded as distinct decisions. No unsupported approval or retrospective operating status is asserted.

61.3 Dependent documents and compatibility

The responsible custodian shall identify every affected profile, manual, procedure, checklist, form and register before use of this text. Existing 108-title architecture and F01–F08 codes shall remain stable. Newly added requirements shall be mapped to the actual dependent documents; a previous checklist shall not be assumed to cover them. Actual constitutional and legal obligations remain separately applicable.

Verification: Reconcile the dependency register against selected requirements and operating versions.

Acceptance / hold rule: Every required operating document is available, consistent and authorised for the intended use. Unresolved conflicts place dependent use on HOLD.

61.4 Actual approval and activation

The adoption dossier shall retain the proposed text, consultation, comment dispositions, valid technical decision, institutional authority, operator identity and exact scope activation. Real signatories and event timestamps shall be recorded when the events occur. A blank, generated or copied signature shall not be used as an approval. Technical and institutional release shall remain separate from the acceptance of a particular applicant.

Verification: Trace the authorisation chain and independently verify each necessary approval.

Acceptance / hold rule: All triggered gates in Clause 4 and Annex P are satisfied before live scope use; otherwise the affected scope remains unavailable.

61.5 Correction, custody and file integrity

The custodian shall retain controlled source versions, change reasons, affected requirements and distribution records even though no numbered change label appears on the publication. Corrections shall not erase historical decisions. The issued PDF shall have complete content, readable figures, working navigation and an identifiable master. Removal of publication labels shall not remove record timestamps, method versions or technical configuration controls.

Verification: Reconcile the final file with its manifest and inspect content, navigation and correction records.

Acceptance / hold rule: No missing section, contradictory edition field or unreadable essential figure; the original evidence and actual history remain retrievable.

62 Requirement specification and deterministic decision logic

NORMATIVE REQUIREMENTS

Application: Applies to every ASTRA requirement, technical profile, calculation and acceptance decision; supplements Clauses 1, 4, 9 and 15 and Annexes C and G.

Accountable functions: Requirement owner and technical authority; independent reviewer; authorised decision maker.

62.1 Atomic requirement record

Each assessed requirement shall have a stable identifier, one accountable owner, an applicability trigger, defined object and configuration, required behaviour or characteristic, observable conditions, verification method and acceptance predicate. Compound statements shall be separated into individually testable rows without deleting any condition. Terms such as adequate, suitable, promptly or representative shall be resolved through the explicit records in this clause before they support an acceptance decision.

Verification: Inspect each requirement row and its linked method, boundary and predicate.

Acceptance / hold rule: Every applicable row is evaluable without inventing an object, limit, observation or decision role. Unresolved essential terms result in HOLD.

62.2 Mandatory parameter completion

An application-dependent value shall be entered in a controlled parameter schedule before the relevant test or evaluation. Each entry shall state symbol, meaning, unit, inclusive or exclusive bounds, uncertainty treatment, operating modes, technical derivation, source evidence, approver and change trigger. A declared value is not adequate merely because the applicant selected it. The independent reviewer shall challenge whether it bounds the claimed environment and consequence.

Verification: Recalculate derivations and check mission, interface and obligation coverage.

Acceptance / hold rule: The complete parameter set is approved prospectively. A blank, TBD, unsupported factor or undefined threshold blocks the dependent release.

62.3 Evidence validity before conformity

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.

62.4 Four requirement states

A requirement state shall be PASS, FAIL, HOLD or N/A. PASS means the approved predicate is satisfied by valid evidence. FAIL means valid evidence demonstrates that the predicate is not satisfied. HOLD means applicability, method, evidence, uncertainty or authority is not sufficiently resolved. N/A means the trigger and retained responsibility are absent and independent approval of that exclusion is recorded. Missing equipment, budget, access or time shall not justify N/A.

Verification: Execute the truth table in Annex AL using actual scope and evidence.

Acceptance / hold rule: Exactly one current state is assigned with reason and traceable evidence. All earlier states are retained.

62.5 No compensation or favourable default

A positive conformity decision shall require PASS for every applicable mandatory requirement, closure of every in-scope nonconformity, valid independent competence and actual authority. N/A rows shall have approved reasons; HOLD and FAIL rows shall not contribute a favourable default. Weighted scores, averages, majority votes, programme membership or good results in another discipline shall not compensate for an unmet condition.

Verification: Reconcile the complete requirement population with the decision dossier; test missing and negative cases.

Acceptance / hold rule: The Boolean conjunction in Annex AL is true. Otherwise no positive grant, renewal or extension is permitted.

62.6 Exceptions, tailoring and unresolved conflict

An exception shall identify the affected requirement, technical basis, permissible authority, scope, consequence and independent review. It shall not waive a mandatory ASTRA gate or an applicable binding obligation. Tailoring shall define how a requirement is met in the actual application, not silently remove it. If two applicable requirements cannot both be satisfied, the responsible authorities shall resolve the conflict before dependent work; an assessor shall not choose the easier rule.

Verification: Review each exclusion, alternative method and concession against controlling requirements.

Acceptance / hold rule: No unapproved exception or unresolved conflict affects a positive conclusion; any known departure remains visible in its separate technical disposition.

62.7 Decision replay and consistency

A decision shall be reproducible from the same frozen requirements, parameter values, original evidence, calculation version, uncertainty model and role assignments. Two competent reviewers reaching different results shall identify the differing input, predicate, assumption or expertise before closure. Interpretation records may clarify a term but shall not change limits after results are known. Equation inputs shall retain unrounded values.

Verification: Independently replay a selected boundary case and reconcile every difference.

Acceptance / hold rule: The replay produces the same supported state, or the case remains HOLD pending a controlled technical resolution.

63 Complete space-domain applicability and mission boundaries

NORMATIVE REQUIREMENTS

Application: Applies to all space-related activities within the retained families, from terrestrial support through Earth orbit, cislunar space, planetary systems, deep space and future reachable environments.

Accountable functions: Mission owner; systems engineering lead; family technical owner; independent scope reviewer.

63.1 Domain selection without geographic omission

The mission owner shall assess every domain in Annex AK and record applicable, not applicable or not yet determined. The scope shall include terrestrial preparation, launch and recovery interfaces as well as the in-space activity. Earth orbit, cislunar and libration-region operations, solar and planetary missions, small bodies, ocean-world exploration and interstellar precursor concepts shall not be excluded solely because they differ from conventional satellite operations.

Verification: Compare the mission concept and responsibility map with all Annex AK domain rows.

Acceptance / hold rule: Every domain has a reasoned disposition. Any unassessed domain that can affect a required outcome remains HOLD.

63.2 Object and activity rather than a universal label

The claimed object shall be identified as a system, subsystem, component, material, process, service, facility, software artefact, person, educational programme, assessment provider or statement. Record what is designed, built, tested, operated, maintained or retired, by whom and where. A phrase such as all space, space-qualified or complete mission assurance shall not replace the exact boundaries and limitations of the evaluated object.

Verification: Compare application, technical schedule, evidence and proposed public wording.

Acceptance / hold rule: The object and activities agree throughout the dossier; unsupported sector-wide or geographically unlimited claims are prohibited.

63.3 Environment, phase and mode matrix

For each applicable domain, define mission phase, operating mode, intended duration, exposure, interfaces, repairability, accessible evidence and credible degraded states. Include dormant storage, transport, separation, commissioning, routine service, communication outage, servicing, retirement and loss-of-mission conditions when relevant. A qualification for one phase shall not automatically cover another phase with different loads, resources or observability.

Verification: Review the complete phase-by-mode matrix and its verification links.

Acceptance / hold rule: Every safety-, mission- or claim-relevant cell has accepted evidence or an explicit restriction; no essential unexamined cell is passed by analogy.

63.4 No automatic new programme family

Space-domain tags organise technical applicability within F01–F08. They shall not be counted as additional accreditation families, new public privileges or independently active programmes. The technical owner shall map each space activity to the existing object route and applicable clauses, then define a dedicated profile where the actual method, environment or competence differs. A portfolio listing is not scope activation.

Verification: Check domain tags against family, module, object and activation records.

Acceptance / hold rule: Every granted space scope has a valid family connection and independently complete profile; no authority is inferred from the catalogue.

63.5 Unknown and future environments

For a novel environment or technology, the technical owner shall document known conditions, uncertain mechanisms, missing measurements, model limitations and the evidence needed to resolve them. Restricted research may continue only inside its approved protective boundary. An operational or conformity claim shall not be issued until the essential criteria and evidence are complete. Existing equations shall not be extrapolated beyond their validity without a tested justification.

Verification: Examine novelty analysis, experiment authority and unresolved-condition register.

Acceptance / hold rule: Unknown essential behaviour is not recorded as safe or conforming. Development status and permitted work are explicit.

63.6 Interface and lifecycle closure

The scope shall include relevant upstream and downstream duties, including supplied design data, ground services, communications, receiving facilities, environmental custody and long-term records. Transfers shall identify the sender, receiver, evidence and acceptance. A contractor delivering one subsystem shall not be made responsible for unrelated mission duties, but an integrator shall not exclude duties it retains because they are performed by others.

Verification: Trace each interface to an accountable performer and retained owner.

Acceptance / hold rule: No essential responsibility, evidence handover or terminal obligation is orphaned.

64 Mission architecture and environmental definition

NORMATIVE REQUIREMENTS

Application: Applies before qualification or mission commitment wherever environment, geometry, mission duration or external services determine the evidence needed.

Accountable functions: Mission systems lead; environment specialists; technical acceptance authority.

64.1 Mission environmental baseline

The baseline shall define relevant mechanical, thermal, pressure, radiation, plasma, charging, electromagnetic, contamination, micrometeoroid, dust, gravitational and atmospheric conditions by phase and location. Each selected model or data source shall have identity, applicable domain, uncertainty and update responsibility. The omission of a mechanism shall be justified technically, not by lack of a test facility.

Verification: Audit environment-to-requirement and environment-to-test traceability.

Acceptance / hold rule: All material environments and coupled effects are bounded by approved assumptions and evidence; undefined exposure blocks qualification acceptance.

64.2 Geometry, reference frames and event time

Trajectory- and geometry-dependent information shall identify frame origin, orientation, epoch, time scale, units, state covariance and transformation version. An exchanged position or orientation shall not be accepted without enough metadata to transform it consistently. Surface-relative, body-fixed, inertial and local engineering coordinates shall remain distinct. Event time, receipt time and ground processing time shall not be merged.

Verification: Recompute selected transformations and challenge wrong-frame and stale-epoch inputs.

Acceptance / hold rule: Transformations meet the approved error and time bounds; incompatible or ambiguous metadata produces HOLD.

64.3 Uncertainty, scenarios and design envelope

Define nominal, bounding, dispersed and degraded scenarios and how they support design, test and operational limits. Record whether uncertainty is statistical, epistemic, model discrepancy or an unbounded knowledge gap. Extreme values shall not be combined as independent random variables without justification. A confidence level shall name its variable, population and model rather than describe the whole mission.

Verification: Review scenario construction, dependencies and sensitivity to uncertain inputs.

Acceptance / hold rule: The accepted envelope covers the declared decisions; unsupported extrapolation is excluded or held.

64.4 Resource budgets and coupled margins

Mass, power, energy, thermal rejection, timing, data, attitude-control resources and consumables shall have explicit allocation and reserve ownership. Account for concurrent loads, common reserves, environmental degradation, ageing, unavailable recharge and terminal obligations. The same reserve shall not be credited to two simultaneous needs. Positive scalar totals shall not replace transient, local or coupled analysis.

Verification: Reconcile subsystem and system budgets by phase and condition; independently check Annex AM calculations used.

Acceptance / hold rule: Each required margin meets its prospectively approved value under all selected bounding conditions; no reserve is double allocated.

64.5 Heritage and similarity

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.

64.6 Baseline maintenance and irreversible decisions

Changes to mission duration, geometry, environment, operating mode, supplier or external service shall trigger a documented impact review. Before an irreversible commitment, the decision maker shall reconcile the current environmental baseline, actual configuration, evidence, reserves, unresolved issues and protective options. Commercial schedules shall not be used as substitute evidence.

Verification: Compare the frozen readiness dossier with the actually delivered configuration and latest accepted mission assumptions.

Acceptance / hold rule: Every essential gate is complete and all permitted actions are stated; otherwise the irreversible commitment remains blocked.

65 Spacecraft platform, payload and subsystem assurance

NORMATIVE REQUIREMENTS

Application: Applies to satellites, probes, stages, habitats, mission vehicles and payloads and to the subsystem interactions supporting their claimed performance.

Accountable functions: Subsystem technical owners and integrator; independent verification specialists.

65.1 Structures, mechanisms and deployment

The organisation shall define structural and mechanism functions, materials, interfaces, loads, thermal distortion, life, release states and deployment observability. Qualification shall address relevant manufacturing variability, lubrication or surface condition, storage ageing, constraints and incomplete deployment. Final configuration and any mechanical lock or restraint state shall be independently verified where it affects an essential function.

Verification: Review configuration-specific load, test, inspection, mechanism and deployment evidence.

Acceptance / hold rule: Each required function and structural criterion is met in its approved envelope; unknown restraint or deployment state blocks dependent operation.

65.2 Thermal control and thermal protection

Thermal assurance shall account for heat generation, solar and planetary inputs, conduction, radiation, thermal storage, contact conductance, coatings, degradation and operating modes. Distinguish steady-state screening equations from transient qualification. Temperature limits shall identify the actual item, location, mode and measurement uncertainty. A single temperature sensor shall not represent all critical locations without a validated relationship.

Verification: Review thermal models, instrumentation, balance correlation and hot/cold/transient test coverage.

Acceptance / hold rule: All required temperatures and gradients meet approved bounds including uncertainty and model discrepancy; unresolved critical locations remain HOLD.

65.3 Power generation, storage and distribution

Power assurance shall identify end-of-life generation, eclipses or outages, duty cycle, distribution losses, peak demand, storage state, switching, grounding and protective isolation. Both available power and stored energy shall satisfy their distinct requirements. Protective tests shall use separately authorised safe procedures. A nominal capacity statement shall not demonstrate usable capacity under ageing and mission temperature.

Verification: Reconcile phase budgets and examine actual storage, conversion and protection evidence.

Acceptance / hold rule: Power, energy and recovery predicates all pass; adequate average generation does not compensate for an unsupported peak or outage condition.

65.4 Avionics, electronics and radiation effects

The device and board assurance record shall retain manufacturer, lot, configuration, screening, operating state and environment-specific suitability. Total-dose degradation, displacement effects and single-event behaviour shall be assessed separately when triggered. System response, error containment, recovery and residual data integrity shall be demonstrated. Radiation values shall state material, location, quantity and model; incompatible dose quantities shall not be combined.

Verification: Inspect parts genealogy, mission susceptibility analysis, specialist results and integrated recovery tests.

Acceptance / hold rule: All triggered mechanisms have accepted application-specific evidence; a part label or dose-only result does not close unexamined single-event behaviour.

65.5 Attitude, pointing, sensing and control interfaces

The assurance case shall define pointing, knowledge, stability, alignment, jitter, timing, observability, actuator limits and degraded modes for the actual payload and mission. Coordinate frames and error budgets shall be explicit. Verification shall include sensor loss, stale data, actuator saturation and misleading measurements within a safe test arrangement. This clause does not specify guidance or manoeuvre commands.

Verification: Trace error allocation to integrated measurement and closed-loop verification on representative configuration.

Acceptance / hold rule: Required performance and protective-state predicates pass; undetected loss of critical observability remains an essential gap.

65.6 Payload function and scientific or service output

Payload requirements shall identify intended outputs, calibration, dynamic range, contamination sensitivity, pointing or timing needs, processing and delivered data quality. Instrument performance, system suitability and scientific interpretation are separate conclusions. Changes in compression, processing or calibration shall retain raw or reconstructable data and algorithm identity. Marketing resolution or accuracy figures shall state the tested conditions and limitations.

Verification: Reconstruct selected output products from identified inputs, calibration and processing.

Acceptance / hold rule: Output criteria are met for the stated domain; unsupported scientific or service claims are not inferred from a functioning instrument.

65.7 Integrated platform acceptance

The integrator shall reconcile all subsystem configurations, resource allocations, interfaces, anomalies, software loads, protective controls and operating restrictions. Individually accepted subsystems shall be examined for common-cause failures and conflicting assumptions. Verify the delivered system rather than a earlier demonstration model. Remaining development actions shall not be presented as completed flight acceptance.

Verification: Conduct independent configuration, interface and evidence closure across the complete integration dossier.

Acceptance / hold rule: All applicable integration gates pass; each unresolved essential interface blocks the dependent mission or system conclusion.

66 Communications, navigation support and time services

NORMATIVE REQUIREMENTS

Application: Applies to radio, optical, crosslink, relay, position/navigation-support and timing services used by any space system or ground user.

Accountable functions: Communications and timing leads; data-service owner; security and systems reviewers.

66.1 End-to-end service definition

Define source, destination, relay, ground station, user, supported modes, data class, service availability, permitted latency, correctness and authority. Separate service connectivity from integrity and from the right to use a frequency or external network. All external dependencies shall have actual service scope, ownership, availability and failure responsibility.

Verification: Trace representative data from origin to authorised use including relays and third parties.

Acceptance / hold rule: The claimed service boundary is complete and each essential dependency is supported; a link diagram alone is insufficient.

66.2 Link and performance budgets

Link calculations shall state distance, frequency or wavelength, antenna or optical characteristics, pointing, losses, noise, coding, data rate and required performance. Free-space attenuation shall not be treated as the complete link model. Atmospheric, weather, acquisition, polarisation, interference and implementation effects shall be included when material. Units and logarithmic reference quantities shall be consistent.

Verification: Independently recompute the budget and validate assumed performance against representative evidence.

Acceptance / hold rule: The worst required operating cases meet approved link and quality margins; omitted material losses or unknown receiver performance block acceptance.

66.3 Delay and feasible intervention

The service shall distinguish one-way propagation, round-trip exchange, queueing, processing, retransmission, human response and actuation delays. A ground intervention shall count as a protective control only when information and action can arrive within the validated hazard-response window. Store-and-forward or disruption-tolerant operation shall define expiration, duplicate handling, priority and stale-command rejection.

Verification: Test worst-case delay and outage scenarios using the approved mission geometry and timing model.

Acceptance / hold rule: Required responses are feasible within the approved window; a nominal human review step does not pass if communication makes it ineffective.

66.4 Data age and time uncertainty

Every consequential data item shall retain event time, time scale, receipt time, sequence, quality flags and relevant uncertainty. Clock drift, conversion error, leap or reset handling and synchronisation loss shall be bounded. Maximum data age and timing uncertainty shall be defined before use. A recent packet receipt shall not make its old event data current.

Verification: Challenge stale, duplicated, reordered, wrong-time-scale and clock-reset data.

Acceptance / hold rule: Data outside approved age or uncertainty bounds are marked unusable for the affected decision and trigger the defined protective response.

66.5 Position and navigation-support integrity

The service shall define position, velocity, orientation or time outputs, reference frame, validity interval, uncertainty, integrity indication and user reliance. The validation shall distinguish nominal error from misleading information and unavailable service. Transformations and combined sources shall preserve correlations. The provider shall not imply that a navigation-support result grants authority to conduct the receiving operation.

Verification: Compare independent truth/reference evidence and test wrong-frame, stale-source and service-loss cases.

Acceptance / hold rule: All performance and integrity predicates pass for the declared use; an unavailable or uncertain essential output is not a valid zero-error estimate.

66.6 Secure command and relay interfaces

Command-bearing links shall verify origin, authority, target, sequence, integrity, timing and permitted operation. Relays shall not enlarge the original authority. Replays, duplicates, interrupted delivery, expired credentials and compromised dependencies shall be handled through validated controls. Security tests shall remain inside written safe authorisation and shall not interfere with live assets.

Verification: Execute safe positive and prohibited command-delivery tests using isolated synthetic fixtures.

Acceptance / hold rule: Unauthorised, stale or wrong-target commands cannot pass the accepted workflow; commanded action and observed physical completion remain distinct.

66.7 Outage, recovery and service evidence

The operator shall reconcile lost data, delayed messages, incomplete transfers and state changes after an outage. Recovery shall restore meaning, configuration, authority and history as well as network availability. Report actual service measures with time windows, excluded outages and missing data. A service restoration shall not retrospectively validate dependent decisions made with unavailable or corrupted information.

Verification: Review outage timelines, replay/reconciliation logs and receiving acceptance.

Acceptance / hold rule: All necessary state and data integrity checks are complete before assured use resumes; remaining gaps are carried into the affected claims.

67 Ground segment, command lifecycle and mission operations

NORMATIVE REQUIREMENTS

Application: Applies to mission control, ground stations, mission planning, simulation, operations staffing and authorised remote execution.

Accountable functions: Mission operations manager; command authority; ground-system owner; independent assurance reviewer.

67.1 Configuration and operational baseline

The ground baseline shall identify deployed hardware, software, databases, operational procedures, configuration dictionaries, simulation models, keys, operators and external services. The controlled baseline shall be linked to each supported flight configuration. A simulator or training installation shall be segregated from live commanding.

Verification: Reconcile installed versions and target mappings with approved release records.

Acceptance / hold rule: Every live mission interface uses an accepted compatible baseline; training or stale configuration cannot be selected as a live authority.

67.2 Command proposal and preconditions

Each consequential command or command sequence shall identify authorised intent, target, version, validity interval, preconditions, expected state change, irreversible effects and required review. Before release, verify actual authority, configuration compatibility and sufficiently current state evidence. Success of a syntax check shall not establish physical suitability.

Verification: Review selected command records and challenge stale-state and wrong-target preconditions safely.

Acceptance / hold rule: All prescribed preconditions are demonstrated and the command remains within approved mission authority; otherwise release is blocked.

67.3 Receipt, execution and completion

The record shall distinguish command prepared, approved, transmitted, received, accepted, started, completed, failed and unknown. A transmission log or acknowledgement shall not be treated as verified physical completion. Completion criteria shall identify telemetry or other evidence, timing, confidence limits and independent checks needed for the actual action.

Verification: Trace a command through its full event and evidence history.

Acceptance / hold rule: Only evidence satisfying the approved completion predicate supports completed status; missing terminal evidence remains unknown or partial.

67.4 Planning and conflicts

Mission plans shall allocate communication, power, thermal, pointing, staffing, observation and maintenance resources and identify prohibited overlaps. Concurrent activities shall be reviewed for coupled effects and common reserves. Planning tools shall be validated against known-answer, conflict, capacity and missing-input scenarios. A scheduled activity shall not be marked executed merely because its time slot elapsed.

Verification: Independently reconcile a representative plan and its actual execution log.

Acceptance / hold rule: No essential conflict remains unresolved; actual execution and deviations are separately evidenced.

67.5 Personnel, handover and remote support

Shift and provider handovers shall state current asset condition, unresolved anomalies, active constraints, commands in progress, planned irreversible actions, evidence gaps and actual authority. Duty personnel shall have competence for their assigned mission and available specialist support. A named on-call role without demonstrated availability shall not count as response capability.

Verification: Observe a representative handover and verify access, competence and acknowledgement.

Acceptance / hold rule: The receiving team acknowledges the complete active state and responsibilities before assuming authority.

67.6 Anomaly response and safe restoration

The operations team shall classify anomalies, preserve raw evidence, control affected commands and follow authorised mission-specific protective procedures. Restoration shall establish current physical and digital state, cause disposition, remaining restrictions and separate technical return authority. A restarted computer or renewed communication link does not prove that the spacecraft or remote process is safe to resume.

Verification: Examine adverse rehearsals and actual restoration records where available.

Acceptance / hold rule: Required state, integrity and protection checks pass before resumed dependent action; unresolved essential uncertainty retains a restriction.

67.7 Rehearsal and independent readiness

Mission readiness shall include representative end-to-end rehearsal across flight configuration, ground systems, people, networks, delays, external support and abnormal conditions. Synthetic data shall be labelled. Failures shall be retained, corrected and retested with the original failing cases. Independent readiness shall state the exact demonstrated configuration and remaining limits.

Verification: Compare the rehearsal matrix, observations, corrections and re-execution evidence.

Acceptance / hold rule: Every required readiness scenario passes or is excluded through a valid scope limitation; no scripted demonstration is claimed as a completed mission.

68 Constellations, traffic interfaces and orbital stewardship

NORMATIVE REQUIREMENTS

Application: Applies to single assets and distributed fleets, orbital data services, shared support and mission-end responsibilities; no manoeuvre or interception instructions are provided.

Accountable functions: Fleet or asset operator; orbital-data technical owner; independent stewardship reviewer.

68.1 Fleet membership and common dependencies

Maintain the identity, configuration, ownership, status and responsible control function for each fleet member. Identify shared software, ground infrastructure, suppliers, communication paths, operational procedures and resource constraints. A result for one satellite shall not be copied to an entire constellation without a demonstrated similarity and coverage argument.

Verification: Reconcile fleet and configuration records with actual membership and service commitments.

Acceptance / hold rule: All included assets and common-cause dependencies are identified; unsupported members remain outside the granted scope.

68.2 Distributed function and degradation

Define the collective service, required contribution of each element, acceptable degradation, reconfiguration authority and conditions for withdrawal. Verification shall address loss, stale state, conflicting leadership, corrupted shared data and simultaneous failure of common services. A large number of assets shall not be interpreted as independent redundancy without evidence.

Verification: Test representative distributed-service and common-cause scenarios.

Acceptance / hold rule: The specified service and protective behaviour meet approved predicates; aggregate uptime does not conceal an essential degraded-state failure.

68.3 Tracking and conjunction-information quality

Tracking and conjunction-support data shall retain source, age, frame, epoch, covariance, hard-body assumptions where used, quality indicators and domain of validity. The responsible function shall assess data sufficiency before relying on a probability or miss-distance result. Screening volume, alert threshold and operational decision thresholds shall remain distinct and prospectively defined.

Verification: Review data lineage, uncertainty and method validity; challenge stale and inconsistent source cases.

Acceptance / hold rule: The data and model support the intended decision. Unsupported collision-probability estimates remain HOLD, not reassuring zero values.

68.4 Coordination and consent

Coordination procedures shall identify counterparties, contact reliability, authority, message meaning, acknowledgement and conflicting assumptions. Receipt of a coordination message shall not be treated as consent to an operation or proof that the other party will act. Any change to a shared interface shall preserve actual responsibility and required permissions.

Verification: Inspect communication records and representative failed-contact or contradictory-message exercises.

Acceptance / hold rule: Each required acknowledgement and authority is established; unresolved coordination essential to the claim blocks that claim.

68.5 Debris prevention and released items

The lifecycle plan shall identify intentional and potential released objects, retained energy, fragmentation risks, degradation and terminal-state responsibilities. The organisation shall define a lawful technical basis for prevention and end-of-life measures and verify their implementation for the actual configuration. A nominal mission plan shall not establish successful debris prevention or disposition.

Verification: Review released-item inventory, risk analysis, protective evidence and closure records.

Acceptance / hold rule: Every triggered prevention and terminal condition has accepted evidence; no unknown disposition is reported as completed.

68.6 Mission extension and terminal resources

Before extending service, reassess remaining energy, support, communications, attitude capability, life, uncertainty, monitoring and resources required for terminal duties. The extension shall not consume a reserve already committed to a required protective or end-of-life function without authorised technical resolution. The decision shall preserve original life history.

Verification: Reconcile updated budgets, remaining-life evidence and terminal feasibility.

Acceptance / hold rule: Required continued-service and terminal predicates both pass; a commercially useful asset is not automatically eligible for extension.

68.7 Status and long-term custody

Closure shall record whether an asset is operating, restricted, dormant, disposed, lost or unknown using verified evidence and defined meanings. Loss of communication shall not be labelled successful disposal. Assign remaining notices, monitoring and records to an actual custodian. A closed commercial contract does not close an unresolved technical or environmental obligation.

Verification: Trace final-state evidence and accepted transfer of residual duties.

Acceptance / hold rule: Terminal claims match observed or explicitly bounded inferred states, and every continuing duty has a receiving owner.

69 Servicing, docking, assembly and on-orbit interventions

NORMATIVE REQUIREMENTS

Application: Applies to authorised cooperative servicing, inspection, docking, assembly, transfer and repair; the clause sets assurance controls, not approach trajectories or control laws.

Accountable functions: Service provider and receiving asset authorities; integrator; independent interface reviewer.

69.1 Consent and exact intervention

Record participating assets, owners, consent, service objective, configuration, permitted interventions and prohibited actions. Design assurance, service-provider competence and permission for a specific operation shall remain separate. An assumed common ownership or commercial order shall not replace the actual technical authority and access rights needed for the intervention.

Verification: Check the consent and authority chain against the declared operation and assets.

Acceptance / hold rule: All required authorities and compatible scope boundaries are valid before intervention; otherwise the activity remains blocked.

69.2 Interface compatibility

Define and verify relevant mechanical, structural, electrical, fluid, thermal, communications, software, timing and contamination interfaces. The evidence shall identify as-operated rather than merely as-designed configurations. Damage, ageing, unknown modifications and inspection accessibility shall be considered. Individually qualified assets shall not be assumed jointly compatible.

Verification: Review interface-control records, difference analysis and representative integrated verification.

Acceptance / hold rule: Every essential interface criterion passes for both participating configurations; unknown critical interfaces remain HOLD.

69.3 Relative-state and completion evidence

The service plan shall define which relative states, contact conditions, connection states and completed tasks must be observed or inferred. Sensor limitations, occlusion, stale telemetry, model uncertainty and ambiguous indications shall have explicit handling. A single contact indication shall not by itself prove secure structural, electrical or fluid connection when those are separate requirements.

Verification: Challenge incomplete and contradictory indications using authorised representative simulations or tests.

Acceptance / hold rule: Each claimed state has sufficient valid evidence and meets its own predicate; ambiguous state cannot be treated as complete.

69.4 Interruptions and safe boundaries

The assurance case shall identify safe interruption states, autonomy limits, human intervention feasibility, shared failures and irreversible actions. Recovery and abort assumptions shall be validated for the actual environment and available resources. This standard does not authorise an assessor to command an intervention or select hazardous operational parameters.

Verification: Review the approved scenario set and evidence for required protective transitions.

Acceptance / hold rule: All essential interruption and protective-state requirements are demonstrated within the authorised envelope.

69.5 Transferred material, energy and data

Transfers shall preserve identity, quantity, units, condition, custody and eligibility of materials, consumables, energy attributes or digital products. Metering, losses, residuals and cross-contamination shall be addressed. Quantity reconciliation shall not be used as proof of chemical, mechanical or functional suitability. Receiving acceptance shall be explicit.

Verification: Reconcile sending and receiving records and inspect suitability evidence.

Acceptance / hold rule: Both identity/quantity and technical eligibility checks pass; unexplained differences or contamination keep the transfer result open.

69.6 Post-intervention configuration and service claim

The final dossier shall state actual work, replacement items, software, repairs, observations, limitations, failed attempts, configuration and receiving authority. Verify affected functions and update maintenance, life and operating information. Partial completion shall remain partial. Service completion shall not imply recertification of the whole receiving asset or extension of its life without separate evidence.

Verification: Review post-intervention verification and receiving acknowledgement.

Acceptance / hold rule: The bounded service predicate is met, affected protections are restored and residual responsibilities are accepted.

70 Launch, re-entry, reuse and ground-interface assurance

NORMATIVE REQUIREMENTS

Application: Applies to assurance of assigned launch and return interfaces, reusable articles and supporting infrastructure; hazardous operating procedures remain separately authorised.

Accountable functions: Vehicle, payload, site and recovery technical authorities; independent readiness function.

70.1 Distinct release objects

The profile shall distinguish vehicle design, payload integration, site capability, mission readiness, individual operating permission and recovery capability. Each object shall identify responsible entity, configuration, environment, evidence and decision authority. A spaceport capability result shall not release a vehicle or a specific launch.

Verification: Compare all requested results with their actual evidence and authority paths.

Acceptance / hold rule: No merged or unbounded approval is issued; each required object-specific gate is independently supported.

70.2 Integrated environment and interface verification

Integration shall address actual handling, transport, mounting, loading, acoustic, dynamic, thermal, electrical, data, separation and contamination interfaces. Verification shall use approved mission-specific conditions and representative fixtures and configurations. Previously accepted payloads shall be reassessed when interface conditions or launch-service assumptions change.

Verification: Reconcile interface and environment matrices with qualification, acceptance and delivered configuration.

Acceptance / hold rule: All required interface criteria are met; undeclared differences or missing essential demonstrations block integrated acceptance.

70.3 Test and hazardous-work readiness

Before consequential tests, verify competent authorised performers, approved procedures, protected facilities, instrumentation, exclusion boundaries, independent checks and stop authority. Technical acceptance limits and protective shutdown limits shall be separate. No universal energetic, pressure or thermal operating values are supplied by this standard.

Verification: Inspect real readiness records and safe witnessing arrangements.

Acceptance / hold rule: All prerequisite protections and measurement capabilities exist before testing; missing permissions or protective functions prohibit the activity.

70.4 Reuse and cumulative history

Reusable structures, mechanisms, thermal protection, tanks, energy systems and electronics shall retain actual use, exposure, storage, damage, repairs, refurbishment and replacement history. Eligibility shall rely on validated inspection and degradation models for the particular item. A successful prior flight or a cosmetically restored surface shall not reset life or close hidden damage uncertainty.

Verification: Trace item history to approved reuse criteria and measured condition.

Acceptance / hold rule: All required life and condition predicates pass; missing critical history or inaccessible required inspection blocks reuse acceptance.

70.5 Return, landing and recovery interfaces

The return assurance case shall identify entry, descent, landing, retrieval, containment, transport and receiving duties within the declared responsibility. Define expected observations and evidence of completion, including unreachable, partial and uncertain outcomes. Public safety, environmental and controlled-material permissions shall be separately confirmed.

Verification: Review the approved return/recovery dossier, communication and custody arrangements.

Acceptance / hold rule: The stated return or recovery claim has sufficient actual evidence; a planned route or lost signal cannot be reported as successful completion.

70.6 Readiness decision and post-event learning

Before commitment, reconcile configuration, qualification, ground readiness, people, support, open anomalies and required terminal resources. After the event, preserve original observations, failures and near misses and assess consequences for subsequent vehicles and payloads. Schedule pressure shall not downgrade a blocking finding.

Verification: Independently review the frozen pre-event dossier and subsequent anomaly-to-population analysis.

Acceptance / hold rule: Every essential gate passes at the actual commitment time; later success does not legitimise an unsupported earlier release.

71 Lunar, planetary, small-body and ocean-world systems

NORMATIVE REQUIREMENTS

Application: Applies to orbiters, landers, rovers, hoppers, atmospheric platforms, subsurface or ocean-world exploration systems and their support infrastructure.

Accountable functions: Mission and surface-system authorities; environment, autonomy, materials and contamination specialists.

71.1 Destination-specific conditions

Define the actual body or environment, region, season or illumination assumptions, terrain, atmosphere, pressure, temperature, radiation, dust, electrostatic effects, gravity and access limitations. The profile shall separate measured conditions from inferred and unknown conditions. A terrestrial, lunar or planetary analogy shall not establish a universal environment specification.

Verification: Examine destination/region assumptions, uncertainty and required evidence.

Acceptance / hold rule: All essential environmental inputs are bounded for the declared mission; missing critical environmental knowledge retains a development or restricted status.

71.2 Surface mobility and interaction

Mobility assurance shall define load, terrain interaction, traction or anchoring, stability, dust effects, sensing, energy, thermal behaviour and recoverability relevant to the actual vehicle. Representative tests shall identify differences in gravity, soil or surface material, pressure and scale. A laboratory traverse shall not be equated with full mission access or survivability.

Verification: Review integrated mobility and resource tests and the justified analogue-transfer argument.

Acceptance / hold rule: Required mobility and protective-state predicates pass for the approved envelope; unsupported terrain classes remain excluded.

71.3 Atmospheric and buoyant exploration

Atmospheric vehicles shall have defined environmental profiles, materials, structural, buoyancy or flight functions, energy, communication and terminal responsibilities. Pressure, composition, corrosion, turbulence and inaccessible maintenance shall be considered when triggered. Airworthiness or site results from a different planetary or terrestrial context shall not be inherited without technical justification.

Verification: Review environment-specific material, structural and functional qualification and data validity.

Acceptance / hold rule: Every essential environmental and functional condition is supported for the stated domain; unvalidated atmosphere assumptions block broader claims.

71.4 Subsurface and ocean-world interfaces

Subsurface or liquid-environment exploration shall identify pressure, thermal, chemical, access, communication, containment and biological/scientific contamination concerns. Verify boundary integrity, sensor observability, retrieval assumptions and evidence custody without providing hazardous access procedures. A surface-system qualification shall not establish suitability for submerged or subsurface duty.

Verification: Review pressure-boundary and environmental evidence through authorised specialist assessment.

Acceptance / hold rule: All triggered boundary, protection and observation predicates pass; uncertain containment or retrieval capability remains explicitly restricted.

71.5 Long darkness and resource interruption

Mission planning shall identify darkness, unavailable recharge, thermal survival, communications gaps and delayed resupply. Energy and consumable reserves shall include degradation, uncertainty, interruptions and terminal duties. Restart after dormancy shall verify state and protection, not only a successful boot.

Verification: Recalculate resource and survival budgets and review representative dormant/restart tests.

Acceptance / hold rule: All required survival and recovery conditions meet approved criteria without double-counted reserves; missing state evidence keeps restart dependent actions held.

71.6 Construction and surface infrastructure

Habitats, pads, utilities, handling systems, civil works and resource facilities shall have a defined design and environment basis, material provenance, site assumptions, inspection strategy and acceptance authority. Hidden work and critical interfaces shall be verified before concealment. Demonstrating a manufacturing technique shall not establish readiness of an integrated surface installation.

Verification: Trace design and material records through construction, commissioning and receiving acceptance.

Acceptance / hold rule: Every essential structural, utility, environmental and operational interface has valid completion evidence before use.

71.7 Autonomy and limited intervention

Autonomous surface work shall define sensing coverage, permitted domain, adaptation limits, command authority, safe cessation and human intervention feasibility. Validation shall include occlusion, unfamiliar conditions, delayed information, partial execution and loss of a shared resource. Human oversight shall not be credited when delay or observability prevents meaningful intervention.

Verification: Challenge the approved autonomous envelope and required protective transitions.

Acceptance / hold rule: All essential scenarios pass; out-of-domain behaviour is limited or stopped under the approved protective design.

71.8 Completion, samples and remaining duties

The mission dossier shall distinguish science acquisition, engineering demonstration, collected sample custody, completed construction, final asset state and environmental closure. Unreachable assets shall retain a stated confidence basis and unknowns. Responsibilities for contamination, residues, hazardous inventories and interpreting long-term records shall survive mission and supplier closure.

Verification: Review final-state evidence, sample manifests and accepted residual-duty assignments.

Acceptance / hold rule: Each conclusion is limited to its demonstrated object and evidence; no lost contact or incomplete transfer is relabelled as complete closure.

72 Deep-space, solar and long-duration exploration

NORMATIVE REQUIREMENTS

Application: Applies to heliophysics, interplanetary, outer-system, distant observatory and interstellar precursor missions and other long-duration concepts.

Accountable functions: Mission owner; long-duration systems, communications and reliability authorities.

72.1 Time horizon and recoverability

The mission basis shall define duration, distance-dependent communication, resource evolution, repairability, replacement feasibility and the period over which responsibility and evidence must remain usable. A planned future repair, relay or supplier service shall not be credited as available without supported commitments and a demonstrated capability basis.

Verification: Review life and support assumptions against mission phases and credible loss cases.

Acceptance / hold rule: Essential mission and protective functions remain supported for the declared duration; speculative future services are not favourable defaults.

72.2 Solar and extreme thermal exposure

Solar, close-body and thermal-extreme missions shall define time-varying flux, geometry, shadowing, surface properties, degradation and transient response. Protection shall be qualified at the relevant material, assembly and system levels. Inverse-square screening and steady-state radiation equations are only applicable within their stated assumptions and do not close transient or coupled behaviour.

Verification: Review environment-specific models, uncertainty, qualified materials and correlated tests.

Acceptance / hold rule: Required temperature, gradient, integrity and functional limits are met throughout the approved envelope; unexamined coupled effects remain HOLD.

72.3 Low-flux and limited-power missions

Distant missions shall evaluate end-of-life generation, storage, conversion, thermal support, communication and command survival concurrently. Prioritised load shedding and dormant modes shall have validated authority and state-recovery rules. Average energy sufficiency shall not hide a time-local peak or thermal survival failure.

Verification: Reconcile resource profiles and perform representative low-resource and recovery verification.

Acceptance / hold rule: Every essential resource and protection predicate passes; unavailable generation or unsupported recovery is not treated as normal service.

72.4 Autonomy during long communication delay

The mission shall identify decisions that cannot wait for ground response and bound the authority assigned to onboard functions. Validation shall account for delayed or unavailable external information, model mismatch, finite stored procedures and safe terminal behaviour. Ground approval received after the hazardous event would occur is not an effective preventive control.

Verification: Evaluate latency arithmetic and scenario-based autonomous response evidence.

Acceptance / hold rule: Protective authority is executable within the approved response time; otherwise redesign, restriction or additional evidence is required.

72.5 Ageing and long-term digital support

The assurance plan shall address materials ageing, accumulated environment, clock stability, memory integrity, software dependencies, obsolete tools, lost expertise and cryptographic migration. Preserve executable or reconstructable models and interpretable data dictionaries. Availability of a signed file does not establish its future readability or the continued correctness of its engineering meaning.

Verification: Review long-life evidence and test migration, recovery and independent reconstruction.

Acceptance / hold rule: Essential historical and current evidence remains usable and required support has accepted continuity arrangements.

72.6 Scientific instruments and observation integrity

Observation claims shall identify instrument calibration, alignment, background effects, processing, timing, uncertainty and data-loss conditions. Engineering acceptance of an instrument shall be separated from a scientific inference from its output. Changes in reduction software shall retain earlier processing and the reason for differences.

Verification: Reprocess a representative observation from identified source data and calibration.

Acceptance / hold rule: The stated technical data-quality criteria are met; disputed scientific interpretation is not declared certain by an ASTRA engineering result.

72.7 Future-domain feasibility and responsible closure

Very long-range or novel propulsion and infrastructure concepts shall identify what has actually been demonstrated and what remains theoretical or unvalidated. Requirements may define a future scope, but no operational capability shall be granted from aspiration alone. The final record shall preserve terminal-state uncertainty, remaining obligations and custody after active support ends.

Verification: Review demonstration-state claims, technical gaps and actual terminal evidence.

Acceptance / hold rule: Only the demonstrated bounded capability is recognised; speculative performance and unknown final states remain clearly identified.

73 Human flight, habitats and extravehicular systems

NORMATIVE REQUIREMENTS

Application: Applies to engineering and operational assurance affecting crew, passengers, occupants and personnel in space-related environments; not a medical treatment protocol.

Accountable functions: Human-system integration lead; life-support and habitat authorities; qualified health and safety specialists.

73.1 Population, mission and human tasks

Define intended occupants, roles, mission duration, environmental conditions, physical access, workload, communication and reasonable variation in users. Identify essential tasks and protective actions. Validation shall state participant representativeness, assistance, training and limitations; one expert demonstration shall not establish capability for all users.

Verification: Review the user/task matrix and representative normal and degraded validation.

Acceptance / hold rule: Each essential task is demonstrated under its approved conditions; unsupported populations and tasks are excluded from the claim.

73.2 Integrated life support

Life-support requirements shall identify atmospheric, water, waste, temperature, humidity, monitoring, consumable and power interfaces appropriate to the mission. Substance-specific and physiological limits shall be set by the competent actual technical and health authorities before use. Do not infer safe habitat conditions from a single sensor or from nominal supplies. The profile shall identify correlated and common-resource failures.

Verification: Review integrated requirements, monitored quantities, sensor validity and contingency tests.

Acceptance / hold rule: Every required environmental and protective predicate is met; unspecified health limits or unverified essential monitoring block acceptance.

73.3 Consumables and survival time

Resource accounting shall separate usable inventory, delivery losses, recovery efficiency, degradation, uncertainty, crew demand, emergency reserves and terminal obligations. A theoretical recycling rate shall not replace demonstrated system recovery and quality. Define the elapsed time to protective intervention and compare it with supported remaining resources. Annex AM provides arithmetic examples, not crew-consumption prescriptions.

Verification: Recompute balances and check source data, quality and concurrent reserve allocations.

Acceptance / hold rule: All approved reserve and survival predicates pass; quantity sufficiency does not compensate for unsuitable water, atmosphere or other supplies.

73.4 Habitat integrity and interfaces

Habitat assurance shall address structural and pressure boundaries, penetrations, connections, fire behaviour, contamination, accessibility, maintenance and emergency compartments where applicable. Hidden work shall have acceptance evidence before concealment. Payload and visiting-system interfaces shall not compromise life support or escape assumptions. Structural or habitat acceptance is not a medical clearance.

Verification: Inspect configuration-specific boundary and integrated protective evidence.

Acceptance / hold rule: All essential integrity and interface conditions pass; an unknown boundary or incompatible visiting configuration blocks occupancy-dependent acceptance.

73.5 Human factors and effective authority

Displays, alerts and procedures shall identify state, urgency, limitations and required actions without ambiguous mode or priority. Workload, fatigue, interruptions, language, delayed feedback and automation bias shall be evaluated. A manual override is an effective control only when a person has the information, time, training and physical or technical ability to use it.

Verification: Observe representative task and intervention performance, including misleading and degraded information.

Acceptance / hold rule: Every essential response passes independently; aggregate usability scores do not offset a failed protective task.

73.6 Extravehicular activity and individual equipment

The profile shall define the equipment configuration, user/task, environment, interfaces, life, inspections, consumables, communications and rescue dependencies for extravehicular or analogous isolated work. Suit, vehicle, habitat and support equipment shall be evaluated as an integrated system. This standard does not prescribe physiological exposure or hazardous operating sequences.

Verification: Review qualified equipment, user fit/task evidence and integrated emergency interfaces.

Acceptance / hold rule: All relevant configuration and protective criteria pass, with actual specialist authority and supported rescue or survival assumptions.

73.7 Medical capability and health-data boundaries

The mission shall identify the qualified health functions, equipment and support access required for its actual population and duration. Engineering assurance shall verify availability, integration, power, maintenance, communication and privacy without inventing treatment protocols or clinical certification. Health information shall be restricted to authorised purposes and handled separately from public conformity records.

Verification: Check actual health-support arrangements, equipment integration and protected data access.

Acceptance / hold rule: Required support functions are demonstrably available and usable within the mission limits; undocumented specialist capacity is not credited.

73.8 Emergency, refuge and safe return

Emergency planning shall define scenario, detection, decision time, protection, refuge or return assumptions, rescue interfaces and actual resources. A cooperation agreement shall not count as demonstrated response capability without compatible personnel, access, equipment and timing. Exercises shall distinguish tabletop review from operational demonstration and shall remain safe.

Verification: Assess scenario-specific exercise and resource evidence and independently check timing feasibility.

Acceptance / hold rule: Every required protective pathway is supported; infeasible response or unavailable essential resources block the dependent human-mission claim.

74 Planetary protection, sample return and scientific integrity

NORMATIVE REQUIREMENTS

Application: Applies where biological, chemical or particulate transfer can affect the environment, scientific interpretation or sample custody; no biological processing or sterilisation recipes are provided.

Accountable functions: Planetary-protection responsible function; sample custodian; mission and facility technical authorities.

74.1 Mission-specific protection classification

The responsible function shall identify destinations, return paths, scientific objectives, exposed materials, biological payloads and applicable protection duties. Forward contamination, backward contamination and scientific interference shall be assessed separately. The selected obligations and technical criteria shall be documented before mission or facility design decisions that depend on them.

Verification: Review destination, pathway and consequence analysis with qualified independent specialists.

Acceptance / hold rule: Every triggered protection duty has an explicit owner, criterion and verification path; an undefined classification remains HOLD.

74.2 Contamination pathways and control allocation

Map contamination sources, transport pathways, contact interfaces, releases and receiving environments across manufacture, test, integration, operation, collection, return and disposition. Allocate controls to actual performers and preserve interface assumptions. A cleaning or containment declaration shall not establish effectiveness without method-specific evidence for the relevant material and pathway.

Verification: Inspect the pathway map and validated evidence for each relied-upon control.

Acceptance / hold rule: All essential pathways are controlled to the approved technical basis; inaccessible required evidence prevents a favourable conclusion.

74.3 Scientific cleanliness and background

Define species, particulates, molecular residues or other backgrounds capable of affecting the specific measurement. Reference samples, witness materials, blanks, calibration and contamination history shall have traceable identity and handling. A broad cleanliness classification shall not establish suitability for an instrument with a different detection limit or scientific objective.

Verification: Review measurement-specific contamination budgets and actual verification results.

Acceptance / hold rule: Required cleanliness and background predicates pass within method uncertainty; uncharacterised contamination remains a limitation on the affected output.

74.4 Sample identity and custody

Each sample shall retain origin description, collection event, container, seal or interface identity, mass or quantity where known, conditions, contamination history, transfers, subdivisions and authorised access. Unknown provenance shall remain unknown. Splitting or pooling shall preserve parent-child links and shall not create duplicate inventories.

Verification: Reconcile original collection, custody, receiving and subdivision records.

Acceptance / hold rule: The sample and its history are unambiguous and usable for the claimed purpose; missing essential links block the dependent sample conclusion.

74.5 Return-chain containment and receiving readiness

Where containment or restricted receiving applies, verify compatible transport, return vehicle, retrieval, custody, receiving facility, authorised personnel and contingency arrangements. The profile shall define the evidence needed to establish boundary integrity and safe transfer without specifying hazardous treatment methods. A ready spacecraft does not establish readiness of an absent receiving facility.

Verification: Review the complete return-to-receiving chain and authorised representative integrity demonstrations.

Acceptance / hold rule: Every essential interface and receiving capability is accepted before dependent return commitments; otherwise the chain remains incomplete.

74.6 Anomalies, unknown state and release of information

Loss of containment indication, unverified seal condition, missing samples or unexplained contamination shall trigger preservation, restriction and qualified review. Do not equate absent alarms with demonstrated integrity. Technical data and scientific interpretations shall retain limitations; public statements shall not imply a sample is harmless or pristine solely because its custody form is complete.

Verification: Examine anomaly decisions, actual observations and bounded reporting.

Acceptance / hold rule: Only supported technical conclusions are released; uncertainty and unresolved protection duties remain visible.

74.7 Disposition and residual responsibility

Final disposition shall identify sample, container, residue, facility, record and long-term custody obligations. Transfer shall include receiving acceptance and usable evidence. Mission completion shall not terminate a continuing protection or scientific-record duty. The custodian shall preserve genuine access conditions and correction channels after organisational closure.

Verification: Trace final-state evidence and accepted residual duties.

Acceptance / hold rule: No required custody or protection obligation is abandoned and no unverified disposal is claimed complete.

75 In-space manufacture, resource use and logistics

NORMATIVE REQUIREMENTS

Application: Applies to manufacturing, processing, assembly, resource utilisation, storage and logistics in orbital, surface and other remote environments.

Accountable functions: Process and product technical owners; receiving service authority; independent qualification reviewer.

75.1 Process purpose and environment

Define intended output, material properties, environment, equipment, software, tooling, personnel or autonomous role, inspection access and downstream use. Distinguish research yield, qualified process capability and product acceptance. A terrestrial qualification shall not automatically transfer to a different gravity, vacuum, thermal, contamination or radiation environment.

Verification: Review environment differences and the process-to-property qualification argument.

Acceptance / hold rule: All essential output properties and influential conditions have an approved evidence path; unsupported transfer remains HOLD.

75.2 Inputs, feedstock and source variability

Retain origin, composition or material type, condition, contamination, storage, reuse, mixing and representative property evidence for feedstock. Local or recovered resources shall have a characterised variability and sampling basis. A claimed resource abundance shall not establish usable quantity or technical eligibility. Source substitution shall be assessed before use.

Verification: Trace input lots and samples to process runs and accepted property evidence.

Acceptance / hold rule: Input identity and suitability meet approved criteria; uncertain composition or life history is not replaced by a nominal source label.

75.3 Essential variables and remote monitoring

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.

75.4 Yield, mass balance and circularity

Material accounting shall separate input, good output, reject, sample consumption, process loss, recovered material, work in progress and unknown difference. Internal recirculation shall not be counted repeatedly as new resource production. Mass closure and yield are different measures; neither proves safety or material performance. Units and measurement uncertainty shall be explicit.

Verification: Independently reconcile the material ledger and separately review quality acceptance.

Acceptance / hold rule: Balances meet the approved uncertainty-based criterion and all claimed good output is technically accepted; unexplained losses or duplicate recovery remain open.

75.5 Logistics, storage and compatibility

Logistics shall preserve item identity, custody, configuration, life, condition and applicable environmental exposure through packaging, handling, transport, transfer and storage. Receiving systems shall confirm mechanical, fluid, electrical, data and contamination compatibility where relevant. Planned delivery shall not be counted as physically received usable inventory.

Verification: Inspect the complete shipment and receiving chain, including excursions and damage.

Acceptance / hold rule: Only accepted usable inventory enters mission budgets; unknown or restricted items are segregated in both physical and digital records.

75.6 Maintenance, spares and distributed production

On-demand or remote production of replacement parts shall satisfy the same applicable design, material, process and acceptance requirements as other sources. Digital files, authorised build configuration, inspection capability and life history shall be controlled. A successfully printed shape shall not establish structural, electrical or environmental suitability. Missing original supply does not waive qualification.

Verification: Review replacement authorisation, production genealogy and configuration-specific verification.

Acceptance / hold rule: Every essential replacement predicate passes before use; unsupported functional or life equivalence is prohibited.

75.7 Handover, resource claims and closure

The final claim shall state actual production, quality, quantity, conditions, uncertainty, exclusions and accepted receiving responsibility. Demonstration of a resource process creates no ownership, extraction right or operating permission. Waste, residues, hazardous inventories and long-term custody shall have accepted disposition.

Verification: Reconcile reported outputs, accepted products, rights/permissions and final-state evidence.

Acceptance / hold rule: The claim is bounded to measured and accepted achievement; undeveloped scale-up and unknown disposition remain separate.

76 Space energy infrastructure and specialised power oversight

NORMATIVE REQUIREMENTS

Application: Applies to power infrastructure and specialised energy sources that support aerospace activity. Nuclear or other highly hazardous designs and operations require dedicated authorised specialist programmes; no design recipes are supplied.

Accountable functions: Energy-system technical authority; facility operator; independent safety and integration reviewers.

76.1 System boundary and conversion chain

Define energy source, conversion, storage, distribution, loads, interfaces, heat rejection and terminal duties. Identify normal and degraded states, common dependencies, exposure and maintenance accessibility. Component efficiency or nameplate power shall not be represented as available end-to-end service capability.

Verification: Trace energy and thermal balances across the actual architecture and conditions.

Acceptance / hold rule: Every essential stage and interface meets approved functional and protective requirements.

76.2 Beamed and remote energy services

A remote energy-service profile shall identify transmitter, receiver, conversion, alignment, intervening environment, control authority and protection of unintended recipients. The assurance case shall address wrong-target, lost-tracking, interrupted-service and emergency shutdown conditions through authorised safe demonstrations. A received-power measurement alone shall not close protection or permission requirements.

Verification: Review written scope, compatible interfaces, performance evidence and safe protective tests.

Acceptance / hold rule: Delivery and all triggered protective predicates pass; no hazardous or unauthorised operation is justified by a positive efficiency value.

76.3 Cryogenic, chemical and pressure interfaces

Specialised energy storage and transfer shall define relevant material compatibility, containment, thermal behaviour, quality, monitoring, protective isolation and emergency interfaces. Actual pressure, composition, exposure and handling limits shall be approved by competent specialists for the specific system. This publication shall not be used as an operating procedure.

Verification: Review authorised technical basis, qualification, inspection and integration evidence.

Acceptance / hold rule: Every essential containment and protection condition is supported; missing hazardous-work authority blocks the activity.

76.4 Nuclear and radiation-source governance

Where a mission uses a nuclear or other controlled radiation source, the organisation shall identify the actual competent authorities, permissions, safety case, transport, launch/operation interfaces, security, emergency responsibilities and end-of-life duties. Independent specialist access shall be sufficient for the bounded evaluation. ASTRA shall not grant source-handling, reactor-design or public-safety permission.

Verification: Verify the existence, scope and authenticity of required specialist approvals and integration evidence.

Acceptance / hold rule: All relevant permissions and assurance interfaces are complete; a generic aerospace credential cannot substitute for them.

76.5 Infrastructure availability and failure propagation

Utilities, storage, conversion and networks shall be evaluated for common failures, load prioritisation, restoration, fire or containment interfaces and dependence on external support. Protection of people and essential assets shall be distinguished from mission-service continuity. A shared resource cannot be credited as independent backup to itself.

Verification: Review dependency analysis and safe tests of loss, isolation and restoration.

Acceptance / hold rule: Every essential protective path remains effective under the approved failure set; unsupported independence is not credited.

76.6 Degradation, environmental claims and retirement

Capacity, conversion and loss models shall reflect ageing and relevant exposure. Environmental claims shall use a separately defined lifecycle boundary and shall not imply technical interchangeability or complete safety. Retirement shall preserve hazardous inventory, terminal protection, custody and monitoring duties.

Verification: Reconcile actual condition, model validity, separate environmental statements and final disposition.

Acceptance / hold rule: Technical life and terminal conditions are met independently of environmental metrics; unknown inventories remain open obligations.

77 Verification campaigns and quantitative closure

NORMATIVE REQUIREMENTS

Application: Applies to every qualification, acceptance, inspection, simulation, demonstration and analysis campaign supporting an ASTRA technical claim.

Accountable functions: Verification manager; method specialists; independent result reviewer.

77.1 Requirement-to-method completeness

The verification matrix shall include every applicable requirement, object/configuration, method, test or analysis purpose, criterion, uncertainty, evidence and authorised conclusion. Inspection, analysis, demonstration and testing shall be selected for the actual failure mechanism. Annex T domains guide coverage but are not ready-made methods. A complete test list shall not replace requirement-level closure.

Verification: Reconcile the requirement population, test matrix and actual evidence using stable identifiers.

Acceptance / hold rule: Every applicable requirement has a valid completed evidence path; any essential uncovered row remains HOLD.

77.2 Campaign design and article pedigree

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

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.

77.4 Combined effects and sequence

The technical plan shall evaluate whether individual tests adequately address coupled environments and order-dependent damage. Thermal, radiation, mechanical, electrical, contamination and software conditions shall be combined or supported by a justified integrated analysis where necessary. Over-test and under-test shall be assessed against the actual evidence purpose.

Verification: Review the interaction matrix and cumulative exposure ledger.

Acceptance / hold rule: Every material combined mechanism has adequate evidence; passing isolated tests does not automatically close unexamined combinations.

77.5 Original data and invalid tests

Retain actual setup, input and response histories, environmental conditions, interruptions, alarms, raw files, corrections, uncertainty and validity classification. An invalid run shall state what evidence remains usable and which requirement is not demonstrated. A repaired or changed article shall not silently replace the originally failed configuration.

Verification: Reconstruct a selected run from raw data and contemporaneous records.

Acceptance / hold rule: The run is independently interpretable and no failed, invalid or missing evidence is concealed.

77.6 Numerical and attribute acceptance

Quantitative decisions shall use the prospectively selected predicate and uncertainty rule. Attribute decisions shall name observable states and essential steps rather than unstructured judgement. Equality at an inclusive limit is handled as specified; empty acceptance regions, invalid units and non-finite values produce HOLD. Rounding shall not change an outcome.

Verification: Replay boundary, negative and missing-input cases using Annex AL and Annex AM.

Acceptance / hold rule: The correct state follows deterministically from valid unrounded inputs and the approved predicate.

77.7 Retest and corrective verification

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.

77.8 Independent campaign closure

The final dossier shall reconcile configuration, criteria, valid results, adverse evidence, untested characteristics, uncertainty, concessions and open duties. Qualification, article acceptance, laboratory competence and ASTRA conformity shall retain separate decisions. A technical concession shall not be relabelled as fulfilment of the original criterion.

Verification: Perform independent requirement-by-requirement closure with actual decision authority.

Acceptance / hold rule: Every applicable gate for the exact claimed object passes; counts, percentages or programme completion dates alone cannot release the object.

78 Digital, AI and autonomous mission assurance

NORMATIVE REQUIREMENTS

Application: Applies to mission software, programmable hardware, models, AI, digital twins, connected production and operational cyber dependencies.

Accountable functions: Software or model authority; security lead; mission operations owner; independent verification function.

78.1 Released digital configuration

Identify requirements, source or logic, generated artefacts, model weights, preprocessing, parameters, tools, dependencies, build environment and loaded target. A version label alone is insufficient to establish the deployed behaviour. Every consequential change shall be attributable and linked to impact, regression and actual release authority.

Verification: Reconstruct the released artefact and compare it with the loaded configuration.

Acceptance / hold rule: The evaluated and deployed digital configurations match, or all differences have accepted verification before use.

78.2 Operational domain and prohibited behaviour

Define intended tasks, users, environment, sensor and network assumptions, autonomous authority, prohibited actions and protective states. Experimental uses shall be segregated from live release. Behaviour outside the approved domain shall trigger the defined limitation or protective response rather than an unsupported autonomous expansion.

Verification: Review domain completeness and execute representative in-domain, out-of-domain and prohibited cases.

Acceptance / hold rule: All essential domain and protective conditions pass; unbounded authority or unknown out-of-domain behaviour blocks release.

78.3 Evaluation data and model credibility

Evaluation shall retain data provenance, rights, labelling, representative populations, partitions, leakage checks, synthetic contribution and adverse cases. Model verification, calibration and independent validation shall be distinguished. A high aggregate score, large dataset or visual twin is not evidence of every rare or safety-critical condition.

Verification: Inspect data partitions and independently reproduce selected performance and model-validation results.

Acceptance / hold rule: Prospective scenario-specific criteria are met with disclosed uncertainty and limitations; unsupported extrapolation remains HOLD.

78.4 Human authority and consequential decisions

Human oversight shall be validated against available information, response time, competence, workload and control access. Automated decision support may organise evidence but shall not independently issue an ASTRA grant, renewal, suspension or restoration. Generated observations and citations shall not be presented as authentic source events.

Verification: Challenge automation bias, false-source and delayed-intervention scenarios.

Acceptance / hold rule: Actual authorised people can perform every required role and source evidence remains verifiable; nominal oversight alone is insufficient.

78.5 Security and trusted updates

Protect source, build, machine instructions, operational data, identities and updates according to the actual threat and safety model. Update acceptance shall verify origin, integrity, authority, target, compatibility and interruption behaviour. Reversion to an earlier load shall not reintroduce an unacceptable defect without explicit technical disposition. Security testing requires written safe authorisation.

Verification: Review trust dependencies and execute isolated permitted and prohibited update tests.

Acceptance / hold rule: All required integrity and protective gates pass; a valid signature alone does not establish functional safety or compatibility.

78.6 Monitoring, drift and adaptation

Define detectable drift, changed exposure, failure signals, missing-data response, authority and reassessment triggers. Monitor what the method can actually observe, not every property inferred from a live dashboard. Adaptation outside the released envelope shall require renewed assurance before reliance. A monitoring gap shall not be treated as evidence of unchanged performance.

Verification: Review monitoring coverage, alert-to-action records and controlled changes.

Acceptance / hold rule: Essential performance and protection remain supported; otherwise restrict the affected use and assess earlier outputs.

78.7 Recovery and semantic portability

Export and recovery shall preserve identities, scope, configuration, evidence states, decisions, history, units, time basis, permissions and relationships. Equal file counts do not establish equal meaning. Reconcile events after the recovery point and obtain receiving acceptance before cutover. Service availability and evidence-integrity acceptance are separate.

Verification: Execute missing-link, wrong-version, interrupted-write, expired-authority and restore tests.

Acceptance / hold rule: All essential records and relationships are usable and correct; unresolved evidence loss keeps dependent decisions on HOLD.

79 Contingency survivability and terminal-state stewardship

NORMATIVE REQUIREMENTS

Application: Applies to mission failures, major disruptions, loss of contact, abandonment, retirement and transfer of continuing duties across all domains.

Accountable functions: Mission or service accountable owner; protective-response authority; records and environmental custodians.

79.1 Protect people and essential assets before mission success

The assurance case shall separate mission-success conditions from required protection when the mission objective cannot be achieved. Define credible severe consequences, essential controls, detection, escalation and authorised stop or restriction. Commercial benefit and a favourable aggregate risk score shall not override a missing essential protective condition.

Verification: Review hazard-to-control-to-verification traceability for failed-mission scenarios.

Acceptance / hold rule: Every required protective function has accepted evidence independently of mission performance metrics.

79.2 Emergency feasibility and resources

Protective and recovery plans shall identify actual people, communication, access, equipment, energy, consumables, time and external assistance. An assumed response shall be credited only within demonstrated capability and mission constraints. A rescue agreement, proposed future service or unallocated reserve shall not be counted as assured availability.

Verification: Reconcile scenario timing, resource budgets and exercised interfaces.

Acceptance / hold rule: All required protective pathways are feasible within their approved response and survival bounds.

79.3 Loss of contact and uncertain physical state

The operator shall define the distinction between missing data, confirmed failure, safe dormant state, lost asset and completed disposition. Preserve last valid observations, their age and uncertainty. The absence of an alarm or signal shall not establish safe state. An inference shall identify its model and limits and shall not be presented as direct observation.

Verification: Review the state-classification record against raw evidence and observability limits.

Acceptance / hold rule: Only a supported state is assigned; uncertain essential conditions retain UNKNOWN in operational records and HOLD in dependent acceptance.

79.4 Affected populations and historical decisions

An event shall be traced to affected configurations, fleet members, materials, methods, software, personnel, reports and prior decisions. Determine both occurrence and escape causes and test competing explanations. Changing a supplier, restarting a service or training one person shall not by itself close a shared systemic cause.

Verification: Inspect end-to-end dependency and look-back analysis with actual notifications.

Acceptance / hold rule: All materially dependent outputs are addressed; no valid adverse history is erased by later correction.

79.5 Terminal evidence and responsible transfer

Terminal-state claims shall specify the exact intended condition, permitted inference, observation method, resources and residual duties. Transfer shall preserve custody and receiving acceptance of records, hazardous inventory, notices, monitoring and unresolved remedies. A file sent or contract ended is not accepted closure.

Verification: Reconcile final-state evidence, inventory and recipient acknowledgement.

Acceptance / hold rule: Every required terminal criterion is demonstrated or openly limited, and every remaining duty has an actual receiving owner.

79.6 Learning and sustained accountability

Lessons shall be translated into controlled requirements, methods, training, resources or interfaces and verified under representative conditions. Protect good-faith reporting and distinguish allegation from substantiated misconduct. Long-term archives shall retain technical meaning, access conditions and correction responsibility after staff, tools or institutions change.

Verification: Review corrective effectiveness and test retrieval by a receiving competent reviewer.

Acceptance / hold rule: The affected controls demonstrably improve and the mission record remains interpretable; publication of a lesson alone is not closure.

80 Integrated all-domain profile and final release

NORMATIVE REQUIREMENTS

Application: Applies to the final technical-profile dossier and each independent result claimed under this publication; connects all retained and added provisions.

Accountable functions: Profile owner; independent technical reviewer; authorised panel or decision function.

80.1 One complete application schedule

The schedule shall join the object tuple, F01–F08 selection, Annex AK domains, phase/mode matrix, required methods, parameter records, competence, evidence, independent decisions and continuing controls. All triggers in Annex AO shall be resolved. Shared records may be reused after relevance review, but shall not merge distinct objects, outcome classes or actual authority.

Verification: Reconcile the full schedule with Clauses 1, 4, 62 and 63 and Annex C.

Acceptance / hold rule: No essential scope, parameter, responsibility or evidence field remains undefined before a positive decision.

80.2 Domain and verification completeness

Map every applicable domain and requirement to valid verification and to an accountable conclusion. Treat domain counts, test counts and completed checklist percentages as planning measures only. Annex T is not exhaustive of all future methods; a newly discovered material mechanism shall create a controlled additional requirement and evidence task before the affected claim proceeds.

Verification: Perform forward and reverse traceability and inspect omitted-domain reasons.

Acceptance / hold rule: Every applicable condition passes or has a justified approved N/A; no HOLD or FAIL is hidden by a coverage percentage.

80.3 Competent independent closure

The independent reviewer shall have verified technical coverage, lawful evidence access and no prohibited case relationship. Technical dissent shall be resolved by evidence, corrected scope or further work. Where a three-person panel is required, all three eligible members shall participate and the established vote rule shall apply only after the technical gates are satisfied.

Verification: Check competence, conflict, access, panel and reasoned decision records.

Acceptance / hold rule: Both the technical conjunction and applicable authority/panel rules pass; a vote cannot cure absent evidence.

80.4 Bounded claim and publication

The outcome shall identify legal holder, issuer, object, configuration, family/module, domain, site or remote responsibility, criteria, limitations, actual dates and ongoing or instance basis. Public wording shall not imply unrestricted coverage of all space, universal safety, statutory permission or external recognition without evidence. The approved cover and edition label do not change those boundaries.

Verification: Compare the actual decision with credential, registry and all proposed public representations.

Acceptance / hold rule: Published scope and status exactly match the authorised decision and preserve every material restriction.

80.5 Continuing conformity and change

Maintain surveillance, technical validity, people, resources, configuration, monitoring and actual state history under the controlling clocks. Mission, environment, population or technology changes shall trigger impact review before expanded reliance. Restoration shall preserve expiry unless a full renewal has occurred and shall not validate the suspended interval.

Verification: Audit actual completion, change and status records rather than scheduled dates alone.

Acceptance / hold rule: The current claim remains fully supported; overdue or invalidated conditions trigger the applicable restriction, suspension or withdrawal.

80.6 Completion boundary

This standard is a requirement and evidence framework. Each actual mission and technical profile shall complete its numerical limits, specialist procedures, permissions and validation. Technical profiles and material requirement changes shall follow Clause 4 before binding live use. No statement in this publication guarantees that every undiscovered physical phenomenon or future technology has already been validated.

Verification: Review the final release dossier and distinguish publisher acceptance from application-specific implementation and validation.

Acceptance / hold rule: Only the exact demonstrated and authorised scope is released; incomplete domains remain available for controlled development, not presumed conformity.

Annex A — Programme portfolio and scope-selection rules

NORMATIVE

The eight families are retained as programme architecture. The result class follows the evaluated object and the permitted current AF terminology, not a family marketing title.

A-1. Family and outcome boundaries

Family	Coverage	Permitted outcome boundary
F01 Management Systems Assurance	Organisation and its system; design/production, maintenance, distribution.	Organisational certification or accurately bounded recognition; AF 9100 conformity only after its actual assessment.
F02 Critical Processes and Products	Site-specific process window or identified product/configuration/family/lot.	Process qualification; product or process conformity. No approval of every output from a qualified machine.
F03 Testing and Inspection	Technical body, method family, property/range, location and relationship.	CAB competence accreditation. A laboratory report is a separate technical output.
F04 Education Programmes	Named programme, discipline, level, curriculum, location and delivery mode.	Programme recognition under current AF definitions; any wider accreditation label remains gated by Annex N.
F05 Airports and Aerodromes	Legal operator, identified aerodrome, infrastructure and assigned functions.	Operational capability recognition; no operating licence or automatic tenant coverage.
F06 Aircraft Maintenance and Technical Services	Entity + facility/station + aircraft/engine/component family + task + limits.	Maintenance or technical-service capability recognition; not a maintenance release or design privilege.
F07 Ground Operations and Aviation Support Services	Provider + headquarters + station + declared G01–G09 tasks.	Station/service capability recognition; no blanket approval of subcontractors or airline operations.
F08 Carbon, Environment and Climate Assurance	Organisational capability or an identified environmental statement.	Separate capability recognition, statement verification/validation and verifier CAB accreditation.

A.1 Common mechanism

F05–F07 and relevant F08 modules may use one application interface, coordinated visits and shared evidence management. This is a common operating mechanism, not a ninth family. Other combinations may use the same administrative efficiencies when their independent technical and decision boundaries are preserved. Required extra work shall not be removed merely because assessments are bundled.

A.2 Scope selection

Select every family triggered by the claimed activity or retained responsibility. Identify the primary outcome and any supporting evidence route. For example, an MRO may present F01 system evidence, F06 maintenance capability, F03 NDT method evidence and F04 training evidence. These links do not award all four results automatically. A supplier or tenant remains a separately bounded performer.

A-2. Initial modules retained from the programme architecture

Family	Module	Boundary to preserve
F06	M01 Line; M02 Base; M03 Engine/APU; M04 Component	Exact facility/station, type/family and authorised task.
F06	M05 Structures/cabin/modification embodiment; M06 Technical asset support; M07 Storage/end of life	Approved data, direct versus advisory responsibility, life and eligibility.
F07	G01 Handling; G02 Cargo/mail; G03 Fuel/energy	Service, station, equipment, personnel and handovers.
F07	G04 Ground equipment; G05 Catering/cabin/sanitation; G06 FBO	Underlying tasks and actual providers remain visible.
F07	G07 Flight/navigation support; G08 Digital systems; G09 Security services	Dedicated technical competence, permissions and restrictions.
F08	C01 Inventory; C02 Reduction/transition; C03 Energy/circularity	Capability, historical information and prospective statements are separate.
F08	C04 Local environment; C05 Climate resilience; C06 Energy/supply claims	Approved methods, boundaries, uncertainties and claim mechanisms.

A.3 Controlled catalogue expansion

The architecture's F02 planning range is not a fixed certified programme count. The separate documentation plan proposes 22 process-profile development subjects; they remain projects until scoped, deduplicated, technically completed and released. NDT and materials testing remain in F03. New education disciplines, airport variants and verifier methods are supplements, not new families.

Annex B — Authority, independence and case-decision matrix

NORMATIVE

B-1. Responsibility and prohibited combinations

Function	Responsible role	Control and boundary
Programme strategy, resources and legal operators	Presidential Council within verified constitutional powers	Not the applicant's technical grant decision.
Technical normative text	Responsible elected technical committee; Council publication authorisation	At least 60-day consultation; substantive two-thirds participation and approval rules.
Application review and scheduling	Authorised Secretariat and technical application reviewer	Verify live scope, actual competence and conflicts; receipt is not grant.
Assessment and witnessing	Competent lead and assigned technical specialists	No final decision on own evaluation; retain actual observations and limits.
Independent technical review	Authorised reviewer independent of evaluation and applicant consultancy	May also decide only when separately authorised and conflict-cleared.
Accreditation grant/renewal/extension and contested adverse outcome	Three independent authorised panel members	All three participate; at least two support; every mandatory gate substantiated.
Other conformity or recognition outcome	Independent authority named in released profile	No original evaluator, relevant consultant or materially interested person.
Urgent protective status action	Authorised duty function under pre-existing written mandate	Immediate protection; applicable 24-hour status response; prompt independent review.
Appeal	Independent three-person panel through constitutional appeals function	Exclude original evaluation/review/decision and materially implicated selectors.
Operator MoU and mark permission	President or other validly authorised signatory	Competence, actual authority and precise written scope must separately exist.
Public registry	Authorised registry custodian	Implements decision, cannot enlarge scope, alter dates or waive status.
Independent review of accrediting operator	Competent external independent reviewers	No self-accreditation or reciprocal nominal approval.

B.1 Case-role test

Before access or appointment, record whether the person prepared, sold, consulted on, evaluated, reviewed or decided the case, and identify ownership and personal relationships. A current conflict requires recusal and replacement, not a signature declaring independence. A technical expert's conclusion is evaluation evidence when they produced it; it cannot simultaneously be the sole independent review of that same work.

B.2 Panel failure conditions

If any of the three required accreditation panel members is absent, ineligible or conflicted, replace the member or defer. Two remaining members are not a valid three-person panel. Where an essential technical objection remains unresolved, a numerical majority cannot establish the missing evidence. Record a hold and the competent action required. A favourable decision requires its complete technical gate independently of the vote.

B.3 Appeals and institutional oversight

Case-panel appointments do not establish permanent committee offices. The responsible constitutional bodies retain their mandates. Appeal authority may correct, remit or replace a supported decision through due process; it cannot order evidence to exist or confer an unavailable statutory permission. Independent oversight shall retain access to the actual record and reasons.

Annex C — Technical-profile specification and completeness gate

NORMATIVE

C-1. Required profile payload

Field group	Required controlled information	Release check
Identity	Profile ID, version, title, owner, technical approver, family/module, issue/effectivity.	Unique, available and within programme authority.
Evaluated object	Entity, product, service, process, person, education programme, body or statement.	No mixed or ambiguous result class.
Domain and boundary	Sites/stations, methods, types, materials, configurations, modes, period and exclusions.	Each limitation is objectively identifiable.
Obligations	Applicable legal/customer/technical commitments and authoritative technical data.	Compatible and available to authorised reviewers.
Prerequisites	Resources, competence, permissions, implemented work and readiness evidence.	Actual proof rather than planned capability.
Requirements	Characteristic/outcome/competence IDs, criterion, units, range, consequence and basis.	Every essential criterion is verifiable and approved before results.
Evaluation	Methods, sampling, tests, live or simulated witnessing, setup and representativeness.	Suitable for the actual decision and technical domain.
Measurement and scoring	Uncertainty, covariance where relevant, decision rule, component scores and essential steps.	No hidden averaging, undefined denominator or retrospective threshold.
Independence	Evaluator, reviewer, panel/decision role and prohibited combinations.	Competence and conflicts can be satisfied in practice.
Time and sites	Work breakdown, shifts, locations, remote suitability and resource floors.	Enough productive work for every necessary conclusion.
Findings	Critical/major/minor conditions, containment, closure and original notification dates.	Failure cannot be relabelled as an optional improvement.

Field group	Required controlled information	Release check
Continuing status	Ongoing/instance basis, duration, surveillance, changes, renewal and withdrawal.	Consistent with this core and controlling AF requirements.
Statements and marks	Permitted exact claim, scope schedule, label use and public verification.	No unapproved expanded accreditation or public-licence claim.
Records	Minimum fields, raw evidence, custody, retention, access and continuity.	Relationships survive export and provider closure.
Release and maintenance	Pilot, unresolved actions, actual adoption, owner, review and amendment route.	All relevant activation gates closed.

C.1 Criterion record

Each criterion row shall contain a unique identifier, statement, object/configuration, applicability, quantitative limit or defined attribute, units, technical basis, verification method, sample/population, uncertainty or rubric, critical-failure condition, evidence reference and responsible decision role. Empty essential limits cannot be replaced by phrases such as appropriate quality or all aerospace use.

C.2 Profile tailoring

A profile may add justified detail and more protective controls but shall not waive a higher AF requirement or mandatory obligation. Alternative methods require prospective technical validation and approval. A variant may rely on previous evidence only after its material differences and failure mechanisms are evaluated. The profile shall identify what is reused and what must be newly demonstrated.

C.3 Completion decision

The profile owner and independent technical reviewer shall sign a completeness conclusion covering every field group. Missing essential criteria, rights, evidence access or competent evaluation keeps that profile in development. Editorial availability, market demand and an applicant's willingness to pay do not close the gate.

Annex D — Assessor, reviewer and decision-maker competence

NORMATIVE

D-1. Entry and role authorisation

Role	Required evidence	Authorisation limit
Internal auditor	Task-relevant experience; at least 16 hours AF/process-audit learning; one complete witnessed audit; satisfactory reporting.	Independent of own work; not automatic third-party authority.
Independent auditor	At least three relevant professional years including two in quality/assurance/technical domain; at least 40 hours AF audit learning; knowledge 80% or higher; practical 85% or higher; all essential steps; four mentored complete audits totalling at least 20 auditor-days.	Actual witnessed approval and bounded route/sector.
Lead auditor	Qualified independent auditor plus three complete audits led under supervision, totalling at least 10 auditor-days; competent team planning and reporting.	No scope beyond verified leadership and technical coverage.
Specialist assessor or expert	At least three years relevant technical practice, normally two within the preceding five; AF orientation; verified actual task demonstration. A non-audit assessor additionally demonstrates the profile's evaluation and reporting task.	Expertise does not automatically authorise audit leadership or final decisions.
Technical reviewer	Verified rule interpretation and technical coverage; five satisfactory mentored complete file reviews.	No independent review of own evaluation.
Decision maker	Verified scope, evidence, impartiality, status and remedy knowledge; five satisfactory mentored complete decisions; access to necessary expertise.	No decision on own evaluation, relevant consultancy or materially interested case.
Application/appeal reviewer	Verified task knowledge and satisfactory observed performance; relevant specialist advice where needed.	Appeal role excludes original case roles.

D.1 Programme competence versus technical specialism

These role minima preserve the common AF assessment baseline. ASTRA family orientation shall cover exact outcome boundaries, profile application, technical evidence, prohibited claims and relevant data controls. It does not convert forty hours of audit learning into expertise in an unfamiliar method. Record recent practice and direct demonstration for the actual laboratory technique, discipline, airport function or service task.

D-2. Continuing authorisation

Role/control	Minimum or trigger	Required response
All assessment roles	At least 16 hours relevant development per 12 months.	Review actual learning and current ability.
Independent auditors	At least four auditor-days across two assignments per 12 months.	Unmet minimum suspends independent role until supervised reactivation.
Lead auditors	At least two complete assignments led per 24 months.	Re-establish current leadership if not met.
Reviewers/decision makers	At least three substantive reviews/decisions per 12 months for the role.	Competence review and supervised reactivation if unmet.
Auditor observation	Witnessed performance at least every 24 months; sooner for new/high-consequence scope or adverse evidence.	Record actual strengths, gaps and limitations.
Auditor inactivity	More than 12 months without relevant practice.	Updated learning and satisfactory witnessed assignment before independent work.
Specialist currency	Relevant current practice and observed evidence at profile-defined intervals.	Review significant change, loss of currency or adverse performance before assignment.
Independent case conflict	Relevant employment or consultancy within previous 24 months.	Exclude case; review older and other material conflicts separately.

D.2 Domain evidence

Laboratory assessors demonstrate method validity, uncertainty and result interpretation. Educational assessors demonstrate outcome assessment, curriculum/level judgement and learner evidence. Airport, maintenance and service assessors demonstrate relevant operational interfaces, task authority, conditions and safe witnessing. Environmental assessors demonstrate inventory boundaries, data, materiality and claim-specific assurance. Record those domains independently; an authorisation shall not default to all families.

D.3 Bootstrap and equivalence

At least two independent competent professionals shall evaluate initial assessor candidates. Map every experience criterion to verified evidence; retain gaps, observed tasks and decisions. Equivalent prior experience does not waive programme knowledge, witnessed performance or independence. Role assessment is not a credential for a real person until the actual evidence and authorised decision exist.

Annex E — Site, method-family and witnessing coverage

NORMATIVE

E-1. Minimum evidence coverage by family

Family	Coverage required before initial grant or extension	Examples of limits
F01	Applicable organisational sites, processes, shifts and readiness/implementation under the actual system scheme.	Use AF 9100 site and time rules when claiming that standard.
F02	Actual site, process family, essential variables, representative materials/geometries and product acceptance.	No automatic new-site or new-material scope.
F03	Each distinct method family, actual technical site, preparation, measurement/inspection, interpretation and report.	Grouping requires common principles and demonstrated bounding capability.
F04	Every claimed programme, level, delivery location/mode and material completion route; representative learner evidence.	No institution-wide inference or wholly simulated graduate population.
F05	Each named aerodrome and included critical operational function, relevant operating conditions and provider interfaces.	A group headquarters visit is insufficient for site capability.
F06	Each included facility/station, type/family/task capability and required independent/release interfaces.	No blanket aircraft or component scope from corporate approval.
F07	Each granted station/service task and local variation; headquarters shared controls separately.	High-risk service not inferred from another station.
F08	Each statement boundary and material category; responsible data systems and relevant sites; declared assurance form.	Inventory verification is not achieved reduction or verifier accreditation.

E.1 Sample selection

Document populations, selection, consequence, known failures, changes and limits. Include adverse records and examine whether a selected case is representative of routine implementation. The assessor, not the applicant's publicity team, controls the evidence selection within lawful access. Judgmental sampling shall not be described as a statistical confidence level.

E.2 Surveillance eligibility

Reduced surveillance sampling is available only through an approved profile for demonstrably homogeneous low-consequence activities. The profile shall define eligible population, mandatory sites, rotation, random/risk selection and expansion. Unique, newly added, high-consequence or materially deficient activities shall not enter a reduced homogeneous pool. An AF 9100 organisational sampling formula shall not be transplanted to technical-provider or station capability without its own justified rule.

E.3 Alternative observation

Remote or simulated observation shall identify purpose, identity, setup, essential steps, fidelity, custody, independent selection, limitations and supplementary work. If the necessary capability is inaccessible or the simulation cannot reproduce it, retain the gap. A competent person's live attendance through a secure connection can support witnessing, but network presence alone is not equivalence to physical access.

E.4 Expansion and completion

Expand the sample when contradictory records, adverse results or common controls indicate broader risk. Record what additional work was completed and what remains uncertain. Close the plan only when every necessary claim has sufficient evidence, or revise the requested scope through an authorised real boundary. Do not label planned or interrupted work completed.

Annex F — Assessment-resource planning and worked calculations

NORMATIVE PLANNING CONTROLS; EXAMPLES INFORMATIVE

F.1 Activity-based model

For non-organisational scopes, assign each work package a necessary productive duration h_i and required competent roles. T_eval = sum(h_i)/8 evaluator-days. Allocate common work once and add distinct technical tasks; record concurrency without double-counting the same task. Separate reports, independent review, panel work, travel and administration. Approve technical sufficiency rather than using the total as a universal minimum. Additional necessary work remains mandatory.

F-1. Synthetic integrated service assessment plan

Task	Productive hours	Basis or limitation
Scope/readiness and common controls	12	One fictional provider; shared work counted once.
Station 1 technical service observation	12	Two declared service tracks; safe access and suitable work assumed.
Station 2 local capability and interfaces	12	Direct local evidence; not inferred from station 1.
Technical records, adverse cases and vertical trails	8	Includes relevant outsourced work and actual results.
Follow-up needed to complete planned observation	4	Not a reserve to omit if the task remains necessary.
Evaluation subtotal	48	48/8 = 6.0 evaluator-days. Not a programme-wide floor.
Report production	6 additional	Excluded from productive evaluation subtotal.
Independent technical review	5 additional	Separate conflict-cleared resources.
Three-person decision work	3 person-hours additional	Assumed one hour of actual work per member. Not evaluation time.

F.2 Organisational calculation where AF 9100 applies

Round effective personnel N upward after justified FTE and unique-critical-role treatment. Base B is 2, 3, 4, 5, 7 or 9 auditor-days for bands 1–10, 11–25, 26–75, 76–150, 151–300 and 301–600 respectively; above 600, B = 9 + ceil((N-600)/300). K is 1.00, 1.15, 1.35 or 1.60 for C0–C3. The additive f is 0.15 for each triggered special-process, assured software/AI/digital-acceptance and materially novel-technology condition. Sites Sv and additional materially different shifts H have their actual meanings. These are AF 9100 rules, not ASTRA-wide empirical estimates.

F.3 Organisational equations

T_calc = ceil(2 × [B × K × (1+f) + 0.5(Sv-1) + 0.5H])/2. T shall meet T_calc and the site floor, with extra time for coverage. T1 = max(0.5, ceil(2 × 0.25T)/2); T2 = T-T1 shall be at least 1.5. Surveillance time is at least max(1, ceil(2 × 0.5T)/2); renewal time is at least max(2, ceil(2 × 0.75T)/2), plus necessary site/technical coverage. Increase T when both stages cannot be achieved. Do not use these equations for personnel examinations or laboratory method witnesses.

F.4 Checked synthetic example

For N=80, C2, special processing and assured digital acceptance, one site and no additional shift: B=5, K=1.35 and f=0.30. The raw time is 8.775; the rounded initial minimum is 9.0 auditor-days, readiness 2.5 and implementation 6.5. Surveillance is at least 4.5 and renewal at least 7.0 auditor-days. Independent review and decision are additional. This reproduces the underlying AF planning example, not a quotation for an actual applicant.

F.5 Optional statistical detection illustration

For independent random observations with constant issue probability p, the probability of detecting at least one issue in n observations is 1-(1-p)^n. To reach C, n = ceil[ln(1-C)/ln(1-p)]. With p=0.10 and C=0.95, n=29 and detection probability is approximately 95.2899%. This does not validate judgmental sampling, dependent evidence or a claim that an organisation is 95% conforming.

Annex G — Decision rules, finding classes and non-compensable gates

NORMATIVE

G-1. Finding and consequence

Class	Decision meaning	Minimum action
Critical	Uncontrolled unacceptable safety/mission risk, deliberate material falsification or serious compromise of essential evidence.	Immediate protection; block grant; within 24 hours on substantiation suspend or effectively restrict affected ongoing status.
Major	Missing or broken required control materially undermines ability to meet criteria, including systemic combinations.	Block grant/renewal/extension until closure; immediately review continuing conformity; suspend affected unsupported scope.
Minor	Local failure without material system breakdown or loss of essential control.	Correct and address cause; no open minor at grant/renewal/extension; bounded existing continuation only on documented grounds.
Observation	Potential improvement without a demonstrated failed requirement.	Optional improvement; not used to hide a failure or require uncontracted consultancy.

G.1 Conjunction of gates

Grant = valid scope AND criteria fulfilled AND evidence adequate AND in-scope nonconformities closed AND competent independent decision authorised. Required operator and mark permissions must be effective before use. No financial, environmental, quality or educational score compensates for an unmet mandatory gate. A vote confirms a supported outcome; it does not manufacture the evidence.

G.2 Full-interval rule

For inclusive specification [L,H], corrected result y and symmetric expanded uncertainty U: conformity is demonstrated if $y-U \geq L$ and $y+U \leq H$. Nonconformity is demonstrated under this rule if $y+U < L$ or $y-U > H$. Otherwise the result is indeterminate. Use actual coverage endpoints for asymmetric uncertainty and only the relevant bound for a one-sided specification. Equality is inside an inclusive limit. Use unrounded values for decisions; report precision separately.

G.3 Rule selection and alternatives

Where uncertainty can materially change a high-consequence acceptance decision, use the full-interval rule unless an independent metrology and relevant technical authority prospectively approve a justified alternative. Simple nominal-limit acceptance requires disclosed risk and suitability; it is not zero-risk. A risk-targeted alternative shall document the objective, consumer/producer risks, model, distribution, dependence, prior information where used, validation and approval. AF 9100 DR-A/DR-B/DR-C controls remain controlling for its claims.

G-2. Synthetic dimensional decisions

L/H, mm	y, mm	U, mm	Conclusion
49.970 / 50.030	50.024	0.004	Conforming under the full-interval rule: [50.020, 50.028].
49.970 / 50.030	50.028	0.004	Indeterminate: upper endpoint 50.032 overlaps limit.
49.970 / 50.030	50.036	0.004	Nonconforming under the rule: lower endpoint 50.032 exceeds upper limit.
49.970 / 50.030	50.026	0.004	Conforming under the rule: upper endpoint equals inclusive limit.

G.4 Boundary and repeated decisions

If uncertainty leaves an empty acceptance region, improve the method or obtain a prospectively justified alternative; do not widen the product requirement silently. Repeat measurement shall follow an approved method retaining original results and accounting for selection effects. Multiple characteristics require consideration of cumulative false-decision risk and dependence. A coverage interval is not automatically a posterior probability that a particular item conforms.

G.5 Technical disposition versus attestation

A lawful concession may authorise bounded use of a known departure when the applicable technical and contractual framework allows it. The record shall preserve the original failed criterion and actual authority. It does not establish fulfilment of that criterion or authorise a conformity attestation with open mandatory failures. A conditional development gate is not a conditional certificate.

Annex H — Controlling programme timetable and state transitions

NORMATIVE

H-1. Mandatory intervals and triggers

Control	Trigger	Interval	Consequence
Ongoing outcome	Independent decision	Maximum 24 months	Shorter profile permitted; no automatic extension.
Routine surveillance	Decision/last completed surveillance	Maximum 12 months	Complete actual evaluation, not just booking.
High-consequence /nov el/integrity-se nsitive surveillance	Decision/last completed surveillance	Maximum 6 months	Mixed scope uses shortest triggered interval unless genuinely separated.
Corrective-action plan	Finding notification	30 calendar days	Immediate protection remains separate.
Major closure	Finding notification	60 calendar days	Verified effectiveness; no presumption of ongoing conformity.
Minor closure	Finding notification	90 calendar days	No initial/renewal/extension with open minor.
Critical protection	Recognition of concern	Immediately	Stop or contain affected work.
Holder critical notice	Awareness	Within 24 hours	Earlier legal/customer duties remain.
Operator critical status action	Substantiated critical concern	Within 24 hours	Suspend or effective evaluated restriction.
Registry status update	Status decision	Within 2 calendar days	Holder urgently informed; exact affected scope.
Suspension resolution	Suspension decision	Maximum 90 calendar days	Restore on evidence, restrict unaffected scope or withdraw.
Final evaluation report	Evaluation close	Within 14 calendar days	Exceptional delay explained; finding clocks unchanged.
Unplanned non-critical material change	Awareness	Within 5 calendar days	Expanded claim still requires prior evaluation.

Control	Trigger	Interval	Consequence
Planned material change	Before implementation/extended claim	Early enough for required prior review	No generic grace period for unassessed scope.
Complaint/appeal acknowledgement	Receipt	Within 5 calendar days	Where a reply channel exists; urgent triage is immediate.
Initial substantive complaint response	Receipt	Within 30 calendar days	Does not replace necessary immediate protection.
Ordinary appeal submission	Decision notice	Normally within 30 calendar days	Good-cause late admission is reasoned and consistent.
Ordinary complaint/appeal determination	Receipt	Normally within 60 calendar days	Necessary extension: reasons, revised date, progress at least every 30 days.
Programme internal audit and formal review	Active operation	At least annually	Performance/risk review quarterly.
Independent accrediting-operator review	Before launch/last review	At most 36 months	Earlier after significant adverse evidence.
Rule/profile suitability review	Issue/last suitability review	At most 3 years	Earlier when material evidence warrants.
Substantive public consultation	Published proposed normative text	At least 60 calendar days	Actual record before final technical approval.

H.1 Date arithmetic

Record awareness, notification, completion, decision, issue and expiry separately with a clear time zone. Days mean calendar days unless expressly stated otherwise. Month intervals end on the corresponding date, or month-end when that date does not exist. The later issue of a report shall not postpone a finding already formally notified. A statutory or contractual earlier duty prevails; a generic administrative period does not postpone it.

H.2 Status rules

Development and pilot are programme states, not live holder accreditations. Holder states are active, restricted, suspended, expired or withdrawn, with a separate historical instance result. Missed required surveillance or closure triggers affected suspension/restriction; expiry remains visible. Restoration does not extend original expiry without a full renewal or validate the suspended interval. A pending appeal does not automatically change those states.

H.3 Date examples — informative

A calendar-month interval ends on the corresponding calendar day, or the last day of the destination month if that day does not exist. A 90-calendar-day suspension uses the actual recorded trigger and is not treated as three calendar months. An ongoing outcome cannot exceed the 24-month anniversary of its actual independent decision. Renewal planning does not extend validity.

Annex I — Technical scopes, report content and registry payload

NORMATIVE

I-1. Provider activity routing

Activity	Scope fields beyond common identity	Independent result boundary
Laboratory testing	Material/item; property; method/version; range/conditions; site; relevant limits.	Testing competence, not product certification.
Calibration	Quantity; range; method; reference basis; uncertainty capability; site/mobile conditions.	Demonstrated calibration capability under stated conditions.
Inspection	Object/stage; method; criteria; independence relationship; access/detection limits.	Inspection competence in its declared relationship.
System certification	System scheme/profile; sector; sites; technical and criticality coverage.	Competence to make the specified organisational certification decisions.
Product/process/service certification	Object family; profile; evaluation methods; instance/ongoing model; surveillance.	No unassessed product line or service extension.
Personnel certification	Role/task profile; level; methods; practical scope; independent decisions; renewal.	Not an occupational licence or employer task authorisation.
Statement validation/verification	Statement type; sector; methodology; assurance form; materiality and boundaries.	Body competence, not endorsement of every future claim.
Proficiency/reference-material activities	Specialised methods, assigned values/property characterisation, statistics, uncertainty and controls.	Dedicated release required; not inferred from laboratory accreditation.

I-2. Minimum technical result report

Group	Mandatory content when applicable
Identification	Issuer, report ID/version, client, object/sample/asset identity, site, method/version, dates, actual performer.
Conditions	Sampling responsibility, preparation, environment, configuration, equipment and deviations.
Results	Actual observations, units, processing, corrections, uncertainty/coverage where needed, decision rule, stated conclusion.
Limits	Subcontracted evidence, opinions, sampling/access limitations, excluded characteristics, non-routine methods.
Authority	Competent signatory, independent review where required, authorisation limits, amendment reason and earlier version.

I-3. Public scope and protected detail

Data group	Public minimum	Protected case detail
Holder/issuer	Legal name; unique identifiers; responsible issuer.	Verified legal evidence; representative and sensitive personnel information.
Scope	Outcome class; family/module; location; technical activity and material restrictions.	Detailed configuration, protected ranges or site identity where lawful handling requires.
Basis	Criteria/profile identifiers and version; evaluated period.	Raw results, method evidence, full sampling and technical justification.
Status	Decision/issue dates; expiry or instance boundary; current restrictions/status.	Full findings, deliberations, conflicts, sensitive appeal records.
Authenticity	Verifiable identifier and authorised status channel.	Signing keys, access logs and security configuration.

I.1 Controlled scope strings

Use the format outcome class | legal holder | family/module | site/station | method/task/programme | configuration/level/range | criteria version | limits | decision | expiry or instance. A field may be protected only with an approved public alternative sufficient to prevent misleading scope. Do not replace a technical scope with a corporate slogan.

Annex J — Educational outcome and attainment evidence framework

NORMATIVE

J-1. Adaptable outcome dimensions

Dimension	Programme-specific outcome to define	Useful direct evidence
Foundational reasoning	Appropriate disciplinary knowledge and quantitative reasoning at the claimed level.	Assessed problems and explanations showing valid assumptions and units.
Problem definition	Frame the actual need, constraints, context and evidence limitations.	Problem statements, requirements and justified boundary choices.
Design and technical judgement	Develop and justify solutions within relevant safety, quality and resource constraints.	Design projects, trade-off records and technical reviews.
Experiment and observation	Plan and perform safe, interpretable practical work.	Lab/practical records, setup, uncertainty and data interpretation.
Digital and data competence	Use relevant computational tools with validation, integrity and privacy controls.	Versioned code/models, known-answer checks and interpretation.
Lifecycle and interfaces	Understand integration, operation, support and change consequences.	Interface analysis, maintenance/support plans or integration tasks.
Quality and evidence	Trace requirements to verified outcomes and correct errors responsibly.	Assurance dossiers, inspection records and corrective-action exercises.
Ethics and responsibility	Recognise limits, conflicts, human consequences and escalation needs.	Case analysis and observed decisions, not declaration alone.
Communication and collaboration	Communicate evidence and work effectively in the actual professional context.	Technical reports, presentations, team/individual contribution evidence.
Learning and adaptation	Identify gaps and acquire updated knowledge for changing tasks.	Reviewed learning/reflection, subsequent improved task performance.

J.1 No universal curriculum claim

The dimensions are a framework for a technically approved discipline and level profile. They are not a declaration that every short course must award a degree or teach every professional domain. The actual profile shall identify applicable outcomes, depth, workload, completion pathways, assessment and essential practical skills. A named degree, professional role or curriculum label requires a corresponding coherent profile.

J.2 Outcome record

For each outcome, retain criterion/rubric version, assessment method, learner population, sample and selection, direct evidence, achievement threshold, observed result, delivery mode, limitations, reviewer and improvement decision. Separate learner attainment from provider-process conformity. A programme may implement its rubric correctly yet identify a weak learning outcome requiring educational improvement; the profile defines the significance for programme status.

J.3 Synthetic attainment calculation

For an illustrative criterion, 34 of 40 evaluated learners demonstrate the specified outcome: 85%. The six not demonstrating it remain visible. If the sample excludes another completion route, the 85% shall not be attributed to that route. A separate essential safety step failed by two learners cannot be compensated by the group's mean score. No 85% universal programme threshold is set by this example.

J.4 Closed-loop evidence

Record baseline weakness, its educational causes, chosen action, resources, implementation, later comparable evidence and the decision whether improvement occurred. A later higher score requires review of changed rubric, sample and difficulty before attributing the increase to the action. Indirect feedback can explain issues but shall not replace required direct evidence of practical ability.

Annex K — Airport, maintenance and service-interface record

NORMATIVE

K-1. Shared-interface fields

Field	Information to record
Identity	Interface ID/version; legal parties; airport/facility/station; service and operational boundary.
Responsibilities	Accountable operator; actual performer; approval, inspection, maintenance and release duties.
Technical basis	Current data; compatibility; parameters owned by each party; required authorisations.
Handover	Inputs, outputs, condition/status, acceptance, acknowledgement and custody.
People and assets	Authorised roles; equipment compatibility; utilities; training and local variation.
Abnormal events	Stop/hold authority; communication; incident categories; unavailable service and fallback.
Change	Prior notification; impact review; temporary conditions; requalification and release.
Records	Actual task/result links; data access; retention; confidentiality; closure and transfer.
Assurance	Separate ASTRA profiles/results; evidence reuse; assessment and surveillance responsibility.

K.1 Synthetic multi-party example

A fictional airport operator contracts a handler, fuel provider and maintenance organisation. The airport's F05 result addresses its infrastructure and retained coordination duties. The handler's G01 result identifies its station and actual tasks; the fuel provider's G03 scope identifies the relevant delivery service; the maintenance scope identifies facilities/types/tasks. A data item may support several assessments after relevance review, but the four entities retain their own scope decisions and claims.

K.2 Failure propagation

If a common utility, shared database or access process fails, trace dependent services and claims. Restriction may be limited only when the unaffected scope is independently demonstrated. Restoring the shared system requires technical integrity and operational acceptance, not only availability. Record which party communicated restrictions and who verified restoration at each dependent interface.

K.3 Maintenance and ground-service handovers

A completed service record shall identify actual asset, configuration, task, date, provider, applicable data, observations, unresolved conditions and receiving acknowledgement where required. It shall not claim that an airport licence, maintenance release or operational clearance was issued by ASTRA. A service coordinator remains responsible for its own commitments without falsely claiming direct execution of subcontracted tasks.

Annex L — Environmental statement methods and transparent calculations

NORMATIVE METHOD CONTROLS; NUMERICAL EXAMPLES INFORMATIVE

L.1 Inventory equation and units

For compatible activities A_i and factors EF_i, gross inventory E = sum(A_i × EF_i). Intensity I = E/Q uses a defined functional output Q. Each category shall state boundary, units, period, factor identity/edition, allocation and data quality. Avoid double counting stages included in an upstream factor and another category. Gross emissions, reductions, removals and compensation shall remain separately reported.

L-1. Synthetic partial operational inventory

Category	Assumed activity	Assumed factor	Calculated emissions
Purchased electricity	200,000 kWh	0.25 kg CO2e/kWh	50,000 kg CO2e
Fuel	10,000 L	2.50 kg CO2e/L	25,000 kg CO2e
Inbound transport	20,000 tonne-km	0.10 kg CO2e/tonne-km	2,000 kg CO2e
Total for this limited boundary	Reporting period and fictional entity	No flight, full supply chain or lifecycle claim	77,000 kg CO2e
Intensity	10,000 service events	77,000/10,000	7.7 kg CO2e per defined event

L.2 Scenario and boundary

If only assumed electricity activity falls to 180,000 kWh, the new partial total is 72,000 kg CO2e: 5,000 lower, or 6.4935% of the original total. This is a calculation scenario, not measured improvement. Actual claims require comparable boundaries, data, production/service mix and review of omitted material effects. These factors are deliberately synthetic and shall not be used as real emission factors.

L.3 Uncertainty and incompleteness

For a general inventory, propagate relevant uncertainty and dependence. For independent category total uncertainties u_i, u(E) = sqrt(sum(u_i^2)); covariance terms are added when needed. With illustrative relative standard uncertainties of 5%, 10% and 20%, absolute components are 2,500, 2,500 and 400 kg CO2e, giving u(E) approximately 3,558.09 kg CO2e. A coverage factor requires justification. Quantified uncertainty does not account automatically for an omitted lifecycle stage; boundary incompleteness is a separate limitation.

L.4 Misstatement and materiality

Keep a register of identified errors, extrapolated sample concerns, omissions, bias and qualitative misstatements. Evaluate aggregate effect against the prospectively approved materiality basis and the intended users. No universal materiality number is set here. A deliberately misleading claim, a missing mandatory category or an improper exclusive attribute allocation may be significant regardless of its numerical percentage.

L-2. Claim distinctions

Claim type	Evidence and allowed interpretation	Prohibited implication
Verified inventory	Actual historical data under stated boundary, methodology and period.	Not automatic reduction, zero emissions or complete flight footprint.
Verified reduction	Comparable baseline and current evidence, recalculations and attribution limits.	Not a future plan or unmeasured scenario.
Validated transition plan	Plausible assumptions, resources, milestones, risk and monitoring.	Not assurance that forecast reductions have occurred or will occur.
Energy/attribute allocation	Eligible traceable quantity and exclusive contractual claim with transparent mechanism.	Not necessarily physical delivery or whole-service zero emissions.
Capability recognition	Implemented organisational controls and performance evidence.	Not verification of every statement or accreditation of the verifier.

Annex M — Complete common case-record dictionary

NORMATIVE

M.1 Common payload

Every applicable record shall include unique record ID, template or schema version, case/object identity, scope/profile version, creation and relevant event/decision dates, accountable author, reviewer/approver, evidence references, status, access class and retention basis. Corrections preserve the original and reason. The module numbers below define payload groups; dedicated blank forms are planned separately and equivalent systems may implement the fields.

M-1. Record modules

Module	Required payload beyond common fields	Controlling provisions
01 Programme adoption and scope activation	Operator and instruments; technical approval; consultation; authority; profile; actual effectivity; complete release gates; signatures.	4, 31; Annex P
02 Application and requested scope	Entity/representative; family/object/module; sites; methods; configuration; period; permissions; previous results; exclusions.	1, 11
03 Admission and evidence-reuse review	Live scope; competence/resources; conflicts; access; existing evidence authenticity/relevance; gaps; accepted/deferred/refused request.	11
04 Technical-profile and criterion schedule	All Annex C fields plus versioned criterion–method–decision rows and critical controls.	4; Annex C
05 Competence, experience and authorisation	Role; verified prerequisites; learning; observed work; scores/essential steps; independent decision; technical limits; currency.	7; Annex D
06 Case conflict and assignment	Persons/entities; previous roles; relationships; 24-month screening; controls; recusal; independent clearance; tasks.	3, 6, 7
07 Assessment plan and time	Scope; criteria; sites/shifts; methods; team; task durations; witnesses; safety/access; samples; actual changes.	12; Annexes E, F
08 Remote-method suitability and session	Identity; authority; security; recording choice; live/recorded evidence; connection; observations; interruption; additional work.	10, 13
09 Witness and vertical technical trail	Task identity; configuration; method; equipment; performer; essential steps; actual data; conclusion; limitations; trail links.	13, 19
10 Evidence and sample index	Requirement; population; selection; item; source; version; provenance; custody; access; validity; purpose and status.	9, 10, 13

Module	Required payload beyond common fields	Controlling provisions
11 Technical result and measurement decision	Object; method; conditions; corrected result; raw data; units; uncertainty/model; decision rule; outcome; technical sign-off.	9; Annex G
12 Finding, containment and corrective action	Requirement/evidence/gap; grade; affected population; protection; original notice/due dates; occurrence/escape causes; effectiveness; closure.	14
13 Independent review and decision	Dossier; competence/conflicts; scope/method/coverage; gates; panel participation/votes if required; reasons; actual dates; permitted claim.	15; Annex B
14 Scope schedule and certificate instruction	Issuer/holder; class; object/family/module; site/range/task; criteria; dates; expiry/instance; limitations; registry and mark permission.	28; Annex I
15 Surveillance, change and renewal	Current scope; criticality; actual due/completion dates; changes; coverage; findings; review; decision; original expiry.	16; Annex H
16 Suspension, restriction, restoration and withdrawal	Cause; affected scope; immediate controls; dates; 90-day limit; unaffected-scope evidence; verified remedy; notices; history.	14–16
17 Complaint, appeal and protected disclosure	Receipt; issue/decision; safety triage; privacy; admissibility; independent panel; evidence; party response; remedy; progress; systemic action.	27
18 Operator agreement and authorisation schedule	Parties; actual authority; competence; binding terms; technical/geographic scope; duties; marks/data; oversight; term; signatures.	3, 11
19 Laboratory/inspection competence and validity	Method/site/range; signatories; equipment; uncertainty; validation; comparisons; witnesses; relationships; adverse work; independent decision.	19, 25

Module	Required payload beyond common fields	Controlling provisions
20 Process qualification and product readiness	Process/product; material/site/equipment; essential variables; qualification trials; first article; acceptance; excursions; requalification.	18
21 Education self-study and outcome attainment	Programme/level/mode; all completion routes; outcome maps; learner/staff/resources; direct evidence; improvement; teach-out.	20; Annex J
22 Airport and operational-interface dossier	Operator/aerodrome; functions; infrastructure; permissions; safety; actual interfaces; emergency; defects; restoration; limits.	21; Annex K
23 Maintenance facility/type/task capability	Legal entity; sites/stations; type/family; tasks; current data; people/tools/parts; work/independent checks; actual release; limitations.	22
24 Station/service and local-variation dossier	Headquarters; station; G-track; actual tasks; providers; equipment/staff; customer/local data; incidents; performance; continuity.	23
25 Environmental statement and verification	Statement/version; boundary/period; categories; activity/factors; materiality/assurance; baseline; errors; evidence; independent conclusion.	24; Annex L
26 Digital evidence, incident and recovery	System/configuration; permissions; raw evidence; event times; affected population; containment; restore/integrity checks; return authority.	10, 26
27 Internal audit, management and independent operator review	Plan; reviewers/conflicts; actual process trails; findings; performance; resources; decisions/actions; verified effectiveness.	29
28 Programme change, transition and closure	Old/new basis; affected parties/scopes; legal and technical actions; notices; transfer/teach-out; records; remaining duties.	30, 31

M.2 Cross-record checks

Application scope shall match the profile; competence shall match the plan; actual evidence shall match the evaluated configuration; findings shall reflect failed conditions; verified closure shall precede grant; decision shall match public scope/status; changes shall preserve history; and operator authority shall match the issuer. A completed form without these links is not a complete dossier.

M.3 Record completeness and signature

A signature identifies the person and approved action; shared credentials or a pasted signature image shall not conceal responsibility. Independent review and decision may be combined only where permitted and attributable. Separate certificate-based digital signatures or controlled authenticated workflows may be used. No form field shall imply actual approval merely because it is preprinted.

Annex N — Existing-instrument compatibility and prospective design decisions

INFORMATIVE ALIGNMENT; REQUIRED COMPATIBILITY GATES ARE IN CLAUSES 0, 2, 4 AND 31

N-1. Protected AF instruments and actions

Instrument or interface	Retained position	Implementation action
AF-CON-001	Presidential Council/President roles; elected committee offices; technical independence; optional services; accreditation defined for assessment bodies.	Verify actual adoption and authority. Wider educational/operational accreditation wording needs explicit higher-instrument review.
AF-SR-001	Common scheme hierarchy; CAB accreditation; programme/capability recognition; independent panel; 24-month outcomes; 6/12-month surveillance; 30/60/90-day actions.	Use compatible current outcome classes. This standard does not amend its definition by implication.
AF 9100:2026	Final unchanged technical text, object routes, competence, audit time, decision rules and timetable.	Apply when that standard is actually claimed. No relabelling of old outcomes or relaxed technical rules.
AF-QM-001 and AF-ML-001	Federation-wide QMS and controlled document inventory.	Add ASTRA documents only after actual control decisions; distinguish prepared from planned and adopted.
Corporate conduct, conflict, privacy, complaints, remote and mark policies	Applicable safeguards remain in force under their actual editions.	Map programme procedures and forms without silently superseding existing corporate documents.
Eight-family architecture	Eight families; common F05–F07/F08 mechanism; G01–G09; C01–C06; separate actual scopes.	Planning names do not grant status. Adopt controlled ASTRA codes and technical profiles through release gates.

N.1 What continues from the architecture

The family count, initial testing/inspection subjects, maintenance scope structure, nine service tracks, six environment modules, common administration, independent outcomes and scope boundaries continue from the development architecture. The architecture itself did not settle detailed competence, time, site coverage, technical limits, fees or public outcome names.

N.2 Programme requirements and profile boundaries

This standard establishes programme-specific common controls, family baseline requirements, profile payloads, coverage tests, educational outcome and attainment controls, environmental claim safeguards, digital state logic and pilot checks. The 22 F02 process subjects organise technical-profile development; each actual process scope requires completed criteria, demonstrated capability and its own authorised release. Catalogue inclusion is not an operational decision or an incorporation of an external scheme.

N.3 Terminology implementation route

The programme brand is AF ASTRA. Under current definitions, CAB competence uses accreditation and education/airport/MRO/service capability uses the appropriate recognition or qualification result. A desired sector-specific accreditation designation may be proposed for controlled constitutional and scheme version. The actual resolution shall identify exact revised provisions, consultation/approval, lawful use, effectivity and affected claims. Until those gates are complete, the compatible labels control. No amendment to the final AF 9100 file is made by this project.

N.4 Open real-world inputs

Actual operating entities, countries, technical limits, fees, submission channels, staff appointments, independent assessors, live records, profile approvals and activation decisions require authentic completion. This document intentionally does not invent those facts. Preparing the master text is distinct from completing those operating prerequisites.

Annex O — Digital record relationships and controlled state logic

NORMATIVE

O-1. Minimum interoperable entities

Entity	Essential keys and attributes	Relationship check
entity	entity_id, legal_name, status, verified_identity_record	One entity may hold several separately decided scopes.
profile	profile_id, version, family, module, criteria, effectivity, release_record	Each case uses an exact approved version.
case	case_id, applicant_id, requested_outcome, profile_refs, scope, sites	Application is separate from grant.
evidence	evidence_id, case_id, type, configuration, provenance, version, access, status	Evidence acceptance is purpose-specific.
finding	finding_id, requirement, evidence_refs, grade, original_notice, due, status	Closing requires actual verified evidence.
assignment	person_id, role, scope_authorisation, conflict_clearance, task	Expired or conflicting authority blocks assignment.
decision	decision_id, case_id, dossier_version, gates, decision_role, votes, date, reason	No evaluator deciding own independent case.
credential	credential_id, decision_id, exact_scope, issue, expiry_or_instance, state	No wider scope than decision; preserve changes.
operator_authorisation	authorisation_id, entity_id, competence_decision, executed_terms, scope, state	Accreditation and operating permission remain separate.
appeal	appeal_id, contested_decision, receipt, independent_panel, result	Does not automatically change credential state.
status_event	event_id, credential_id, prior_state, new_state, decision_id, actual_time	Append history rather than overwrite.
release	release_id, profile_version, technical_and_institutional_approval, effective_time	Live applications only for released scopes.

O.1 Grant guard

A digital workflow shall reject a grant instruction when profile release, exact scope, complete evidence, criterion fulfilment, finding closure, competent independent decision or required authority is absent. Where accreditation panel participation is required, all three eligible members and sufficient votes must exist. The workflow may flag those conditions; an accountable authorised person makes the actual decision.

O.2 State transitions

Application → admitted → evaluation → review → decided is a case workflow, not a promise of positive outcome. A refused case may return through controlled new evaluation with history retained. Active → suspended → restored or withdrawn requires real status decisions; expired → renewed starts from the actual new decision and preserves the gap. Restricted scopes shall retain the full earlier history and identify the independently unaffected part.

O.3 Export and interoperability

An export shall contain readable decisions, exact scope, field dictionary, timestamps, version and status relationships, necessary evidence manifest and permissions. Validate counts and meaning after import, including units, identifiers, character encoding and time zones. Exporting a certificate image alone is not transfer of a complete technical dossier. Protect sensitive information and provide redacted public views where appropriate.

Annex P — Pilot test set and profile-activation checklist

NORMATIVE

P-1. Required representative workflow challenges

Test	Scenario	Expected control
P01	Complete synthetic positive case	Grant only after every technical, independence and authority gate is substantiated.
P02	Undefined method or criterion	Keep scope in development; no live grant.
P03	Missing essential evidence	Hold dependent conclusion; do not mark not applicable.
P04	Unresolved critical result	Immediate protection and correct status action; high score does not compensate.
P05	Open minor at initial grant	Block grant until verified closure.
P06	Existing bounded minor	Require protection, cause/extent, accepted plan and independent continuation rationale.
P07	Major affecting shared controls	Review all dependent scopes; no unsupported continuation.
P08	Conflicted evaluator or reviewer	Exclude and reassign before relevant work.
P09	Missing panel member	No valid three-person accreditation decision.
P10	High scores but failed essential competence step	Refuse authorisation for the role until valid remediation/reassessment.
P11	Remote feed interruption or prerecorded substitution	Record limitation and repeat/supplement required observation.
P12	Unassessed station added to scope	Block extension until local evidence and independent decision.
P13	Invalid calibration or method	Hold affected results and review prior work.
P14	Full-interval boundary result	Apply inclusive bound with unrounded values; retain indeterminate separately.
P15	Incomplete educational completion route	No blanket programme conclusion over missing route.

Test	Scenario	Expected control
P16	Environmental plan presented as reduction	Reject claim wording; separate validation from achieved historical change.
P17	Exclusive supply attribute counted twice	Resolve allocation before supporting the claim.
P18	Expired credential and pending renewal	Preserve expiry and gap; booking does not extend.
P19	Suspension beyond 90 days	Restore on evidence, restrict demonstrably unaffected scope or withdraw; no reset.
P20	Appeal while suspended	Independent remedy proceeds; no automatic reinstatement.
P21	Backup restored but evidence link broken	Hold assured use until integrity is established.
P22	False or broadened registry claim	Correct public scope, investigate source and preserve history.
P23	Provider closure	Protect records, holders, open cases and lawful transfer.
P24	Unsupported expanded accreditation title	Apply compatible current outcome or complete explicit higher-instrument amendment first.

P-2. Actual activation gates

Gate	Evidence required before live release
Authority	Verified operator and responsible issuer; actual delegations; compatible outcome terminology.
Normative process	Completed consultation, comment disposition, technical approval and institutional publication/adoption.
Technical profile	Complete object/criterion/method/decision/coverage/continuing-control definition.
People	Competent assessors, specialists, reviewers, panels and independent remedies with actual availability.
Operating documents	Relevant manual/procedures/checklists/forms complete, consistent and available.
Resources and terms	Facilities or witnessing access; data systems; financial/liability arrangements; executed agreements and fees.
Pilot and correction	Representative technical and workflow tests completed; blocking findings closed.
Registry and claims	Validated exact scope, status, authentication, privacy, history and approved wording.
Continuity	Recovery, provider exit, learner/customer protection and unresolved-case handling.
Actual decision	Authorised scope-specific release with date, limits, signatories and published availability.

P.1 Acceptance of the pilot

The pilot record shall distinguish synthetic tests, genuine evaluation observations and unresolved technical limitations. Passing a scripted workflow test does not validate empirical method sufficiency. The independent readiness reviewer shall determine whether the actual technical profile and team are ready for the proposed live scope. A completed checklist is not the release decision itself.

Annex Q — Documentation hierarchy and implementation sequence

INFORMATIVE DEVELOPMENT PLAN

Q-1. Controlled-document layers

Layer	Contents	Release condition
Core standard	AF ASTRA-100:2026 / AF-AST-STD-001 and applicable normative annexes.	Actual normative approval and programme adoption.
Programme manuals	Operations, provider competence, sector capability, decision function and registry.	Consistent practical workflows and trained users.
Policies and procedures	Programme-specific implementation of impartiality, access, methods, assessment, remedies, data and continuing status.	No dilution or silent replacement of corporate AF safeguards.
Technical profiles	Eight family profile books with individual methods, tasks, locations/levels and acceptance criteria.	Technically complete and independently validated for exact scope.
Guides and checklists	Applicant/assessor explanations and complete requirement-level evaluation tools.	Trace to actual controlling clauses; no invented requirements.
Forms and registers	Blank records implementing Annex M, approval, scope and state relationships.	Validated fields, access, history and genuine completion.
Implemented evidence	Real applications, evaluations, decisions, notifications, surveillance and corrections.	Authentic events; no fabricated pilot or operational records.

Q.1 Document identifiers and readiness

AF-AST document codes identify controlled ASTRA publications. AF-AST-ML-001 records the actual identity, availability, approval and effectivity of each operating document. A reserved code does not establish an issued or adopted file. Technical module entries organise scope development; they are not additional programme families or automatically issued certificates.

Q.2 Delivery sequence

Develop the implementation system in dependency order: establish the core standard and document controls; implement common manuals, procedures and records; complete the applicable technical-provider, education, operational, environmental, management-system and critical-process profiles; then integrate controlled pilots and release evidence. Work may proceed in parallel according to actual need and resources without skipping a dependency or treating another family's readiness as proof of the selected scope.

Q.3 No phantom documents

A reference to a required information set is implemented by the actual controlling annex until a dedicated template is issued. A planned procedure is not represented as an existing approved file. Before a profile opens, check that its complete dependent document set exists, has been approved where required, is consistent and is available to relevant users. The unchanged corporate Master List shall be updated only through its actual control process.

Annex R — Calculation checks and integrated synthetic cases

INFORMATIVE

R-1. Decision and calculation examples

Example	Calculation or evidence	Result and interpretation
Accreditation panel	Three eligible members participate; two affirmative, one adverse; all mandatory gates supported.	Numerical threshold met. Dissent recorded; cannot override an unresolved mandatory evidence gap.
Invalid panel	Only two of three required members participate; both vote yes.	No valid three-person panel, despite 100% of present votes.
Committee normative ballot	Nine eligible members; six substantive yes/no votes; four yes and two no.	ceil(2×9/3)=6 participation; ceil(2×6/3)=4 affirmative; arithmetic minima met.
Non-compensable competence	Knowledge 88%; practical 91%; one essential safety step failed.	No role authorisation from averaged 89.5%; remediate and directly reassess.
Independent uncertainties	u1=0.003 and u2=0.004 mm.	Combined standard uncertainty 0.005 mm; with justified k=2, U=0.010 mm.
Correlated uncertainties	Same components; correlation 0.5.	Variance 0.000037 mm^2; u approximately 0.00608276 mm. Independence cannot be assumed away.
Service availability	960 available hours and 40 unavailable hours in the defined observation window.	96%; does not establish correctness or safety while available.
Quality completeness	190 verified of 200 applicable criteria; one remaining critical control unverified.	95% completion but no positive conformity grant.
Education attainment	34 of 40 assessed learners meet one defined outcome.	85%; sample and outcome specific, not a programme certification score.
Fuel/service trace	A source lot splits into 200, 200 and 100 units.	500 units reconcile, but identity/condition and customer links still require evidence.

R.1 Integrated application

A fictional provider requests F06 maintenance capability at two stations, F03 NDT competence for one technique and a C01 historical inventory verification. Share legal identity and relevant document controls after checking applicability. Evaluate both maintenance stations and the NDT method separately; environmental verification retains its own period, boundary and data. A major calibration-control failure affects NDT results and any maintenance decisions relying on them. Contain those scopes and review prior work. A satisfactory carbon inventory cannot close the technical failure.

R.2 Permitted completion

After demonstrated correction, prior-result disposition and independent review, each scope receives its actual decision. The maintenance outcome remains capability recognition under current AF terminology; the independent NDT body may receive CAB accreditation only through its complete technical and independent authority route. The inventory statement records only the historical boundary examined. No one certificate establishes every claim for all three scopes.

R.3 Verification limits

The supporting computational checks test arithmetic and specified logical behaviour using synthetic cases. They do not prove a real applicant's competence, adequacy of technical limits, completion of consultation or acceptance in any jurisdiction. Operational tools require their own validated environment, authentic inputs, competent review and controlled use.

Annex S — Technical-subject catalogue

INFORMATIVE CATALOGUE; APPLICABILITY AND RELEASE GATES REMAIN NORMATIVE UNDER CLAUSES 1, 4 AND 31.

This catalogue defines the 68 technical-subject identities in the eight-family architecture. It preserves the code-to-subject relationships used for scope selection. A specific method, aircraft type, station, educational programme or environmental statement requires its own completed technical profile and release evidence. Current operational availability shall be established from the authorised scope register, not inferred from catalogue inclusion.

S.1 F01 — Management systems: three subjects

Code	Technical subject	Boundary
F01-S01	Design and production system	Actual organisational activities and sites; AF 9100 remains a separate claimed standard.
F01-S02	Maintenance system	The management-system outcome is not a maintenance task release.
F01-S03	Distribution system	Authenticity, storage and supply responsibilities; no unassessed repair or production privilege.

S.2 F02 — Critical processes and products: 22 subjects

Code	Technical subject	Essential scope distinction
F02-CP01	Thermal treatment	Actual material, equipment, thermal history and qualified window.
F02-CP02	Fusion joining	Qualified joining route, material, geometry and personnel.
F02-CP03	Solid-state joining	Demonstrated process and interface properties.
F02-CP04	Brazing and soldering	Joint, preparation, materials, process and acceptance.
F02-CP05	Chemical surface preparation	Controlled surface condition and downstream compatibility.
F02-CP06	Plating and conversion coatings	Qualified substrate, treatment and required properties.
F02-CP07	Thermal spray processes	Actual deposition route, substrate and coating performance.
F02-CP08	Organic coating processes	Preparation, application, cure, condition and properties.
F02-CP09	Composite material processing	Constituent identity, lay-up, cure and laminate evidence.
F02-CP10	Structural bonding	Preparation, bond process, durability and inspectability.
F02-CP11	Metal additive manufacture	Feedstock, machine, digital build, geometry and post-processing.
F02-CP12	Polymer additive manufacture	Material history, build configuration and application properties.
F02-CP13	Casting	Material, mould/process history, representative properties and defects.
F02-CP14	Forging and forming	Material state, deformation route, geometry and downstream treatment.
F02-CP15	Precision machining	Actual geometry, surface condition, tools and characteristic acceptance.
F02-CP16	Non-conventional machining	Process effects on hidden and surface characteristics.
F02-CP17	Mechanical surface enhancement	Controlled surface process, coverage and consequential properties.
F02-CP18	Electronics assembly	Parts, interconnections, loaded configuration and workmanship.
F02-CP19	Wire and harness assembly	Circuit identity, terminations, routing and relevant electrical checks.
F02-CP20	Optical assembly	Optical identity, alignment, cleanliness and functional acceptance.

Code	Technical subject	Essential scope distinction
F02-CP21	Critical mechanical assembly	Fit, fastening, tooling, concealed steps and final configuration.
F02-CP22	Cleanliness and contamination-sensitive processing	Defined contamination limits, validated methods and preserved condition.

S.3 F03 — Technical providers: ten subjects

Code	Technical subject	Result boundary
F03-L01	Non-destructive testing	Competence for actual technique, item, range and location.
F03-L02	Materials testing	Competence for specified measurands, methods and specimens.
F03-L03	Calibration and metrology	Demonstrated quantity, range and uncertainty capability.
F03-L04	Inspection body activities	Declared object, stage, method and independence relationship.
F03-L05	Management-system certification bodies	Full audit-to-decision competence for the actual scheme.
F03-L06	Product, process and service certification bodies	Exact object and conformity model; no automatic extension.
F03-L07	Personnel certification bodies	Secure and valid assessment of the defined task or role.
F03-L08	Validation and verification bodies	Statement type, methodology, sector and assurance form.
F03-L09	Proficiency activity providers	Specialised exercise design, assigned values and statistical validity.
F03-L10	Reference material producers	Characterisation, homogeneity, stability and uncertainty.

S.4 F04 — Education: six subjects

Code	Technical subject	Boundary
F04-E01	Engineering degree programmes	Programme, discipline, level, curriculum, location and completion routes.
F04-E02	Engineering technology programmes	Demonstrated applied outcomes appropriate to the actual award.
F04-E03	Computing and digital programmes	Verified learner capability, not assumed tool capability.
F04-E04	Applied science programmes	Coherent disciplinary depth and experimental evidence.
F04-E05	Technical and vocational programmes	Direct practical competence for the published pathway.
F04-E06	Professional continuing-development programmes	Actual learning outcomes; attendance is a separate result.

S.5 F05 — Airports and aerodromes: five subjects

Code	Technical subject	Boundary
F05-A01	Conventional aerodromes: international, regional, cargo and general aviation	Named operator and site; actual functions and operating basis.
F05-A02	Heliports	Dedicated technical supplement and permissions.
F05-A03	Vertiports	Configuration-specific aircraft, infrastructure and energy interfaces.
F05-A04	Spaceports and launch-site interfaces	Dedicated scope; no launch permission from conventional airport recognition.
F05-A05	Civil/military shared aerodrome interfaces	Clear shared authority, access and operational responsibilities.

S.6 F06 — Maintenance and technical services: seven subjects

Code	Technical subject	Boundary
F06-M01	Line maintenance	Facility/station, type/family, task and actual release privileges.
F06-M02	Base maintenance	Verified capability for the declared base-maintenance tasks.
F06-M03	Engine and APU services	Actual engine/APU family, process and technical limits.
F06-M04	Component maintenance	Specified component and task; eligibility and life history retained.
F06-M05	Structures, cabin and modification embodiment	Approved technical data; embodiment is not design approval.
F06-M06	Technical asset support	Advice, planning and records responsibility distinct from maintenance release.
F06-M07	Storage, preservation and end of life	Preserved identity, condition, eligibility and responsible disposition.

S.7 F07 — Aviation support: nine subjects

Code	Technical subject	Boundary
F07-G01	Ground handling and turnaround	Actual station, task, equipment and handover.
F07-G02	Cargo, mail and specialist logistics	Shipment identity, custody and specialist permissions.
F07-G03	Fuel and energy services	Declared service and energy architecture; novel capability separately demonstrated.
F07-G04	Ground equipment and technical facilities	Equipment/service compatibility, condition and competent release.
F07-G05	Catering, cabin and sanitation services	Actual hygiene, contamination and aircraft-interface duties.
F07-G06	FBO and business-aviation support	Directly delivered and coordinated services distinguished.
F07-G07	Flight and air-navigation support	Dedicated data/service scope; actual operating authority remains separate.
F07-G08	Aviation digital and operational systems	Deployed configuration, data integrity and validated fallback.
F07-G09	Specialist aviation security services	Authorised protected review; no transfer of public powers.

S.8 F08 — Environment and climate: six subjects

Code	Technical subject	Boundary
F08-C01	Inventory and data	Defined entity, categories, period, methods and data.
F08-C02	Reduction and transition	Historical achievement distinct from prospective plan.
F08-C03	Energy and circular resources	Actual flows and technical eligibility of reused inputs.
F08-C04	Local environmental performance	Relevant receptors, periods, methods and operating variation.
F08-C05	Climate resilience	Stated scenarios, dependencies, adaptation and limitations.
F08-C06	Low-carbon energy and supply claims	Physical delivery, contractual attributes and exclusive allocation distinguished.

Catalogue arithmetic: 3 + 22 + 10 + 6 + 5 + 7 + 9 + 6 = 68. These counts describe the retained planning architecture; they are not performance scores or counts of live accreditations.

Annex T — Aerospace verification-domain planning matrix

NORMATIVE PLANNING PAYLOAD; THE 38 DOMAIN GROUPINGS ARE INFORMATIVE ORGANISATION OF TECHNICAL WORK.

For each triggered domain, the technical profile shall record requirement and configuration, intended decision, applicable environment, method/version, actual limits and technical basis, article and fixture representativeness, measurement chain, uncertainty, safety review, competent performer, observations, anomalies and independent conclusion. The following descriptions identify what must be considered; they are not operating instructions or universal test severities. Domains may overlap in one integrated verification programme without creating duplicate claims or additional families.

Domain	Planning subject	Evidence focus and limitation
T01	Mechanical material properties	Parent material, specimen orientation and condition, method, raw response and justified population inference.
T02	Physical and chemical characterisation	Composition or property, preparation, interference, reference basis, detection and method uncertainty.
T03	Dimensional and geometric metrology	Datum and coordinate system, actual measurand, configuration, correction and full measurement uncertainty.
T04	Non-destructive evaluation	Technique, defect mechanism, material/geometry, access, personnel and demonstrated detection limits.
T05	Static structural strength and stiffness	Loads and boundary conditions from the actual technical basis; fixture effects and article representativeness.
T06	Fatigue, durability and damage growth	Duty/exposure model, relevant damage, sequence, detection and remaining-life inference limits.
T07	Fracture and joint integrity	Material and interface condition, relevant failure mechanism, method and valid interpretation.
T08	Modal and structural dynamic characterisation	Actual configuration, excitation/measurement locations, boundary conditions and model correlation.
T09	Sine and random vibration	Mission-derived input, axes, fixtures, control, response limits and cumulative article exposure.
T10	Mechanical and separation shock	Actual shock environment, measurement bandwidth, fixture/structure transmission and authorised safety controls.
T11	Acoustic exposure	Environment, spectral/time definition, article operating state, sensor placement and structural response.
T12	Thermal-vacuum performance	Pressure/thermal conditions, heat paths, operating modes, measurement and configuration-specific acceptance.

Domain	Planning subject	Evidence focus and limitation
T13	Thermal balance and model correlation	Energy inputs, boundaries, equilibrium criteria, instrumentation and justified model agreement.
T14	High/low temperature and cycling	Intended use/storage duty, transitions, functional checks and relevant accumulated exposure.
T15	Thermal shock	Actual rapid-transition rationale, article condition, hidden damage and post-exposure verification.
T16	Humidity and condensation	Exposure basis, moisture-sensitive mechanisms, operating state, recovery and material effects.
T17	Altitude, pressure and decompression	Applicable pressure history and enclosure/system response under approved specialist methods.
T18	Corrosion and salt exposure	Relevant substrate/coating, exposure mechanism, specimen condition and limits of service-life extrapolation.
T19	Fluid and chemical compatibility	Actual relevant substances, contact conditions, material changes and post-exposure function.
T20	Sand and dust	Particle and environment basis, ingress/abrasion mechanisms, sensitive interfaces and cleanliness effects.
T21	Water, rain and ingress	Actual installation, exposure direction, seals, functional state and stated detection/acceptance boundary.
T22	Icing, freezing and thawing	Application-specific environment, relevant accumulation or transition effects and safe specialist evaluation.
T23	Solar, ultraviolet and weathering	Spectrum/exposure rationale, material condition and limits of accelerated-ageing claims.
T24	Fire, flammability, heat, smoke and relevant toxic effects	Application-specific safety basis; authorised facilities, methods and protective controls; separate measured properties.
T25	Outgassing and contamination	Material history, particulate/molecular criterion, collection or measurement method and sensitive-surface relevance.
T26	Accumulated radiation and displacement effects	Mission environment, article/part configuration, authorised specialist testing and degradation interpretation.
T27	Single-event susceptibility	Actual device and operating state, specialist evidence, observed effects and mission inference limitations.
T28	Charging and electrostatic effects	Relevant charging paths, bonding, material condition, protective behaviour and authorised test boundaries.
T29	Electromagnetic emissions and immunity	Conducted/radiated paths, ports, modes, installation, instrumentation and applicable performance criteria.

Domain	Planning subject	Evidence focus and limitation
T30	High-intensity radiated-field assurance	Mission/installation basis, coupling paths, representative configuration and required specialist coverage.
T31	Lightning-effects assurance	Applicable direct/indirect effects, bonding and installation basis; safe authorised specialist verification.
T32	Power quality and electrical transients	Actual supply architecture, operating modes, disturbances, protective response and data acquisition.
T33	Insulation, bonding, grounding, harness and shielding	Circuit/configuration identity, workmanship, relevant electrical properties and installed interface performance.
T34	Leakage, pressure and containment	Boundary identity, material and joint history, approved test basis, instrument suitability and safe authorisation.
T35	Energy storage protection and degradation	Configuration/history, coupled failure mechanisms, protection, qualified duty and state-estimation limitations.
T36	Propulsion and integrated functional performance	Approved duty/envelope, critical-part trace, instrumentation, integration, protective functions and qualification boundary.
T37	Software, AI, cyber and model validation	Intended-use-specific methods; traceability, target/domain representativeness, adverse cases and independent review.
T38	Human, service and operational interfaces	Representative users/tasks, workload, handovers, degraded support, protected response and actual service limits.

T.1 Domain completion record

The responsible technical owner shall resolve applicability for all domains relevant to the actual activity. Non-applicability requires a technical rationale; a missing facility or budget is not non-applicability. Domains not listed explicitly may be added within a controlled technical profile when necessary. No wording in this matrix guarantees that these 38 groupings cover every future method or specialised legal requirement.

T.2 Test-readiness and completion decisions

Readiness shall confirm actual criterion, configuration, facilities, instrumentation, safety and competence. Completion shall distinguish valid pass, valid failure, indeterminate result and invalid test. A result may satisfy one characteristic while failing another. The final acceptance shall identify the exact object and profile, preserve all adverse evidence and be made by the appropriate authorised function.

Annex U — Lifecycle gates and mission-assurance dossier

NORMATIVE RECORD REQUIREMENTS; GATE NAMES MAY BE ADAPTED WITHOUT REMOVING THE REQUIRED DECISIONS.

Gate function	Minimum information	Blocking conditions
Need and concept	Intended users, mission/service objective, domain, duration, responsibilities and initial hazards.	Undefined beneficiary, duty or material responsibility.
Requirements baseline	Allocated requirements, interfaces, verification methods, technical basis and open assumptions.	Essential criterion or interface remains unevaluable.
Design and architecture	Configuration, analyses, critical characteristics, software/human dependencies and independent challenge.	Unsupported essential protective function or unresolved cross-interface incompatibility.
Qualification readiness	Representative article, approved methods/limits, suitable facilities, competent people and safety review.	Invalid measurement, missing permissions or unrepresentative essential test.
Production or service readiness	Actual resources, qualified processes, source controls, current instructions and delivery evidence.	A plan is offered instead of demonstrated local capability.
Integrated handover	As-built state, closed requirements, operating/support data, training, restrictions and recipient acceptance.	Unresolved blocking defect or unknown critical configuration.
Continued assurance	Field evidence, changes, maintenance, suppliers, surveillance and updated assumptions.	Current claim no longer supported or required surveillance missed.
Responsible retirement	Final-state evidence, hazardous inventories, data custody, environment, recipients and remaining duties.	Closure would erase evidence, abandon duties or falsely report completed disposal.

U.1 Required gate-decision payload

The record shall identify the gate and object, baseline versions, criteria, submitted evidence, review participants and competence, conflicts, open issues, decision, reason, conditions, owner, due date, permitted actions, prohibited actions, signatures and actual dates. Development conditions shall not be converted into a conditional conformity certificate. A later closure shall retain the original held or conditional state.

U.2 Mission-assurance index

The dossier shall connect concept, requirements, interfaces, hazard analysis, engineering budgets, configuration, source genealogy, process qualification, verification, personnel, release, operations and end of life. A controlled index shall identify unavailable evidence, limitations of reuse and the responsible custodian. A summary without access to essential supporting information is not a complete mission-assurance dossier.

Annex V — Technical-clause applicability and evidence map

NORMATIVE APPLICABILITY RECORD; THE MAPPING DOES NOT CREATE AUTOMATIC CONFORMITY.

The responsible organisation shall use activity and retained responsibility to select applicable expanded clauses. The table identifies principal connections, not exclusive ones. An assessor shall retain a reasoned decision for excluded clauses. An implementation workpack or shorter checklist may aid navigation but cannot replace the complete applicable requirement.

Clause	Principal trigger	Main evidence and retained family connection
32	Lifecycle or integration responsibility	Mission concept, gates and assurance case; F01/F02/F05–F07 as relevant.
33	Requirement or configuration authority	Allocated requirements, interfaces and actual configuration; cross-family.
34	Aircraft, UAS or advanced mobility	Installed-system/domain evidence; F01/F02/F03 and relevant services.
35	Space product or mission	Environment, parts, ground and readiness case; F01/F02/F03.
36	Launch, re-entry, reuse or spaceport interfaces	Exact permission and site/vehicle evidence; existing routes and dedicated profile.
37	Orbital, servicing or in-space production	Authorised interactions, remote evidence and final-state record.
38	Lunar, planetary or remote-surface work	Mission-specific resources, autonomy, access and support evidence.
39	People affected by an assured system	User/task, workload, life-support and protective-response evidence.
40	Defense, maritime or heavy industry	Actual contractual/technical basis, interfaces and long-life support.
41	Critical manufacture	Qualified route, essential variables and genealogy; F02.
42	Verification or test reliance	Technical matrix, valid methods and actual results; F03 supports other objects.
43	Energy and propulsion	Integrated hazards, qualification and support boundaries.
44	Digital artefacts affect outputs	Reviewed baseline, build identity, verification and release.
45	AI or adaptive behaviour	Use/domain, data lineage, performance, authority and drift.

Clause	Principal trigger	Main evidence and retained family connection
46	Model-based decisions	Purpose-specific credibility and physical/model configuration.
47	Digital security affects assurance	Trust boundaries, defensive controls and verified recovery.
48	Procurement or external delivery	Actual performers, flow-down, source authenticity and exit.
49	Maintenance or asset support	Facility/type/task, current data, life history and release; F06.
50	Site and operational coordination	Local capability and interfaces; F05 with distinct supporting results.
51	Ground or specialist support	Headquarters/station/service and actual output validity; F07.
52	Education and technical learning	Programme identity, learner evidence and protection; F04.
53	Environmental capability or statements	Defined boundary, data and independent conclusion; F08.
54	Safety-relevant responsibility	Hazards, protective controls, actual response and learning.
55	Reliability or life claims	Defined exposure, failure, model, uncertainty and actual history.
56	Registry or digital evidence	Record identity, purpose states, decision linkage and portability.
57	Assessors or accrediting operator	Actual competence, independence, moderation and oversight.
58	Independent assessment and ongoing status	Complete scope, coverage, gate, chronology and truthful claim.
59	Novel technology or methodology	Need, evidence gaps, controlled demonstration and adoption.
60	Programme implementation	Dependency-led roadmap and exact-profile readiness.
61	Use of this expanded version	Identity, compatibility, real adoption and publication integrity.

Annex W — Critical-process qualification and route evidence

NORMATIVE RECORD PAYLOAD; ALL NUMERICAL PROCESS LIMITS REQUIRE AN APPROVED APPLICATION-SPECIFIC BASIS.

W.1 Common qualification envelope

For every selected CP module, identify actual site, process, product relationship, materials and conditions, equipment and tooling, software/recipe identity, essential variables, justified ranges, representative geometry, personnel, environment, trials, tests, uncertainty, acceptance, independent review, restrictions and requalification triggers. Record preparation and post-processing interactions. No machine or supplier qualification establishes every product that may use it.

Module(s)	Evidence emphasis	Typical change requiring review
CP01	Actual thermal history, equipment uniformity/suitability, material and resulting properties.	Equipment, load arrangement, material condition or process window.
CP02–CP04	Joint design interface, preparation, consumables, actual route and hidden-property verification.	Material combination, geometry, procedure, equipment or personnel scope.
CP05–CP08	Surface condition, relevant chemical/bath/coating controls, substrate and downstream effects.	Chemistry/source, preparation, coating, cure or substrate.
CP09–CP10	Constituent/out-time history, lay-up or bond preparation, tooling, cure and durability evidence.	Constituent source, storage excursion, surface treatment, geometry or cure route.
CP11–CP12	Feedstock reuse, machine state, build file, orientation, location and post-processing.	Slicing/toolchain, feedstock, machine, build family or subsequent treatment.
CP13–CP14	Material state, forming/casting history, representative properties and defect controls.	Source, geometry, process route or downstream treatment.
CP15–CP16	Geometry, tool/machine programme, surface integrity and relevant hidden effects.	Toolpath, equipment, method, tool, material or critical geometry.
CP17	Surface process coverage, essential variables and relevant fatigue/surface properties.	Media/tool, parameters, geometry or substrate condition.
CP18–CP19	Component/circuit identity, terminations, loaded configuration, workmanship and function.	Source, interconnection process, software, routing or protective features.

Module(s)	Evidence emphasis	Typical change requiring review
CP20	Optical identity, alignment, sensitive surfaces, contamination and measured function.	Assembly technique, adhesive, surface treatment, alignment or environment.
CP21	Fit, fastening, tooling, concealed steps and configuration-specific function.	Critical component, sequence, tool or acceptance method.
CP22	Defined particulate/molecular criterion, method, cleanliness history and preserved condition.	Cleaning material, facility, packaging, exposure or measurement technique.

W.2 Excursion and product acceptance

An excursion record shall identify the last demonstrated valid state, affected runs and articles, actual variable history, possible hidden effects, inspection capability, disposition and recipients. A favourable subsequent run does not validate the earlier population. First article, production readiness, process qualification, unit/lot acceptance and independent certification shall retain separate conclusions.

W.3 Transfer dossier

The sending and receiving parties shall reconcile equipment, material, environment, people, software, method and inspection differences. The dossier shall state retained evidence, additional demonstration, actual receiving results and accepted restrictions. Commercial transfer completion shall not replace technical receiving acceptance or the independent decision required for a new site in scope.

Annex X — Aviation and mobility scope-control cards

NORMATIVE RECORD REQUIREMENTS; THE CASES BELOW ARE SYNTHETIC AND INFORMATIVE.

Record group	Minimum content
Aircraft and equipment	Type/family and configuration; intended use; design/production/maintenance approval holders; installation and support data.
UAS or remote system	Aircraft, control station, links, navigation/services, remote personnel, operating domain and contingency validation.
Advanced mobility	Aircraft-site-energy-passenger interfaces; representative service conditions; degraded support; actual permissions.
Installation change	Before/after configuration; structural, electrical, thermal, data, human and maintenance effects; required new verification.
Continued operation	Actual fleet configurations; occurrences; service history; updates; life status; restrictions and responsible release.

X.1 Synthetic case: separately qualified equipment

A fictional avionics component has valid bench evidence. Installation introduces a different power interface and cooling environment. The original component result may be reused for unchanged characteristics, but it does not close installation compatibility. The integrator records the differences and obtains the additional evidence before making the installed-system claim. A valid organisational certificate does not change this conclusion.

X.2 Synthetic case: new remote-service area

A fictional unmanned-service provider proposes a materially different environment and communications dependency. Its earlier operating-domain evidence is not automatically extended. The responsible technical function reviews the changed conditions, fallback and human-intervention assumptions. The new claim remains held until the necessary evidence, permissions and independent scope decision are complete.

Annex Y — Space, exploration and remote-evidence dossier

NORMATIVE RECORD REQUIREMENTS; MISSION-SPECIFIC NUMERICAL LIMITS ARE NOT PROVIDED.

Domain	Minimum dossier
Mission architecture	Objectives, duration, repairability, roles, payload/platform/launch/ground interfaces and external assumptions.
Space environment	Actual environment basis; qualification versus acceptance; test-article differences; uncertainty and accumulated exposure.
Components/materials	Provenance, mission suitability, process/screening evidence, environmental susceptibility and substitution review.
Ground and commands	Controlled configuration; command authority; timing; authentication; rehearsals; outage and anomaly response.
Remote state	Sensor and telemetry origin, time, calibration/validation, data loss, inferences and unobservable critical properties.
Servicing/assembly	Asset identities; authorised interactions; compatible interfaces; remote completion criteria; abort/safe-state responsibility.
Surface activity	Environment, terrain/contamination, resource budgets, communications, human/autonomy authority and inaccessible maintenance.
Human mission	Life-support and habitation interfaces, occupancy/duration, workload, emergency and safe-return assumptions.
End of life	Resources, failure cases, applicable duties, actual final-state evidence, uncertainty and continuing custody.

Y.1 Evidence classification

The record shall label directly observed information, instrument-derived measurement, model-based inference, operator declaration and unknown state. The classification shall remain attached during aggregation or transfer. A telemetry gap shall not be filled with a favourable default. An unavailable critical physical observation shall be addressed through valid supplementary evidence or a limited conclusion, not a broad statement of mission success.

Y.2 Remote completion review

Before a completion claim, reconcile the intended action, authorised configuration, actual commands, observed response, interpretation limitations and remaining obligations. Distinguish partial completion and technical success from final environmental or operational closure. Independent review shall have appropriate technical competence and lawful access. A mission label or terrestrial analogy shall not supply missing evidence.

Annex Z — Human-system and protective-response evidence

NORMATIVE RECORD REQUIREMENTS.

Element	Required evidence question
Users and tasks	Which actual user populations, tasks, skills and constraints are represented?
Conditions	Are workload, fatigue, interruptions, delayed communication and degraded information addressed?
Interface	Can the user identify actual state, priorities, limitations and required action?
Intervention	Does the responsible person have sufficient time, information and technical ability to intervene?
Essential steps	Which protective responses must pass individually rather than be averaged into a score?
Representation	What differences between test participants, simulation and actual users limit the conclusion?
Life support	Are occupancy, duration, resources, monitoring, maintenance and supporting services integrated?
Emergency	Are actual resources and external interfaces available, compatible and safely exercised?
Worker protection	Do task authority, supervision, access, hazardous-energy interfaces and restoration controls function?
Change	Which alterations in users, automation, procedures or environment trigger reassessment?

Z.1 Decision record

Record the participant or task population, consent and privacy arrangements where relevant, criteria, configuration, scenario, observations, assistance provided, failures, uncertainty and limitations. Coaching during demonstration shall be visible. The final conclusion shall identify the exact user/task and conditions demonstrated. This annex does not establish a clinical diagnosis, fitness certificate or medical treatment protocol.

Annex AA — Software, AI and model assurance cards

NORMATIVE RECORD REQUIREMENTS; AN INTEGRATED CARD MAY BE USED WHEN ALL RELEVANT FIELDS ARE PRESERVED.

Card	Required payload
Digital artefact	Intended use; consequence; source/logic/configuration; build and tools; dependencies; target; reviews; verification; anomalies; release.
AI use and authority	Owner; purpose; domain; prohibited use; affected decisions; alternatives; human authority; intervention/fallback.
Data	Provenance and rights; collection/labelling; version; populations; conditions; partitions; leakage controls; gaps; synthetic contribution.
AI evaluation	Prospective error criteria; essential cases; denominators; relevant strata; uncertainty; adverse results; out-of-domain behaviour.
Model release	Weights; preprocessing; thresholds; dependencies; sensor configuration; target; limits; monitoring; rollback; actual approval.
Digital twin	Asset identity; synchronisation; source/age; physical and model configuration; stale-state detection and permitted use.
Model credibility	Purpose; implementation verification; independent validation evidence; calibration; sensitivity; uncertainty; extrapolation and limits.
Long-life support	Source/build access; licences; supplier/cloud dependency; obsolescence; migration; record readability and retirement.

AA.1 Essential release challenge

For each card, the reviewer shall ask whether a completed field is supported by usable evidence. An impressive model score shall not close a failed essential operating case. An explanatory narrative shall not replace source and test records. A model or tool change shall preserve earlier versions and trigger impact review of previously supported decisions. The accountable release authority remains identifiable.

Annex AB — Defensive cyber-assurance and recovery record

NORMATIVE RECORD REQUIREMENTS; NO INTRUSIVE TESTING IS AUTHORISED BY THIS ANNEX.

Record	Required content
System and trust boundary	Assets, owners, interfaces, users, dependencies and relevant safety/security consequences.
Access	Identity, role, scope, grant/removal dates, privileged actions, emergency access and actual actor attribution.
Dependency and vulnerability	Component/version, provenance, support, relevant exposure, consequence, disposition, responsible party and verification.
Update	Source and integrity, target, compatibility, authorisation, interruption behaviour, rollback restrictions and release identity.
Cryptographic transition	Trust/key inventory, validity/revocation, ownership, migration need, service compatibility and historical evidence preservation.
Authorised testing	Written scope, allowed methods, safety review, data handling, restoration and actual observations.
Incident	Awareness, containment, original evidence, affected configurations/outputs, required notices, correction and technical restart.
Recovery	Baseline, recovery point, service availability, data/configuration integrity, missing events and independent acceptance of return.

AB.1 Separation of successful outcomes

A passing defensive test is evidence for its stated scope, not a guarantee of immunity. A completed patch is not proof of defect closure until verified. A restored service is not assured until relevant data and configuration are accepted. A current signing credential does not prove the underlying engineering conclusion. These distinctions shall remain visible in the final report and public claim.

Annex AC — Supply genealogy, life history and handover

NORMATIVE RECORD REQUIREMENTS.

Relationship	Required information and check
Source to receipt	Actual supplier/performer, item/lot/serial, quantities and units, condition, specification and verified evidence.
Receipt to process	Material eligibility, storage/out-time, preparation, process identity, actual equipment/personnel and configuration.
Split and merge	Parent-child identities, quantities, losses, mixing/reuse rules, condition and custody.
Assembly	Component and loaded-software identity, configuration, concealed steps, deviations and acceptance.
Removal and installation	Asset and positions, old/new items, reason, life and repair history, eligibility and actual release.
Transfer	Sending/receiving scope, material differences, retained/new evidence, actual acceptance and restrictions.
End of life	Serviceability/scrap determination, controlled disposition, sensitive data, materials, record custody and unresolved duties.

AC.1 Synthetic quantity example

A fictional source lot of 500 units is split into 200, 200 and 100 units. The arithmetic reconciles, but the record must still show correct identities, relevant condition and recipient links. If 20 units are consumed in testing, the subsequent balance must account for that consumption rather than duplicate the original quantity. Quantity reconciliation does not establish technical suitability or prove authenticity.

AC.2 Unknown history

Where origin, exposure, repair or life status is missing, record the gap and the technical decision it prevents. A passed inspection supports only characteristics within its detection capability. It shall not reset a life limit or establish an unobservable prior history. Approved alternatives require an actual technical basis and cannot be invented by a record template.

Annex AD — Integrated service and local-station interface record

NORMATIVE RECORD REQUIREMENTS.

Interface field	Content
Parties and boundary	Legal entities, actual performers, site/station, service track, task and relevant permissions.
Technical basis	Current customer/asset information, compatible configurations, actual parameters and responsible technical authorities.
Handover	Input/output, identity, condition, completion state, unresolved items, receiving acknowledgement and custody.
Local variation	Infrastructure, language, climate, equipment, staff, operating hours and local obligations.
Dependencies	Utilities, data, suppliers, emergency services, authorisations and common-cause exposure.
Disruption	Trigger, stop authority, communication, fallback, affected services and continuity restrictions.
Restoration	Verified cause and correction, data/physical integrity, local readiness and actual return authority.
Assurance boundary	Supporting family evidence, separate outcomes, public claims and continuing surveillance.

AD.1 Synthetic common-platform event

A fictional airport, handler and maintenance organisation depend on one configuration database. A data-integrity incident affects their duties differently. Each identifies the outputs and decisions that relied on the compromised information. Restoring the database connection does not close those reviews. Service restoration and ASTRA status are decided through their respective actual authorities. A valid environmental statement for the airport does not compensate for the technical uncertainty.

Annex AE — Competence, moderation and independent oversight

NORMATIVE RECORD REQUIREMENTS; ANNEX D REMAINS THE CONTROLLING SOURCE OF ROLE MINIMA.

Record	Mandatory evidence
Candidate entry	Role, domain, verified experience, learning, prior-work equivalence, gaps and assessor independence.
Practical demonstration	Actual task/configuration, pre-set criteria, essential steps, observations, assistance, failures and limitations.
Mentored work	Candidate contribution, supervisor, case/task, genuine productive work, feedback and accepted completion.
Role decision	Independent competent authority, full criteria, remaining limits, actual authorisation, period and monitoring.
Continuing practice	Relevant development, practice, observed performance, report quality, complaints and new-method impact.
Reactivation	Unmet condition, restricted role, updated preparation, supervised demonstration and actual restoration.
Moderation	Case and reference basis, independent first responses, reasoning differences, evidence, discussion and action.
Operator review	Independent mandate, reviewers/conflicts, actual process/case coverage, findings, limitations, correction and follow-up.

AE.1 Synthetic practical-failure example

A fictional candidate obtains 88% in knowledge and 91% in practical scoring but fails one essential safety step. The average of 89.5% does not authorise the role. The original attempt remains recorded; remediation and an appropriate reassessment address the failed essential performance. This example does not add a new universal score threshold or replace Annex D.

AE.2 Consistency is not correctness

An exercise shall preserve both initial and moderated responses. Agreement may improve because reasoning improved, because the facts were clarified or because participants felt pressure to agree. The review shall distinguish these possibilities. A senior person's preferred answer or the most common response does not close missing technical evidence.

Annex AF — Digital validation and prohibited-transition challenges

NORMATIVE TEST DESIGN REQUIREMENTS; ALL TEST IDENTITIES SHALL BE SYNTHETIC OR OTHERWISE SAFELY CONTROLLED.

Challenge	Required expected behaviour
Undefined or unreleased profile	No live positive claim; preserve development status.
Missing essential source	Hold the dependent conclusion; do not convert the gap to non-applicability.
Wrong object or configuration	Detect or expose mismatch before reliance.
Open critical or major finding	No unsupported grant, renewal or extension.
Open minor at new grant	Apply the existing all-findings-closed gate.
Conflicted evaluator/decider	Block or hold the prohibited assignment.
Expired role authority at event time	No later renewal silently validates prior unauthorised action.
Missing required panel member	No valid three-person accreditation outcome from two participants.
Expired or suspended credential	Reprint, import, appeal or payment does not revive it.
Invalid number, unit or time	Do not treat blanks or ambiguous values as favourable defaults.
Duplicate key or stale update	Preserve coherent identity and detect conflicting versions.
Interrupted write or import	Do not publish an incomplete dossier as a complete approved state.
Missing evidence link after migration	Equal file counts do not close semantic integrity.
Recovery from an earlier point	Identify and reconcile later events and current status.
Public/private projection	Publish only authorised scope and permitted information.
Synthetic test data	Prevent test credentials and notices from reaching live recipients.

AF.1 Required execution record

For each test, record system/version, requirement, preconditions, input, expected behaviour, actual steps, observed result, evidence, tester, defect, consequence, correction, retest and acceptance. Independently computed known answers shall be used for relevant calculations. A spreadsheet can record the tests but does not itself authenticate identities, enforce production permissions or prove operational deployment.

Annex AG — Quantitative evidence and synthetic calculation checks

INFORMATIVE; NUMERICAL EXAMPLES ARE NOT PRODUCT LIMITS, ACTUAL OBSERVATIONS OR CONFORMITY SCORES.

AG.1 Independent random detection example

For n independent observations and a constant issue probability p, the probability of at least one detection is 1 - (1 - p)^n. With p = 0.10 and a target of 0.95, the smallest integer n is 29 and the calculated probability is approximately 0.952899. This model does not describe judgmental sampling automatically. It does not mean an organisation is 95% conforming or that an undetected critical requirement may be treated as fulfilled.

AG.2 Uncertainty and dependence

Two independent standard-uncertainty components of 0.003 mm and 0.004 mm combine to 0.005 mm by the root-sum-of-squares method. If the correlation is 0.5, the variance includes the covariance contribution and becomes 0.000037 mm², giving approximately 0.00608276 mm. Independence cannot be assumed solely to obtain a smaller number. Expanded uncertainty additionally requires an appropriate coverage factor and interpretation.

AG.3 Full-interval decisions

For the synthetic inclusive specification 49.970 to 50.030 mm and expanded uncertainty 0.004 mm, a corrected result of 50.024 mm gives the interval 50.020 to 50.028 mm and demonstrates conformity under Annex G. A result of 50.028 mm produces 50.024 to 50.032 mm and remains indeterminate. A result of 50.036 mm produces 50.032 to 50.040 mm and demonstrates nonconformity under that rule. Do not round an indeterminate result into acceptance.

AG.4 Availability and scope of the claim

For 960 available hours and 40 unavailable hours in the defined observation window, measured availability is 960 / 1,000 = 96%. The record must state included downtime, system configuration and data completeness. The figure does not establish correctness, safety or integrity while the system was available. A service can be available while producing wrong information; separate measures are needed for that behaviour.

AG.5 Partial environmental inventory

Using deliberately synthetic activities and factors, 200,000 kWh × 0.25 kg CO2e/kWh, 10,000 L × 2.50 kg CO2e/L and 20,000 tonne-km × 0.10 kg CO2e/tonne-km total 77,000 kg CO2e. For 10,000 defined service events, the partial intensity is 7.7 kg CO2e/event. Omitting relevant lifecycle stages remains a boundary limitation, not a contribution automatically covered by measurement uncertainty. These factors shall not be used as real emission factors.

AG.6 Readiness and non-compensable gates

190 verified criteria out of 200 gives 95% completion. If a required protective control remains unverified, that percentage does not permit a positive grant. The readiness metric is useful for work planning only. The actual decision remains a conjunction of all applicable conditions in Clause 15 and Annex G. The same distinction applies to learner attainment, document counts, supplier coverage and software test completion.

Annex AH — Dependency-led rollout and foundation workpacks

INFORMATIVE ROADMAP; THE ACTUAL ACTIVATION CONDITIONS IN CLAUSES 4 AND 31 AND ANNEX P REMAIN NORMATIVE.

Retained work package	Implementation focus	Evidence before dependent progression
1 — Foundation	Core standard, documentation plan and master inventory.	Actual authority, controlled text and accurate development status.
2 — Common operating system	Policies, manuals, procedures, records, common checklist and schedules.	Working owners, usable methods, validated records and independent controls.
3 — Technical providers	F03 scopes, specialist competence and method-family witnessing.	Complete criteria, adequate access and actual capability evidence.
4 — Education	F04 outcomes, delivery routes, attainment and learner protection.	Exact programme and authentic relevant delivery/assessment evidence.
5 — Operational capability	F05–F07 site, maintenance and station/service interfaces.	Direct local capability and preserved independent responsibilities.
6 — Environment	F08 methods, data, statement boundaries and claim controls.	Competent engagement, suitable evidence and separate conclusion types.
7 — Systems, processes and future methods	F01/F02 detailed profiles and controlled technical extensions.	Retained AF 9100 rules; valid application-specific methods and limits.
8 — Integrated release	Technical/workflow pilots, correction, independent review and activation.	Every relevant gate complete; real authorised release and truthful public status.

AH.1 Foundation workpacks retained by subject

Existing code	Existing subject	Main function in implementation
ASTRA-IMP-10	Assessor Learning and Qualification Workpack	Actual entry, demonstration, independent role decision and currency.
ASTRA-IMP-11	Technical Profile Completion and First-Case Workpack	Evaluable profile, parameter schedule and complete first-case evidence.
ASTRA-IMP-12	Digital Registry, Credential and Publication Workpack	Source records, scope/status integrity and verified publication.
ASTRA-IMP-13	Independent Accrediting-Operator Evaluation Workpack	Independent examination of the operator itself.
ASTRA-IMP-14	Technical Consistency and Case Moderation Workpack	Compared reasoning, technical dissent and learning.
ASTRA-IMP-15	Surveillance, Renewal and Status-Control Workpack	Actual cycle evidence, original clocks and truthful history.
ASTRA-IMP-16	Consultation, Publication and Controlled Transition Dossier	Genuine consultation, reasoned approval and prospective transition.

These workpacks remain separate publications with their existing code meanings. This standard links their subjects; it does not claim to reproduce every page or every exercise in the implementation collection. Later implementation identifiers are navigation and supporting work, not proof of mandatory new programme stages.

AH.2 Base documentation architecture

Document class	Retained title count
Core standard; development plan; master list	1 + 1 + 1
Policies; manuals; guides	4 + 5 + 12
Procedures; technical profile books	28 + 8
Checklists; forms	9 + 28
Registers; controlled schedules	7 + 4
Total retained base titles	108

The document inventory distinguishes issued publications, adopted operating versions and demonstrated implementation. A complete document count is not an operational readiness score. Changes to the Master List and dependent files remain subject to their own document-control process.

Annex AI — Publication status and edition maintenance

NORMATIVE PUBLICATION AND TRANSITION CONTROLS

FIRST EDITION identifies the published requirement text. Publication acceptance and application-specific operational decisions have separate purposes and records. The current publication-status page identifies the publisher release; the technical and activation records remain controlled under Clauses 4, 31 and 61.

Control	Required treatment
Publication identity	ASTRA / AEROSPACE STANDARD; AF ASTRA-100:2026; AF-AST-STD-001; FIRST EDITION; edition date 30 September 2026.
Publisher acceptance	Approve the identified publication for release. Do not describe this decision as a completed technical pilot, a scope accreditation or an applicant conformity decision.
Requirement status	Apply all triggered normative provisions and approved technical-profile conditions. Informative guides and synthetic examples explain the provisions but do not replace them.
Technical approval	Retain the competent review, consultation, comment dispositions and approval evidence required by Clause 4.3 for the applicable normative process.
Profile activation	Record the exact operator, profile, available resources, completed pilot, closed findings and independent readiness and activation decisions under Annex P.
Edition maintenance	Retain change reasons, affected provision identifiers, effective events and recipient communication. Preserve historical technical and outcome records.
Related documents	Assess profiles, procedures, forms, checklists and tools for compatibility. A reference in the standard does not itself update another controlled document.

AI.1 Requirement-level adoption record

The responsible organisation shall record each affected requirement, object, profile, site or remote duty; prior operating basis; actual gap; necessary technical method, competence, evidence and tool change; owner; verification; effective event; and communication. New obligations shall not be applied retrospectively as though they governed an earlier decision. A publication acceptance shall not conceal the genuine event history of a technical or operational record.

AI.2 Final consistency check

Before live use, verify that the adopted text, technical profile, checklists, methods, parameter schedules, competence assignments, tools and public wording agree. An unresolved essential inconsistency shall place the affected use on HOLD until corrected through actual authority. Identify issued, adopted and operational records separately and preserve the basis of every earlier decision.

AI.3 Publication maintenance entry

Date	Entry	Effect
10 October 2026	Publisher-authorised publication release; reader navigation, typography, activity guides and illustrative records.	Edition identity retained. No operating scope activated, committee vote asserted or field result created.

This publication record documents the publisher's release instruction. It does not record a committee ballot, consultation outcome, independent technical endorsement or completed field pilot.

Annex AJ — Application limits and evidence interpretation

INFORMATIVE

A published standard supplies a common requirement basis. A valid conclusion additionally needs the correct application, controlled technical criteria, competent people and authentic evidence. Use the distinctions below when planning work, reviewing reports or approving a claim.

Evidence or decision	Permitted interpretation	Boundary
Publisher acceptance	The identified text is authorised for publication.	Does not demonstrate an active technical profile or a real applicant's conformity.
Technical profile approval	The actual object, criteria, methods, limits and responsibilities are approved for their stated use.	Does not establish that tests were performed or that every operating site is competent.
Synthetic calculation or filled example	Explains the specified method, input handling and decision logic.	Not a measurement, witnessed event, authentic signature or universal engineering limit.
Laboratory or field evidence	Supports the observed object, configuration, conditions and stated inference.	Does not automatically qualify another method, environment, variant or operating period.
Independent review and decision	Establishes the supported conclusion within actual authority and scope.	Cannot repair missing evidence through a vote, payment or broad programme label.
Scope activation	Makes only the independently ready profile available under its controlled conditions.	Does not activate the entire portfolio or create statutory operating permission.

AJ.1 Self-contained requirements and other obligations

No named outside organisation or separately published external standard is incorporated as a normative reference in this publication. Actual legal duties, contractual constraints and competent public permissions remain applicable to the participating entity. The responsible operator maintains the genuine obligation and technical-evidence register required by Clause 5.1.

AJ.2 Technical certainty and unresolved knowledge

Deterministic acceptance means that an identified rule yields a defined state from valid inputs. It does not remove measurement uncertainty, unknown mechanisms or model discrepancy. Missing essential values, unsupported model use or unresolved technical contradiction lead to HOLD rather than assumed conformity. Application-specific specialist review, actual validation and authentic approval remain necessary.

Annex AK — All-space domain applicability catalogue

NORMATIVE APPLICABILITY RECORD; DOMAIN TAGS ARE ORGANISATIONAL

For each row, record applicability, responsible owner, exact object, phase/mode, profile, criteria, evidence and decision. An absent trigger may be N/A only after independent approval. Unknown applicability remains HOLD. The catalogue does not allocate public operating powers or guarantee that every future phenomenon is already understood.

AK01 Terrestrial engineering and supply

Coverage: Design offices, manufacturing, material sources, procurement and integration.

Mandatory profile content: Actual site, source, configuration, delegated responsibilities and released technical data.

Acceptance boundary: Every delivered characteristic and essential supplier interface is traceable to accepted evidence.

Principal ASTRA connections: 32, 33, 41, 48, 62–65

AK02 Test facilities and technical providers

Coverage: Environmental, structural, materials, calibration and inspection services, including mobile and remote work.

Mandatory profile content: Method, range, uncertainty, environment, site, signatory and provider relationship.

Acceptance boundary: Actual method competence and valid result evidence are separately demonstrated.

Principal ASTRA connections: 8, 9, 19, 25, 42, 77

AK03 Launch sites and spaceports

Coverage: Site infrastructure, handling, ground services, emergency interfaces and actual permissions.

Mandatory profile content: Named site/operator, vehicle and payload classes, utilities, restrictions and receiving parties.

Acceptance boundary: No site outcome is used as vehicle, launch or mission permission.

Principal ASTRA connections: 21, 36, 50, 70

AK04 Launch and deployment interfaces

Coverage: Vehicle/payload integration, handling, ascent environment, separation and commissioning.

Mandatory profile content: Article pedigree, qualification envelope, interfaces and distinct readiness/permission decisions.

Acceptance boundary: Every required integration and protective condition is met before the actual commitment.

Principal ASTRA connections: 35, 36, 64, 65, 70

AK05 Reusable launch and return articles

Coverage: Cumulative exposure, refurbishment, thermal protection, hidden damage and life decisions.

Mandatory profile content: Serial identity, use history, inspection detectability, qualified repair and current limits.

Acceptance boundary: Reuse is based on actual history and accepted condition, never a reset life.

Principal ASTRA connections: 36, 43, 49, 55, 70

AK06 Low Earth orbit systems

Coverage: Satellites, stations and services in the declared near-Earth operating environment.

Mandatory profile content: Actual orbit and duration, drag/atmosphere, atomic oxygen where material, radiation and terminal duties.

Acceptance boundary: Environment-specific qualification and end-of-life capability support the bounded mission.

Principal ASTRA connections: 35, 37, 64–68

AK07 Medium, geosynchronous and high Earth orbits

Coverage: Navigation, communication, relay and other specified orbit-dependent services.

Mandatory profile content: Actual geometry, radiation/charging, links, clocks, service bounds and disposal assumptions.

Acceptance boundary: No lower-orbit or nominal-link evidence automatically covers a different environment.

Principal ASTRA connections: 35, 64–68

AK08 Highly elliptical and transfer regions

Coverage: Missions crossing materially different exposure, geometry and communication regimes.

Mandatory profile content: Phase-dependent environment, cumulative exposure, timing, resources and state confidence.

Acceptance boundary: Every phase and transition has a supported envelope and verification path.

Principal ASTRA connections: 32, 35, 64, 66, 72

AK09 Cislunar and libration-region systems

Coverage: Lunar vicinity, relays, gateways, transportation interfaces and regional services.

Mandatory profile content: Reference frames, communication constraints, resources, users and external support.

Acceptance boundary: The exact operating domain and service dependencies are technically complete.

Principal ASTRA connections: 35–39, 64, 66, 69, 72

AK10 Constellations and formation services

Coverage: Distributed functions, inter-satellite links, fleet management and shared ground support.

Mandatory profile content: Member configuration, collective service, common causes, coordination and degraded modes.

Acceptance boundary: Distributed performance and independent redundancy assumptions are validated.

Principal ASTRA connections: 33, 47, 55, 66, 68, 78

AK11 Orbital traffic and tracking support

Coverage: Tracking, conjunction information, data services and inter-operator coordination.

Mandatory profile content: Source age, epoch/frame, covariance, model suitability, decision thresholds and authority.

Acceptance boundary: A metric is accepted only for its validated data/model scope; missing data are not zero risk.

Principal ASTRA connections: 37, 51, 66, 68

AK12 Cooperative docking and servicing

Coverage: Authorised inspection, connection, transfer, repair and service interventions.

Mandatory profile content: Consent, actual assets, relative-state evidence, compatible interfaces and protected states.

Acceptance boundary: All essential interface and completion states are independently supported.

Principal ASTRA connections: 33, 37, 65–69

AK13 On-orbit assembly and manufacture

Coverage: Assembly, additive or other production, finishing and output verification in space.

Mandatory profile content: Inputs, essential variables, environment, sensor/model validity and product acceptance.

Acceptance boundary: Process execution is not substituted for evidence of required output properties.

Principal ASTRA connections: 18, 37, 41, 69, 75

AK14 Stations and inhabited orbital platforms

Coverage: Habitation, payload integration, visiting vehicles, occupants and support.

Mandatory profile content: Occupancy/duration, life support, emergency, consumables, human tasks and docking interfaces.

Acceptance boundary: Integrated human protection and resources are accepted independently of mission success.

Principal ASTRA connections: 39, 43, 54, 69, 73

AK15 Extravehicular and isolated crew work

Coverage: Individual equipment, user/task, environment, support and rescue dependencies.

Mandatory profile content: Actual equipment configuration, essential skills, consumables, communications and authority.

Acceptance boundary: Essential individual and integrated protective tasks pass without averaging.

Principal ASTRA connections: 7, 39, 52, 73

AK16 Lunar surface systems

Coverage: Landers, rovers, infrastructure, observation and processing on the Moon.

Mandatory profile content: Dust, local terrain, illumination, temperature, gravity, radiation and communication assumptions.

Acceptance boundary: Destination-specific evidence bounds the actual region, phase and operating mode.

Principal ASTRA connections: 38, 64, 71, 73–75

AK17 Planetary landers and surface vehicles

Coverage: Surface exploration, scientific instruments, mobility and handling.

Mandatory profile content: Environment/region, terrain, access, autonomy, supportability and contamination control.

Acceptance boundary: Terrestrial analogy is justified; unknown critical surface conditions remain restricted.

Principal ASTRA connections: 38, 65, 71, 74

AK18 Atmospheric and buoyant exploration

Coverage: Planetary atmospheric vehicles, balloons, aircraft and relevant instruments.

Mandatory profile content: Atmosphere, pressure, chemistry, thermal conditions, flight/buoyancy functions and terminal state.

Acceptance boundary: All relevant environment-specific structural and functional predicates pass.

Principal ASTRA connections: 34, 38, 64, 65, 71

AK19 Small-body and comet operations

Coverage: Observation, cooperative contact, sampling and resource demonstrations.

Mandatory profile content: Body uncertainty, surface interaction, contamination, autonomy and sample custody.

Acceptance boundary: Uncertain body/interaction properties are not treated as established terrestrial conditions.

Principal ASTRA connections: 35, 38, 64, 69, 71, 74

AK20 Subsurface and ocean-world exploration

Coverage: Subsurface, liquid, ice and extreme-pressure exploration systems and their interfaces.

Mandatory profile content: Pressure/chemistry, thermal state, containment, access, communication and protection duties.

Acceptance boundary: Specialist boundary and contamination evidence precedes dependent use.

Principal ASTRA connections: 38, 64, 71, 74

AK21 Interplanetary cruise and deep-space missions

Coverage: Spacecraft, relays, science operations and long-delay mission support.

Mandatory profile content: Duration, communications, resources, remote autonomy, radiation and repairability.

Acceptance boundary: Human and autonomous actions are feasible within actual timing and resource limits.

Principal ASTRA connections: 35, 64–67, 72

AK22 Solar and heliophysics missions

Coverage: Solar observations and missions with relevant thermal, plasma and radiation extremes.

Mandatory profile content: Time-varying flux, geometry, surface degradation, charged environment and instrument calibration.

Acceptance boundary: Protection and data-quality evidence cover the actual mission envelope, not a screening equation alone.

Principal ASTRA connections: 35, 64, 65, 72

AK23 Outer-system and distant observatories

Coverage: Low-flux, long-life, long-delay science and infrastructure applications.

Mandatory profile content: End-of-life power, thermal survival, data return, ageing and long-term support.

Acceptance boundary: Required lifetime and survival margins are met with credible continuity and data integrity.

Principal ASTRA connections: 35, 55, 65, 66, 72

AK24 Interstellar precursor and future distant systems

Coverage: Bounded research and demonstrable capabilities for very long-range or novel concepts.

Mandatory profile content: Validated physics/model domain, actual demonstration state, gaps, authority and terminal duties.

Acceptance boundary: Research promise is not an operational grant; unsupported capability stays in development.

Principal ASTRA connections: 26, 59, 63, 72

AK25 Human exploration and surface habitats

Coverage: Crew transport interfaces, habitation, exploration support and emergency protection.

Mandatory profile content: Users, tasks, duration, life support, radiation/environment, health-support and safe-return assumptions.

Acceptance boundary: Every essential human protection and feasibility predicate is supported by specialists.

Principal ASTRA connections: 39, 54, 71, 73

AK26 Planetary protection and sample return

Coverage: Forward/backward contamination, scientific cleanliness, samples and receiving chain.

Mandatory profile content: Destination, pathway, applicable protection duties, containment, custody and receiving readiness.

Acceptance boundary: No dependent commitment precedes complete protection and receiving evidence.

Principal ASTRA connections: 35, 38, 69–74

AK27 Resource utilisation and remote processing

Coverage: Resource characterisation, processing, quality, storage, use and residues.

Mandatory profile content: Input variability, environmental qualification, quantity/quality, rights and disposition.

Acceptance boundary: Resource yield, product eligibility and permission remain distinct.

Principal ASTRA connections: 18, 37, 38, 53, 75

AK28 Space logistics and distributed supply

Coverage: Warehousing, transfer, spares, custody, condition, receiving and service continuity.

Mandatory profile content: Actual items, life, environment, compatible interfaces and arrival/acceptance states.

Acceptance boundary: Only physically or otherwise validly confirmed accepted usable inventory supports mission budgets.

Principal ASTRA connections: 48, 49, 69, 75

AK29 Specialised energy infrastructure

Coverage: Generation, storage, conversion, remote delivery and controlled high-hazard power interfaces.

Mandatory profile content: Architecture, margins, protection, specialist permissions, heat rejection and terminal inventory.

Acceptance boundary: Performance never substitutes for safety, source authority or terminal accountability.

Principal ASTRA connections: 43, 53, 65, 76

AK30 Ground, communication and navigation services

Coverage: Mission control, RF/optical links, timing, data processing, relays and PNT support.

Mandatory profile content: Deployed configuration, authority, source-to-user integrity, delay, uncertainty and recovery.

Acceptance boundary: Availability, correctness, authority and completion are separately demonstrated.

Principal ASTRA connections: 10, 23, 51, 56, 66, 67

AK31 Digital and autonomous space systems

Coverage: Software, programmable hardware, AI, models, twins and defensive security.

Mandatory profile content: Intended use, domain, source/build/model identity, data, validation, human authority and support.

Acceptance boundary: All essential behaviours and prohibited transitions are verified for the actual deployment.

Principal ASTRA connections: 44–47, 56, 78

AK32 Retirement and long-term stewardship

Coverage: Disposal, passivation governance, loss-of-contact states, records and residual obligations.

Mandatory profile content: Terminal criteria, actual evidence, unknowns, remaining inventories, notifications and custody.

Acceptance boundary: Final-state claims are truthful and every unresolved duty has an accepted owner.

Principal ASTRA connections: 30, 36, 37, 53–55, 68, 79

Any additional material domain, method or failure mechanism shall be incorporated through a controlled profile and the same evidence and authority gates. The absence of an activity name from this catalogue is not permission to ignore an applicable requirement.

Annex AL — Explicit acceptance grammar and decision tables

NORMATIVE

This annex makes requirement interpretation reproducible. It does not replace engineering judgement needed to establish a valid technical basis; it requires that basis to be completed before judging results.

AL.1 Mandatory atomic requirement fields

Field group	Required information
Identity	Requirement ID, title, controlling ASTRA clause, owner and exact controlled version.
Trigger	Activity or retained responsibility that makes the condition applicable; scope-specific N/A evidence and independent approval.
Object	Legal entity, performer, item or service, configuration, site/domain, relevant period and phase/mode.
Statement	Who shall do what, to which object, under which stated conditions. Separate each independently testable condition.
Acceptance	Numerical limit with units and inclusivity, or an explicitly observable attribute/state/essential step; no unresolved TBD.
Basis	Technical derivation, applicable obligations, environment, representativeness and approvals. A self-selected number is not sufficient.
Method	Inspection, analysis, demonstration or test; method identity, inputs, setup, instruments, processing and validity criteria.
Uncertainty	Corrections, standard/expanded uncertainty, coverage, dependence, error bounds, decision risk and selected rule.
Coverage	Population, specimen/article, sample selection, modes, locations, adverse conditions and justified inference.
Evidence	Original records, actual timestamps, data provenance, performer, configuration, access and known limitations.
Decision	PASS / FAIL / HOLD / N/A; predicate result, reason, independent reviewer and actual authorised outcome.
Change	Triggers for reassessment, affected prior outputs, retained history, restrictions and receiving custody.

AL.2 Deterministic requirement states

Condition	State	Mandatory action
Trigger absent; no retained duty; independent exclusion approved	N/A	Retain the reason; reassess after scope change.
Trigger unresolved, exclusion unsupported or essential parameter missing	HOLD	Define and approve the missing basis before reliance.
Applicable; evidence invalid, missing, wrong-version or inaccessible	HOLD	Resolve validity and affected past use. Do not default to zero.
Applicable; valid evidence satisfies the approved predicate	PASS	Retain the evidence and bounded conclusion.
Applicable; valid evidence demonstrates predicate failure	FAIL	Contain, investigate and follow finding/disposition rules.
Valid measurement interval overlaps a specification boundary under full-interval rule	HOLD	Do not treat insufficient demonstration as either accepted conformity or a proven material defect.
A prior PASS is invalidated by new evidence	HOLD or FAIL, according to evidence	Preserve the prior state and initiate impact/status review.

AL.3 Measurement input validity

Before evaluating a numerical predicate, require finite real inputs, compatible units, a defined measurand, traceable object/configuration, non-negative uncertainty and a justified uncertainty interpretation. For two-sided limits require $L \leq H$. Reject invalid, unavailable or malformed values. Use unrounded computation and preserve reported rounding separately. A missing upper or lower limit means one-sided treatment only if the approved requirement explicitly defines it that way.

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. For an upper-only limit H, PASS requires $b \leq H$, FAIL $a > H$, otherwise HOLD. For a lower-only limit L, PASS requires $a \geq L$, FAIL $b < L$, otherwise HOLD. For exclusive bounds, the corresponding equality becomes outside the acceptance set. The selected boundary convention shall be explicit before the test.

AL.4 Gate pseudocode

```
INPUT: frozen scope, requirements, parameters, evidence, roles, authority
FOR EACH requirement:
IF trigger absent AND independent exclusion approved: state = N/A
ELSE IF applicability unresolved: state = HOLD
ELSE IF parameter/method/evidence validity incomplete: state = HOLD
ELSE: evaluate the pre-approved predicate and uncertainty rule
state = PASS, FAIL or HOLD
GRANT = every applicable row is PASS
AND every N/A has independent justification
AND all in-scope nonconformities are verified closed
AND exact scope, competence, independence and authority are valid
AND required panel participation and voting conditions are met
IF GRANT is false: no positive grant, renewal or extension
RETAIN: inputs, original states, reasons, actual event times and history
```

AL.5 Defined qualitative terms

Term	Required operational definition
Suitable / adequate	Meets every identified method, uncertainty, environment, capacity and protective condition for the actual application.
Representative	Difference matrix shows why the selected population/configuration/environment bounds the claim; material exclusions are explicit.
Material change	A change capable of affecting scope, authority, a required predicate, method validity, uncertainty, essential protection or the basis of an earlier conclusion.
Independent	The assigned person/entity passes actual case and institutional conflict rules, not merely a signed declaration.
Immediate protection	Act without avoidable administrative delay when the concern is recognised, using existing safe authority; applicable stated notification clocks still run.
Complete	Every mandatory field, relationship and supporting evidence needed for the specific decision is present and valid; blank templates or file counts are not completion.
Validated	The stated method/model/use has prospective criteria and adequate actual demonstration for its claimed domain, including adverse cases and unresolved limitations.

Annex AM — Quantitative methods and checked synthetic examples

NORMATIVE USE AND VALIDITY CONTROLS; EXAMPLE VALUES ARE INFORMATIVE

Each calculation shall state purpose, equation, units, assumptions, actual inputs, uncertainty or bounds, validation domain, criterion, result and independent review. The following 25 examples test arithmetic and interpretation. No example value is an actual mission datum or a universal technical limit.

ID	Calculation subject
Q01	Measurement uncertainty and covariance
Q02	Inclusive limits and four distinct measurement outcomes
Q03	Positive-decision conjunction and essential failure
Q04	Committee arithmetic and accreditation panels
Q05	Productive evaluation time without double counting
Q06	Random detection sample size
Q07	Zero observed failures and an exact binomial bound
Q08	No failures during exposure: exponential bound
Q09	Availability is not output correctness
Q10	Usable storage energy and outage reserve
Q11	End-of-life power and peak demand
Q12	Radiative heat rejection screening
Q13	Transient thermal imbalance
Q14	Free-space loss and link margin
Q15	Light-time and ground-intervention feasibility
Q16	Outage data storage with overhead
Q17	Clock uncertainty and maximum data age
Q18	Structural margin with explicitly assigned factors
Q19	Vibration spectral integration and units
Q20	Cumulative fatigue screening
Q21	Accumulated dose bookkeeping

ID	Calculation subject
Q22	Process consumables, recovery and unusable inventory
Q23	Material genealogy, yield and retained work
Q24	Environmental inventory and uncertainty
Q25	Reliability architecture and common-cause sensitivity

AM.Q01 Measurement uncertainty and covariance

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

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

$$U = k u_c$$

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 = $0.003^2 + 0.004^2 = 0.000025$ mm².

2. $u_c = 0.005$ mm; $U = 0.010$ mm for the stated k.

3. Correlated covariance = $0.5 \times 0.003 \times 0.004 = 0.000006$ mm².

4. Correlated variance = $0.000025 + 2 \times 0.000006 = 0.000037$ mm².

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

AM.Q02 Inclusive limits and four distinct measurement outcomes

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

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 ± 0.004 → [50.020, 50.028] mm: PASS.

2. 50.028 ± 0.004 → [50.024, 50.032] mm: HOLD, interval overlaps the upper limit.

3. 50.036 ± 0.004 → [50.032, 50.040] mm: FAIL, interval entirely above the limit.

4. 50.026 ± 0.004 → [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

AM.Q03 Positive-decision conjunction and essential failure

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$G = S \wedge P \wedge E \wedge F \wedge C \wedge I \wedge A$$

Requirement completion = completed applicable rows / all applicable rows

Variables and units

S=valid scope; P=all predicates passed; E=adequate valid evidence; F=all in-scope findings closed; C=competence; I=independence; A=actual authority.

Example inputs

A synthetic file has 200 applicable rows; 190 are complete. One remaining row concerns an essential protective control. Six other gate groups are true.

Calculation and checks

1. Completion = 190/200 = 0.95 = 95%.

2. The unverified essential row makes P false and E false for the requested conclusion.

3. G = true false false … = false.

Decision interpretation: No positive grant. The completion percentage is a planning measure only. A conditional development permission is a separate bounded action, not a conformity certificate.

Validity limits: No averaging, vote or commercial action can change a false mandatory gate. N/A requires independent approval of the absent trigger; it is not a way to remove unfinished work.

ASTRA connections: 15.2; Annex G.1; 62.5; 80

AM.Q04 Committee arithmetic and accreditation panels

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

Substantive participation minimum = ceil(2N/3)

Affirmative minimum = ceil(2V/3)

Variables and units

N is the eligible committee population; V is the number of substantive yes/no votes. These equations concern the technical committee, not an applicant panel.

Example inputs

Synthetic committee: N=9, V=6, yes=4, no=2. Separate accreditation panel: three eligible members, two affirmative and one adverse.

Calculation and checks

1. Participation: ceil(2×9/3)=6; actual V=6 meets it.

2. Affirmative: ceil(2×6/3)=4; actual yes=4 meets it.

3. Accreditation panel: all three must participate; at least two support and all technical gates must pass.

4. Two participating panel members voting yes do not form a valid three-person panel.

Decision interpretation: The committee arithmetic passes for the stated case. The separate panel can decide positively only if technical gates and eligibility are all established.

Validity limits: Abstentions are not substantive committee yes/no votes. Rounding is upward. A mathematical majority never resolves missing technical evidence or an ineligible member.

ASTRA connections: 3.4; 4.3; 15.3; Annex B

AM.Q05 Productive evaluation time without double counting

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$T_{eval} = \Sigma h_i / 8$ evaluator-days

Total resource = evaluation + separate reporting/review/travel resources

Variables and units

h_i are distinct productive technical person-hours. Shared tasks are counted once unless distinct real work is documented.

Example inputs

Synthetic tasks: 12, 12, 12, 8 and 4 productive hours. Report 6 h; independent review 5 h; panel 3 person-hours.

Calculation and checks

1. Evaluation hours = 12+12+12+8+4 = 48 h.

2. T_{eval} = 48/8 = 6 evaluator-days.

3. Separate report/review/panel time = 6+5+3 = 14 person-hours.

4. Total stated technical resources = 62 person-hours before travel and other separately justified work.

Decision interpretation: Six evaluator-days describes only this synthetic activity breakdown. It is not a universal minimum or quotation.

Validity limits: Do not count a trainee as an independent productive assessor or two passive observers as two completed tasks. Calendar duration, person-hours and evaluator-days are distinct.

ASTRA connections: 12.4; Annex F.1; 58.2

AM.Q06 Random detection sample size

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

P(at least one detection) = 1-(1-p)^n

n_min = 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

1. ln(0.05)/ln(0.90) = 28.433158...; round upward to n=29.

2. P(detection at n=29) = 1-0.9^29 = 0.9528987130.

3. 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

AM.Q07 Zero observed failures and an exact binomial bound

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

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

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

Variables and units

α=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 α=0.05. Examine n=30 and a target upper failure probability of 0.01.

Calculation and checks

1. For n=30: p_upper = 1-0.05^(1/30) = 0.095033853 = 9.5033853%.

2. For p_target=0.01: ceil[ln(0.05)/ln(0.99)] = 299.

3. For n=299: p_upper ≈ 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

AM.Q08 No failures during exposure: exponential bound

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$\lambda_{upper} = -\ln(\alpha)/T$

$MTBF_{lower} = T/[-\ln(\alpha)]$

Variables and units

T is total comparable exposure time under a justified constant-rate model; α=1-confidence; no failures occur. λ has reciprocal-time units.

Example inputs

Synthetic T=800 operating hours; one-sided confidence=95%, α=0.05.

Calculation and checks

1. -ln(0.05) = 2.9957322736.

2. λ_{upper} = 2.9957322736/800 = 0.003744665342 h^-1.

3. $MTBF_{lower}$ = 800/2.9957322736 = 267.0465606 h.

Decision interpretation: The observed zero-failure record supports only the stated model-based lower bound, not infinite mean life.

Validity limits: Ageing, wear-out, maintenance quality, heterogeneity and common causes may violate the constant-rate assumption. MTBF is not a guaranteed individual life and does not extend a mandatory life limit.

ASTRA connections: 55; 79

AM.Q09 Availability is not output correctness

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$A_{observed} = T_{available}/T_{window}$$

$$\text{Correct-service fraction} = T_{available\_and\_correct}/T_{window}$$

Variables and units

All categories shall use the same declared window and explicit downtime and integrity definitions. Missing time is separately recorded.

Example inputs

Synthetic window=1,000 h; available=960 h; unavailable=40 h. Of the available time, 20 h produced unacceptable information.

Calculation and checks

1. Availability = 960/1,000 = 96%.

2. Available-and-correct time = 960-20 = 940 h.

3. Correct-service fraction = 940/1,000 = 94%.

Decision interpretation: The 96% availability value does not prove correctness during every available hour. The two measures support different requirements.

Validity limits: The service boundary, outages, correctness test, unknown intervals and planned exclusions must be established in advance. A high uptime percentage cannot close an integrity failure.

ASTRA connections: 51.4; 55.1; 66.7; 78.7

AM.Q10 Usable storage energy and outage reserve

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$E_{need} = \Sigma(P_i t_i)$$

$$E_{usable} = E_{nameplate} \times f_{EOL} \times DoD \times \eta$$

$$m = (E_{usable}-E_{need})/E_{need}$$

Variables and units

P is power in W and t in h; resulting energy is Wh. f_EOL, allowable depth of discharge DoD and efficiency η are dimensionless and application-validated.

Example inputs

Synthetic outage load=300 W for 2 h. Storage=1,200 Wh; f_EOL=0.80; DoD=0.75; η=0.90. Illustrative required margin=5%.

Calculation and checks

1. E_need = 300×2 = 600 Wh.

2. E_usable = 1,200×0.80×0.75×0.90 = 648 Wh.

3. Reserve = 48 Wh; m=48/600 = 8%.

4. If load becomes 330 W, need=660 Wh and margin=(648-660)/660 = -1.81818%.

Decision interpretation: The first synthetic energy-margin predicate passes the example 5% requirement; the changed load fails it. Other thermal, power and protection criteria remain separate.

Validity limits: These factors and the 5% value are not universal design limits. Do not count thermal-support or terminal reserves twice, assume efficiency is constant outside its evidence domain, or treat energy adequacy as peak-power capability.

ASTRA connections: 33.5; 43; 64.4; 65.3

AM.Q11 End-of-life power and peak demand

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$P_{EOL} = P_{BOL} \times f_{degradation} \times \eta_{distribution}$$

$$m_P = (P_{EOL}-P_{required})/P_{required}$$

Variables and units

All power quantities are evaluated for the same declared condition; degradation and conversion factors need valid evidence.

Example inputs

Synthetic P_BOL=2,000 W; degradation factor=0.85; distribution factor=0.92; load=1,400 W. Example minimum margin=10%.

Calculation and checks

1. P_EOL=2,000×0.85×0.92=1,564 W.

2. Headroom=164 W; margin=164/1,400=11.7142857%.

3. An extra concurrent 120 W changes load to 1,520 W; margin=44/1,520=2.8947368%.

Decision interpretation: The base case passes the example margin. The concurrent extra load does not; positive headroom alone is insufficient when the accepted criterion requires a larger reserve.

Validity limits: Evaluate transients, temperature, geometry, outages and fault conditions separately. EOL generation is not a stored-energy reserve, and nameplate ratings are not a validated mission budget.

ASTRA connections: 33.5; 65.3; 72.3

AM.Q12 Radiative heat rejection screening

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$Q_{rad} = \varepsilon \sigma A (T_{hot}^4 - T_{sink}^4)$$

Variables and units

ε is effective emissivity under the stated grey-surface model; σ=5.670374419×10^-8 W m^-2 K^-4; A is effective radiating area; all temperatures are kelvin.

Example inputs

Synthetic ε=0.80, A=2 m², T_hot=300 K, T_sink=200 K; simplified full-view conditions. Heat load=500 W; example required reserve=10%.

Calculation and checks

1. T_hot^4-T_sink^4 = 300^4-200^4 = 6.5×10^9 K^4.

2. Q_rad = 0.80×σ×2×6.5×10^9 = 589.7189396 W.

3. Required capacity at the example reserve = 500×1.10 = 550 W.

4. Screening headroom over reserved requirement = 39.7189396 W.

Decision interpretation: This simplified screening balance passes the example capacity predicate. It is not integrated thermal qualification.

Validity limits: Real view factors, absorbed external flux, temperature-dependent properties, contact conduction, multi-node geometry and transient behaviour require appropriate models. Celsius cannot be used in the fourth-power term. The constant is general physical knowledge, not an ASTRA invention.

ASTRA connections: 35.2; 65.2; 72.2

AM.Q13 Transient thermal imbalance

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$C_{th}\, dT/dt = Q_{in}-Q_{out}$

$\Delta T \approx (Q_{in}-Q_{out})\, \Delta t/C_{th}$

Variables and units

C_th is effective thermal capacitance in J/K. The finite step is valid only over a range where the lumped assumptions and net heat are adequately constant.

Example inputs

Synthetic C_th=2,000 J/K, Q_in=120 W, Q_out=80 W; step=60 s.

Calculation and checks

1. Net heating=40 W = 40 J/s.

2. dT/dt=40/2,000=0.02 K/s.

3. ΔT≈0.02×60=1.2 K.

Decision interpretation: A 1.2 K increase is the stated local screening result. Compare it with the approved temperature and gradient limits; no acceptance is implied without them.

Validity limits: Changing radiation, conduction, phase change, multiple nodes or temperature-dependent heat sources can invalidate constant-rate extrapolation. Do not extrapolate this 60-second calculation to mission life.

ASTRA connections: 65.2; 72.2; 77.4

AM.Q14 Free-space loss and link margin

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$L_{fs} = 20 \log_{10}(4\pi R f/c) \text{ dB}$$

$$P_r = P_t + G_t + G_r - L_{fs} - L_{other}$$

$$M_{link} = P_r - P_{threshold}$$

Variables and units

R is path length in metres; f is frequency in Hz; c=299,792,458 m/s. P_t, P_r and threshold use dBW; antenna gains and losses use compatible dB references.

Example inputs

Synthetic R=4.0×10^8 m, f=8.4×10^9 Hz; P_t=10 dBW, G_t=50 dBi, G_r=60 dBi, other losses=4 dB; receiver threshold=-110 dBW. Example required margin=3 dB.

Calculation and checks

1. L_fs ≈ 222.974568770 dB.

2. P_r = 10+50+60-L_fs-4 ≈ -106.974568770 dBW.

3. M_link ≈ 3.025431230 dB.

4. Adding 0.5 dB of actual loss reduces that margin by 0.5 dB.

Decision interpretation: The 3.025431230 dB margin passes the stated 3 dB example predicate. With the additional 0.5 dB loss, the margin is 2.525431230 dB and fails. All real losses and required receiver performance must first be supported.

Validity limits: This is far-field free-space screening, not a complete RF/optical or interference model. Do not add dB values with incompatible reference quantities. Weather, pointing, acquisition, noise and coding may govern the actual result.

ASTRA connections: 66.2

AM.Q15 Light-time and ground-intervention feasibility

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$t_{oneway} = R/c$$

$$t_{response} = 2R/c + t_{ground} + t_{actuation}$$

Variables and units

R is a simplified constant path length in m; c=299,792,458 m/s. Processing, queueing, geometry change and other delays require additional terms where material.

Example inputs

Synthetic R=2.25×10^11 m; ground processing=20 s; actuation=10 s; approved illustrative hazard-response window=1,200 s.

Calculation and checks

1. One-way light-time=750.519214196 s.

2. Round-trip propagation=1501.038428392 s.

3. Earliest modelled response=1531.038428392 s.

4. The response exceeds 1,200 s by 331.038428392 s.

Decision interpretation: The proposed ground intervention fails the example feasibility predicate and cannot be credited as the timely protective control.

Validity limits: The actual path and timing model must be used for a real mission. No communication architecture removes propagation delay; onboard protection still needs independent validation and authority.

ASTRA connections: 66.3; 67; 72.4; 73.8

AM.Q16 Outage data storage with overhead

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$B_{required} = R_{data} \times t_{outage} \times f_{overhead}$$

$$1 \text{ byte} = 8 \text{ bits}$$

Variables and units

Use a defined payload rate and explicit overhead, reserves and decimal/binary storage conventions. Avoid mixing Mbit/s and MB/s.

Example inputs

Synthetic 2.0×10^6 bit/s, 6 h outage, overhead factor=1.25; usable storage=64×10^9 bit.

Calculation and checks

1. Outage duration=6×3,600=21,600 s.

2. Required capacity=2.0×10^6×21,600×1.25=54×10^9 bit.

3. In decimal bytes this is 6.75×10^9 bytes = 6.75 GB.

4. Headroom=10×10^9 bit; headroom/required=18.5185185%.

Decision interpretation: The example quantity fits in the stated usable capacity. Data priority, integrity and required extra reserve still need their own criteria.

Validity limits: Do not credit unvalidated compression, unavailable storage blocks or capacity already allocated elsewhere. Tests must include overflow, power interruption, duplicate delivery and recovery.

ASTRA connections: 66.3; 67.4; 78.7

AM.Q17 Clock uncertainty and maximum data age

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$u_t = \sqrt{u_{event}^2 + u_{sync}^2}$ for justified independence

$U_t = k\, u_t$

Upper age endpoint = age_estimate + U_t

Variables and units

Time components refer to the same event and time basis. Correlation and systematic conversion errors require appropriate treatment.

Example inputs

Synthetic standard components 3 ms and 4 ms; illustrative k=2; maximum inclusive permitted data age=100 ms.

Calculation and checks

1. $u_t=\sqrt{3^2+4^2}=5$ ms; $U_t=10$ ms.

2. At age estimate 95 ms, interval=[85,105] ms: HOLD under the full-interval rule.

3. At age estimate 80 ms, interval=[70,90] ms: PASS for this age criterion.

Decision interpretation: A recently received packet can still contain stale event data. The 95 ms estimate is not rounded down into acceptance.

Validity limits: This calculation does not account automatically for unrecorded queueing, an incorrect epoch or an unknown time scale. Such validity defects cause HOLD before the age predicate is evaluated.

ASTRA connections: 66.4; Annex G; 77.6

AM.Q18 Structural margin with explicitly assigned factors

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$MS = allowable\_lower\_bound/(factor \times demand\_upper\_bound)-1$$

Variables and units

Use compatible force, stress or other characteristic units and a consistent definition of applied factors. The chosen lower and upper bounds must not double-count uncertainty.

Example inputs

Synthetic allowable lower bound=150 kN; demand upper bound=100 kN; approved example factor=1.25; required example margin=0.10.

Calculation and checks

1. Factored demand=1.25×100=125 kN.

2. MS=150/125-1=0.20.

3. The result 0.20 is at least the example required 0.10.

Decision interpretation: The stated scalar margin passes its example predicate. Every other required load case and mechanism remains separately evaluated.

Validity limits: No factor or margin here is a universal structural design rule. Buckling, joints, thermal loads, dynamics, damage, fatigue and model validity may require distinct analysis and evidence.

ASTRA connections: 33.5; 65.1; 77

AM.Q19 Vibration spectral integration and units

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$a_{rms}^2 = \int S_a(f)\, df$

$a_{rms} = \sqrt{a_{rms}^2}$

Variables and units

S_a is acceleration power spectral density. With g^2/Hz and Hz, the integrated variance is g^2. The specified conventional acceleration conversion is 9.80665 m/s^2 per g.

Example inputs

Synthetic flat PSD=0.04 g^2/Hz from 20 to 120 Hz; no content outside that illustrative band.

Calculation and checks

1. Bandwidth=120-20=100 Hz.

2. Variance=0.04×100=4 g^2.

3. RMS=sqrt(4)=2 g = 19.6133 m/s^2.

Decision interpretation: The integration is correct for the stated flat spectrum. It does not define a test severity or establish qualification.

Validity limits: Real piecewise spectra, control methods, fixture dynamics, cross-axis behaviour, time duration and response limits require an approved profile. Do not integrate a logarithmic amplitude representation as though it were a linear PSD.

ASTRA connections: 42; Annex T; 77

AM.Q20 Cumulative fatigue screening

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$D = \Sigma(n_i/N_i)$$

Variables and units

n_i is applied cycles at condition i; N_i is an appropriate evidence-based reference life for that same condition. The linear damage model is a screening assumption.

Example inputs

Synthetic n_1=1,000; N_1=10,000; n_2=5,000; N_2=20,000. Example screening acceptance $D \leq 0.50$.

Calculation and checks

1. Contribution 1=1,000/10,000=0.10.

2. Contribution 2=5,000/20,000=0.25.

3. Total D=0.35≤0.50.

Decision interpretation: The example passes only the stated linear screening predicate. This does not establish remaining life or qualified reuse.

Validity limits: Sequence effects, scatter, mean stress, environment, overload, damage detection and model applicability require separate evidence. Neither D=1 nor the example 0.50 is prescribed here as a universal limit.

ASTRA connections: 36.4; 55.5; 65.1; 70.4

AM.Q21 Accumulated dose bookkeeping

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$D_{total} = \Sigma(dose\_rate_i \times exposure\_time_i)$$

$$D_{assessment} = F \times D_{total}$$

Variables and units

All contributions must represent the same physical dose quantity, material, location and shielding/configuration basis. F is a separately justified uncertainty or design factor.

Example inputs

Synthetic rates: 0.20 Gy/day for 50 days and 0.05 Gy/day for 200 days; illustrative F=1.5; accepted example tolerance lower bound=30 Gy.

Calculation and checks

1. Segment 1=0.20×50=10 Gy.

2. Segment 2=0.05×200=10 Gy.

3. Total=20 Gy; factored assessment=1.5×20=30 Gy.

4. The assessment equals the inclusive example tolerance bound.

Decision interpretation: The numerical dose predicate passes at equality for this example. No other radiation-effect mechanism is closed by that comparison.

Validity limits: Do not add device absorbed dose, human equivalent dose and unrelated quantities. Single-event susceptibility, displacement damage, rate effects and model validity require their own qualified specialist evidence. No exposure or source-handling procedure is provided.

ASTRA connections: 35.2–35.3; 65.4; 76.4

AM.Q22 Process consumables, recovery and unusable inventory

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

Gross demand = number_of_units × unit_rate × duration

Usable feed need = gross demand × (1-recovery_fraction)

Stock requirement = feed need + unusable allowance + reserved amount

Variables and units

This is a non-physiological process-resource example. Recovery is credited only when quantity, quality and availability are demonstrated for the same duty.

Example inputs

Synthetic four identical process units; 2 kg/day/unit for 10 days; validated illustrative recovery=60%; unusable allowance=5 kg; reserve=8 kg; stock=50 kg.

Calculation and checks

1. Gross demand=4×2×10=80 kg.

2. Fresh usable feed need=80×(1-0.60)=32 kg.

3. Stock requirement=32+5+8=45 kg.

4. Headroom=50-45=5 kg.

Decision interpretation: The example quantity requirement is met. It supplies no crew-consumption rate or health criterion.

Validity limits: Availability, recovery timing, quality, contamination, storage losses and common-resource failure are separate checks. A calculated recycling benefit cannot substitute for demonstrated usable output.

ASTRA connections: 64.4; 73.3; 75.4–75.5

AM.Q23 Material genealogy, yield and retained work

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

Input = good + reject + tests + losses + work_in_progress

First-pass yield = accepted_first_pass_output/input

Variables and units

All quantities shall use a consistent lot and period. Recovered material remains linked to its origin and is not counted twice as new production.

Example inputs

Synthetic input=500 units; good first-pass=410; reject=30; destructive tests=10; process losses=20; work in progress=30.

Calculation and checks

1. Reconciliation=410+30+10+20+30=500 units.

2. First-pass yield=410/500=82%.

3. If 20 rejected units are later recovered, the recovery does not increase original input or first-pass output.

Decision interpretation: The quantity balance closes. Technical identity, condition and acceptance evidence still determine whether the 410 outputs are eligible.

Validity limits: A closed balance does not prove authenticity, completeness or material quality. Mixing quantities with different units or unverified scrap/recovery transfers invalidates the reconciliation.

ASTRA connections: 18.4; 48.4; Annex AC; 75.4

AM.Q24 Environmental inventory and uncertainty

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$$E = \Sigma(A_i \times EF_i)$$

$$u(E) = \sqrt{\Sigma u_i^2}$$ only for independent components

Variables and units

A_i are activities and EF_i compatible factors for the same declared boundary. All factors below are deliberately fictional and shall not be used for actual emissions.

Example inputs

Synthetic 200,000 kWh×0.25 kg CO2e/kWh; 10,000 L×2.50 kg CO2e/L; 20,000 tonne-km×0.10 kg CO2e/tonne-km. Relative standard uncertainties=5%, 10%, 20%.

Calculation and checks

1. Category totals=50,000; 25,000; 2,000 kg CO2e. Total=77,000 kg CO2e.

2. For 10,000 defined service events, intensity=7.7 kg CO2e/event.

3. Standard components=2,500; 2,500; 400 kg CO2e.

4. $u(E)=\sqrt{2{,}500^2+2{,}500^2+400^2}=3{,}558.089375$ kg CO2e.

Decision interpretation: The arithmetic is correct for this limited synthetic boundary. No real environmental achievement or full lifecycle footprint is asserted.

Validity limits: Covariance is required where sources are dependent. Quantified uncertainty does not absorb omitted lifecycle stages, unsuitable factors, double allocation or missing mandatory categories.

ASTRA connections: 24; 53; Annex L

AM.Q25 Reliability architecture and common-cause sensitivity

SYNTHETIC CALCULATION — NOT A DESIGN PRESCRIPTION

$R_{series} = R_1 R_2$ for independent required elements

$R_{parallel} = 1-(1-R_1)(1-R_2)$ for independent full-capability alternatives

$R_{with\_common\_event} = (1-q) R_{parallel}$

Variables and units

R_1 and R_2 refer to the same mission duration and domain. q is an illustrative independent probability of a common event defeating both alternatives. Perfect switching is assumed only for this example.

Example inputs

Synthetic $R_1=0.98$, $R_2=0.99$; illustrative common-event probability $q=0.01$.

Calculation and checks

1. Series result=0.98×0.99=0.9702.

2. Ideal independent parallel result=1-(0.02×0.01)=0.9998.

3. With the stated common event: 0.99×0.9998=0.989802.

Decision interpretation: The architecture and common-dependency assumptions materially change the result. Component figures alone cannot establish system reliability.

Validity limits: Unequal functions, imperfect switching, dormant failures, shared software, maintenance or external resources require a different model. The example probabilities are not actual mission data or prescribed targets.

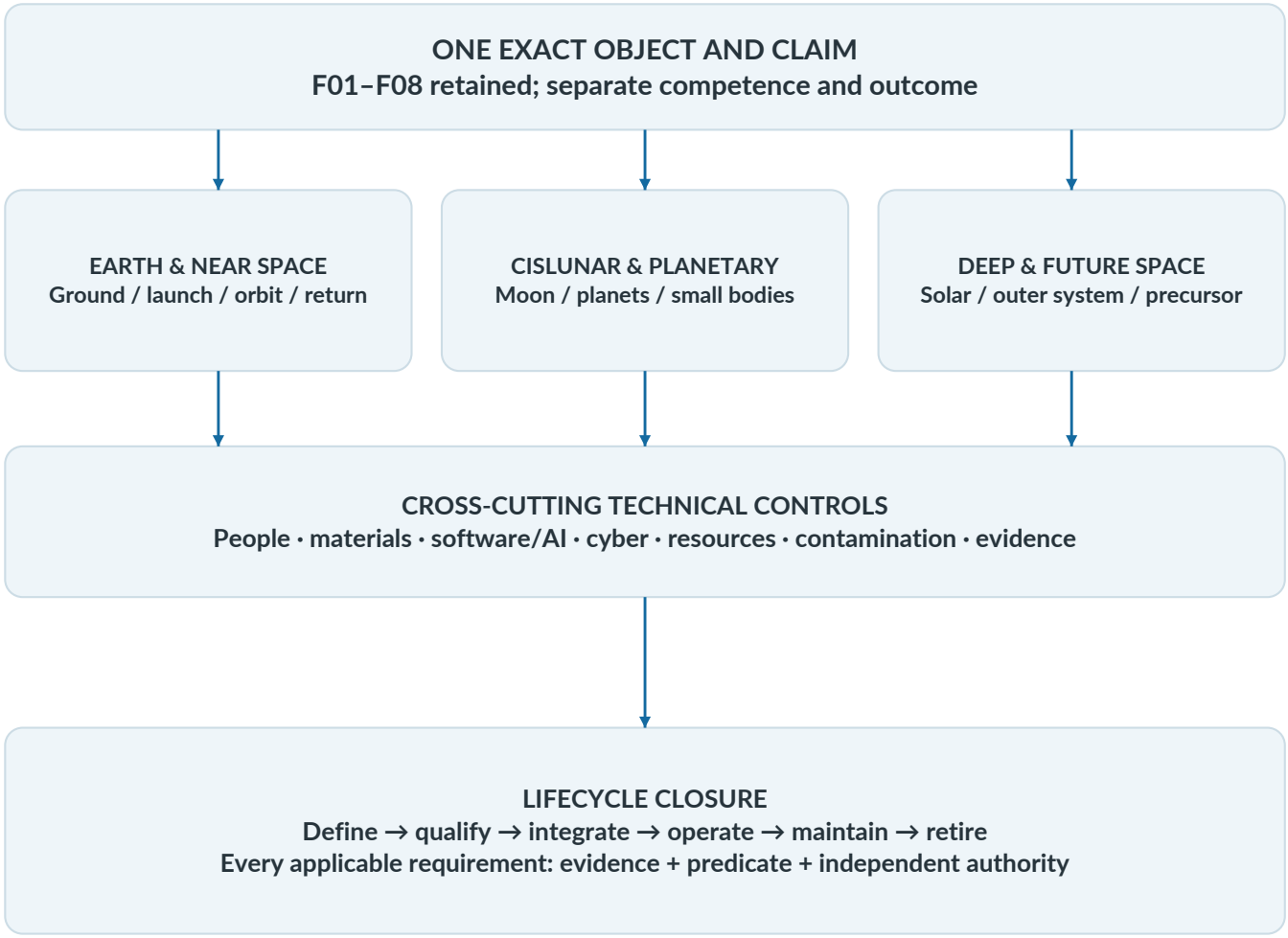
ASTRA connections: 55.2; 68.1–68.2; 76.5

Annex AN — Decision and assurance diagrams

INFORMATIVE VISUALISATIONS OF THE CONTROLLING REQUIREMENTS

The diagrams organise the stated rules and do not add operational permissions. Clause text, approved technical profiles and the explicit predicates remain controlling. Diagram arrows are workflow or evidence relationships, not trajectories or hazardous operating instructions.

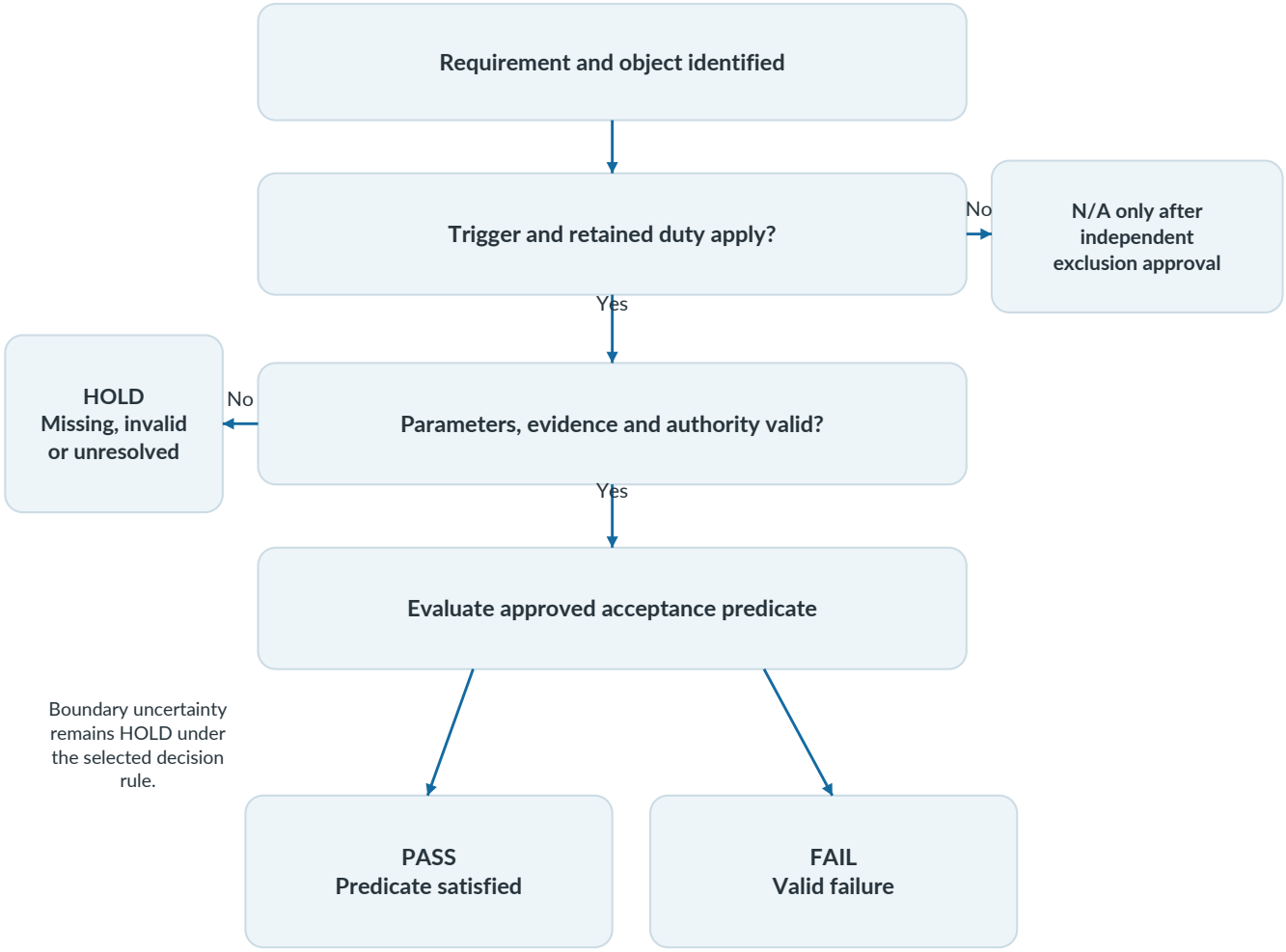
AN-01 Space-domain and lifecycle architecture



Use this diagram to organise the scope, not to claim an unrestricted all-space approval. Each domain is mapped to the retained F01–F08 families, actual objects and application-specific technical requirements. The lifecycle row applies to every selected domain.

Controlling connections: 62–65; Annex AK

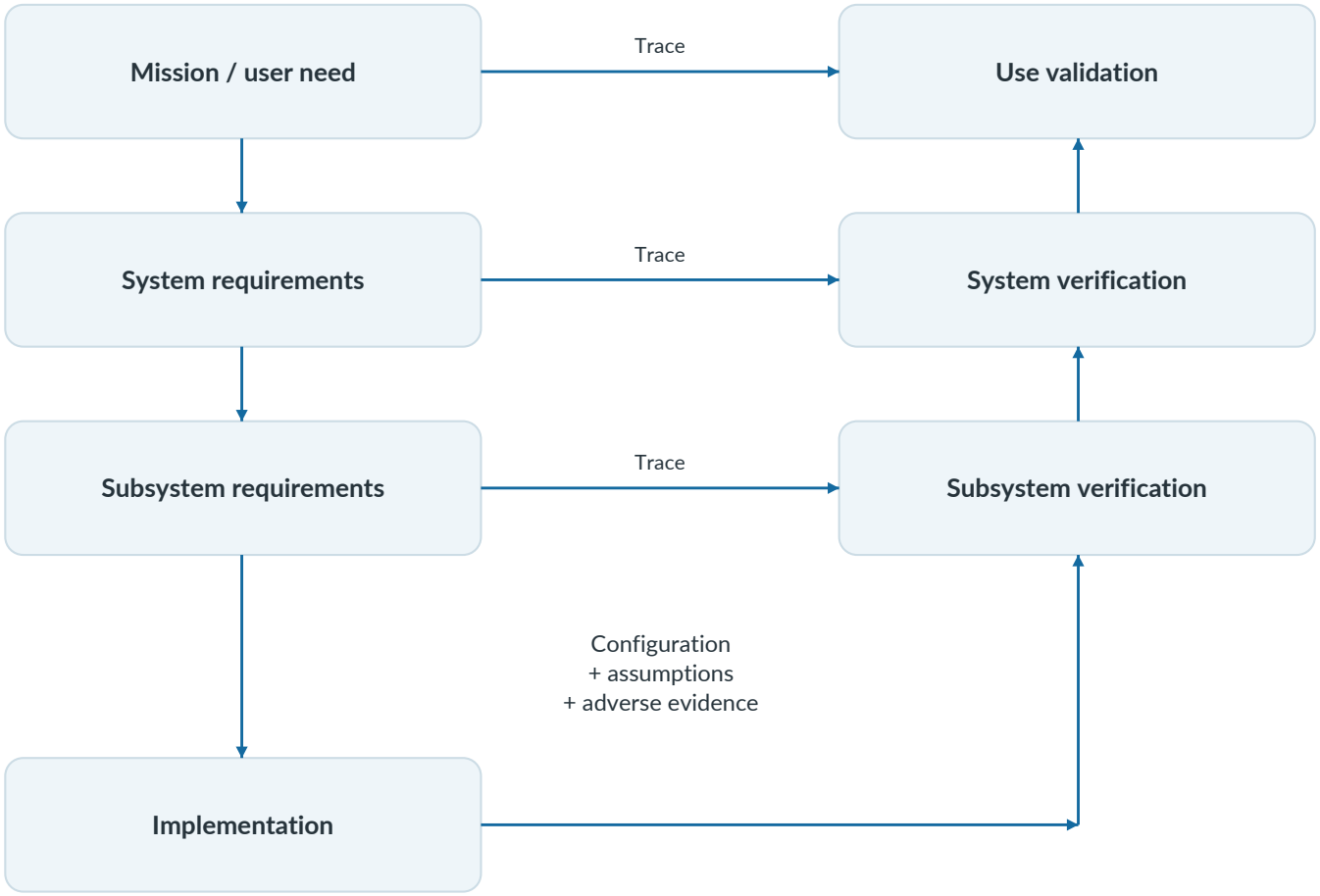
AN-02 Requirement-state decision path



N/A requires the trigger and retained responsibility to be absent plus independent approval. Missing or invalid evidence is HOLD. For a measurement with interval uncertainty, apply Annex G before selecting PASS or FAIL; an overlapping interval remains HOLD. The diagram does not replace the full truth table in Annex AL.

Controlling connections: 62; Annexes G and AL

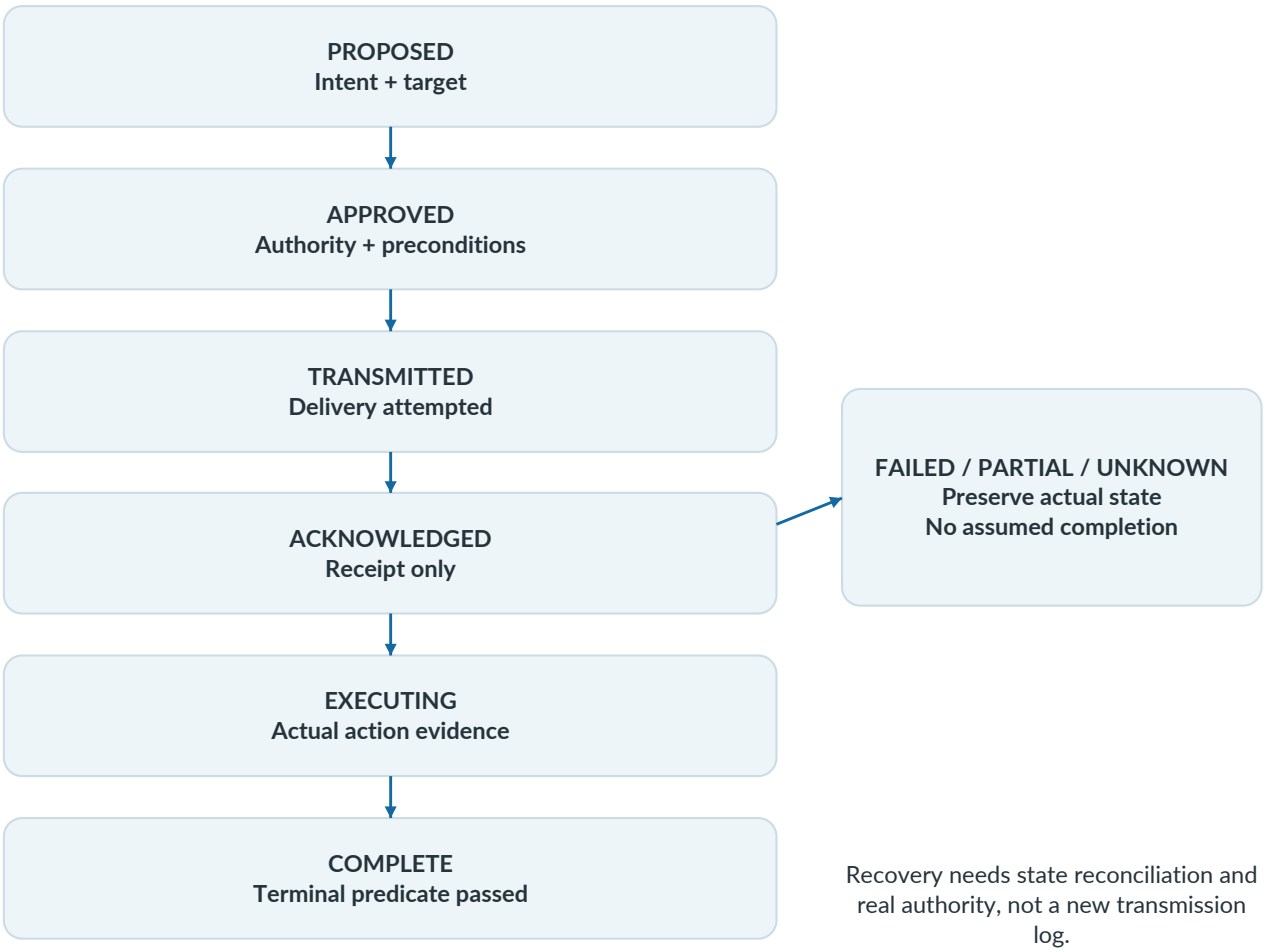
AN-03 Requirements, implementation and verification linkage



The arrows represent traceability and controlled realisation. Qualification and use validation remain distinct. At each level, evidence shall match the actual configuration and retain assumptions, adverse results and limitations; completing the right-hand sequence does not itself issue a conformity decision.

Controlling connections: 32–33; 64; 77

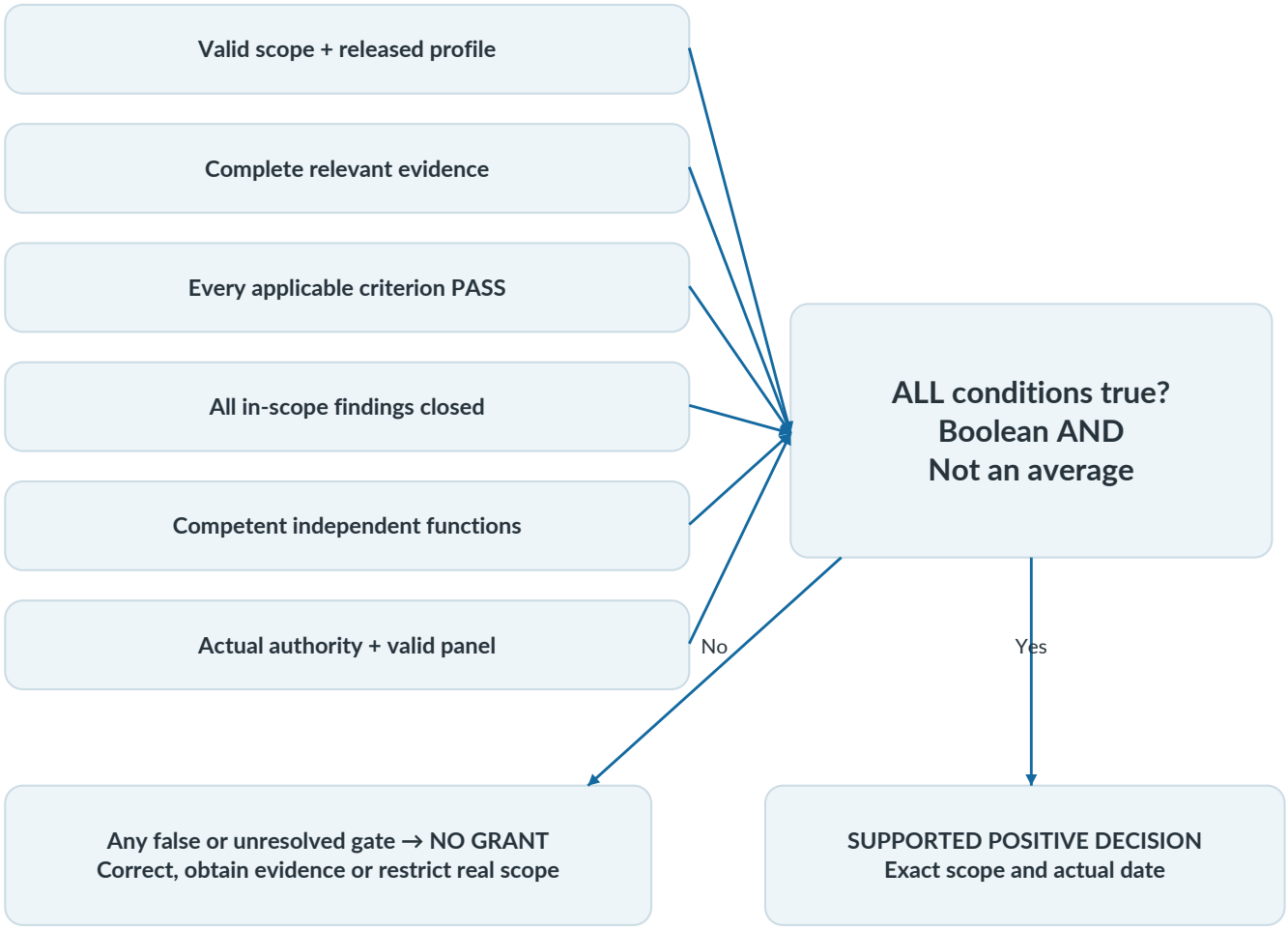
AN-04 Command evidence and terminal-state chain



Receipt acknowledgement proves receipt only. Execution and physical completion require their own accepted evidence. FAILED, PARTIAL and UNKNOWN may arise during execution or any uncertain transition. Recovery returns through state reconciliation and the applicable authority checks, never through an assumed success state.

Controlling connections: 66–67; 69; 78–79

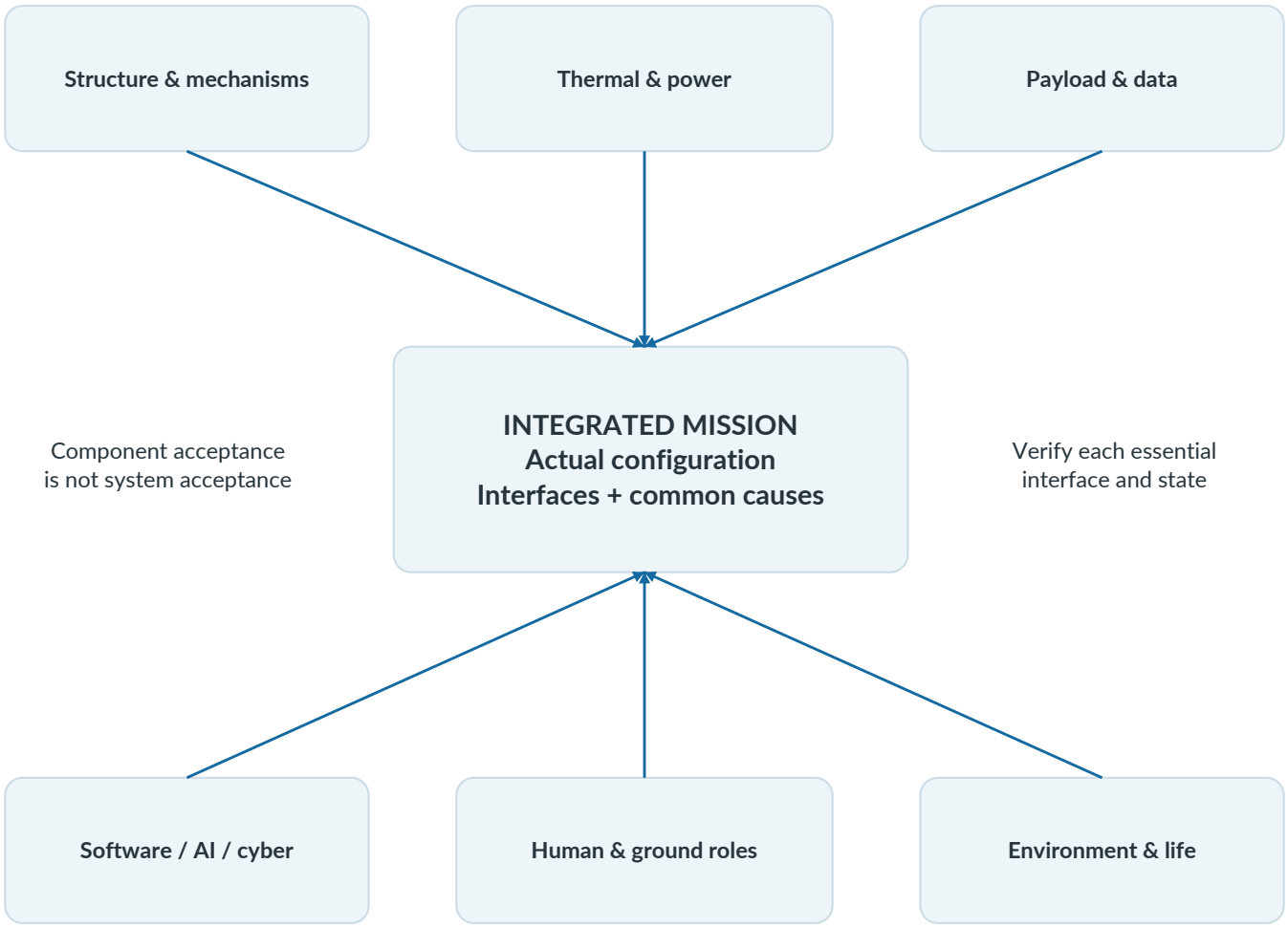
AN-05 Non-compensable independent release gate



The six input groups are joined by Boolean AND. When accreditation requires a three-person panel, all three eligible members participate and at least two support the reasoned outcome after the technical gates are complete. No gate is replaced by a score, payment, sponsor status or majority preference.

Controlling connections: 3.4; 15; 62.5; 80

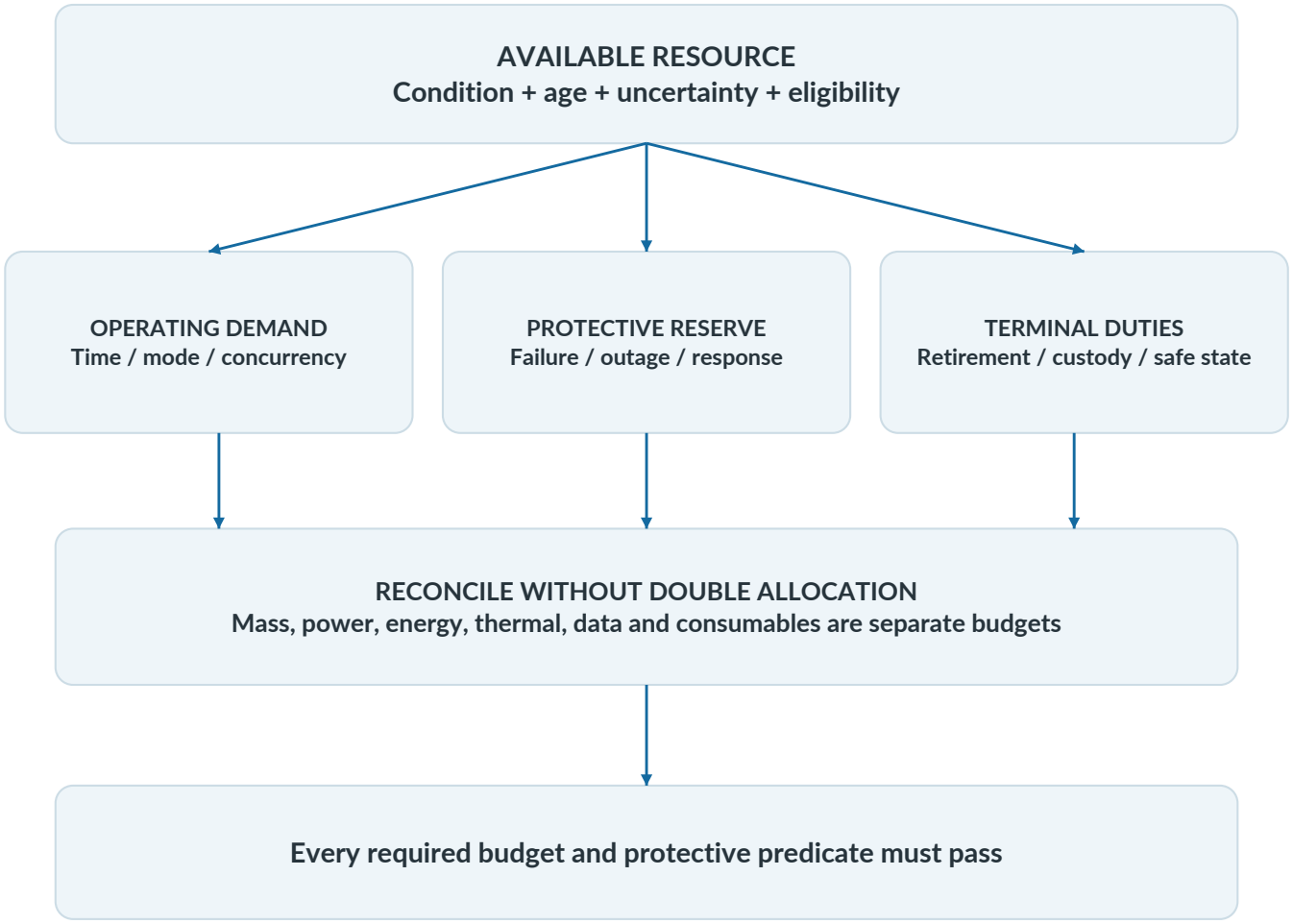
AN-06 Integrated mission interfaces



Each surrounding discipline has separately owned requirements and evidence. Arrows indicate integrated interfaces and dependencies, not operational command paths. Individually acceptable subsystems do not prove compatibility, common-cause resilience or the acceptability of the delivered integrated mission.

Controlling connections: 33; 64–65; 73; 78

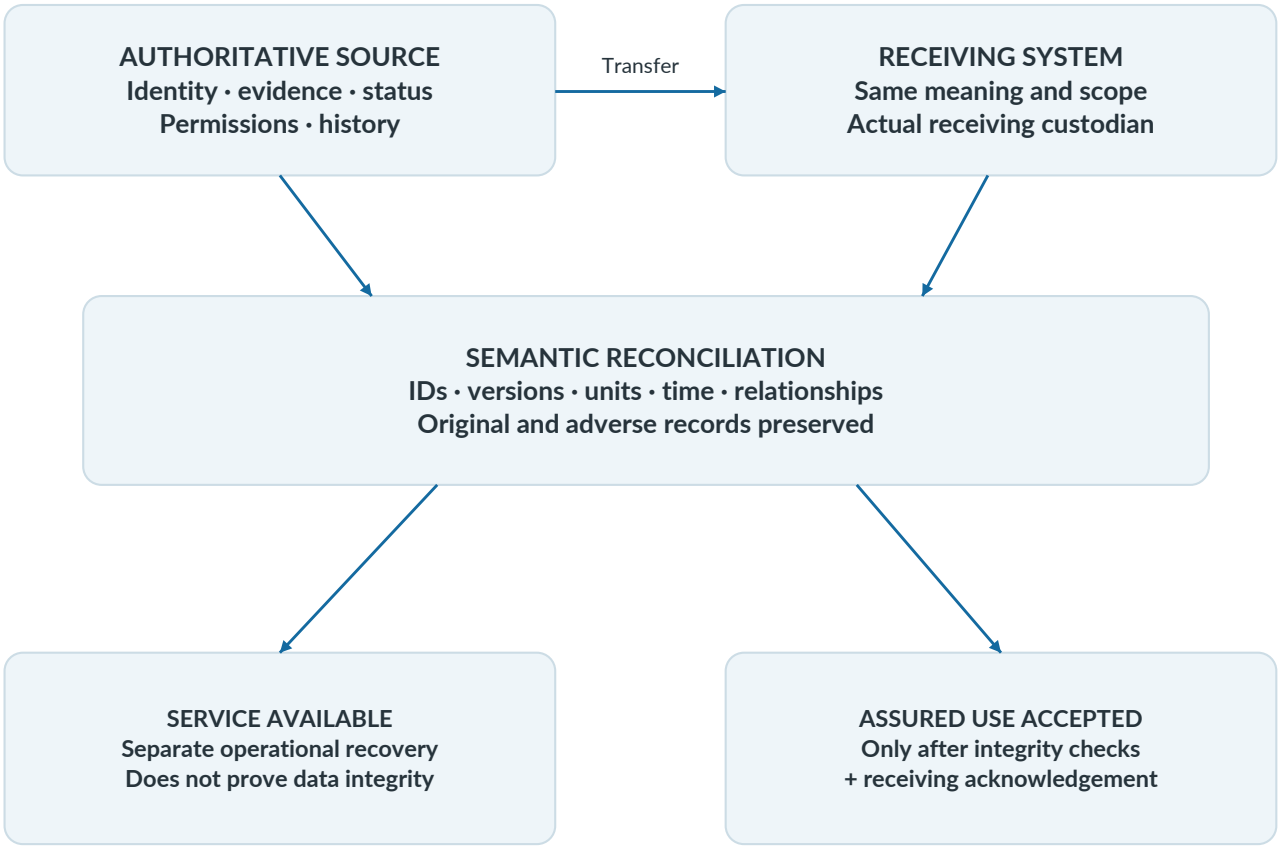
AN-07 Resources, reserves and terminal obligations



Operating demand, protective reserves and terminal duties shall be reconciled for simultaneous needs. A reserve has one explicit allocation unless joint availability is technically demonstrated. Positive energy cannot compensate for inadequate peak power; the same principle applies to other unlike quantities.

Controlling connections: 33.5; 43; 64.4; 68.5; 73.3

AN-08 Evidence migration and recovery acceptance



Missing essential evidence or links → HOLD dependent use; preserve source and unresolved duties.

Network availability and semantic integrity are different outcomes. Reconciliation includes the actual meanings, relationships and histories needed to support decisions. Equal file counts or a successful backup job are not sufficient. A sent archive becomes accepted custody only after a receiving function verifies usability and acknowledges duties.

Controlling connections: 10; 56; 67; 78.7; 79.5

Annex AO — Mandatory technical parameter schedules

NORMATIVE RECORD REQUIREMENTS

Every triggered group shall be completed for the actual application. The schedule shall not merely list topics: it shall contain approved values or defined attributes, evidence, units, uncertainty, owner and actual authority. The absence of applicable technical limits is a HOLD condition, not a request for an assessor to invent them.

P01 Mission and scope

Required scope and values: Legal owner, performer, family/module, object, domain, configuration, location, duration and modes.

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P02 Environment and exposure

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

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P03 Requirements and acceptance

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

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P04 Geometry and reference systems

Required scope and values: Frame origin/orientation, epoch, time scale, coordinate units, transformation and covariance.

Derivation and evidence: Validated transformation and independent known-answer checks.

Release test: Correct frame and time are maintained through every interface.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P05 Materials and process qualification

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

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P06 Test article and fixtures

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

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P07 Measurement and uncertainty

Required scope and values: Measurand, instrument/range, corrections, sensitivity, covariance, coverage, time/space sampling and calibration.

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P08 Structure, life and mechanisms

Required scope and values: Loads, allowables, factors, life, geometry, material state, mechanisms, detectability and approved reserve.

Derivation and evidence: Qualified structural/life model and representative evidence.

Release test: Each prospectively defined margin and essential mechanism predicate passes.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P09 Power and energy

Required scope and values: End-of-life generation, peak load, usable storage, efficiency, outage/eclipses, mode durations and terminal reserve.

Derivation and evidence: Configuration-specific phase budget and protection tests.

Release test: Power and energy limits both pass without duplicate reserve credit.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P10 Thermal and environmental control

Required scope and values: Node/location, mode, temperatures/gradients, heat inputs, sink/view factors, properties, uncertainty and transient cases.

Derivation and evidence: Correlated thermal model and applicable environment tests.

Release test: All required hot, cold and transition conditions meet approved limits.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P11 Communication and timing

Required scope and values: Distance, frequency/wavelength, gain/loss, noise, rate, margin, latency, event time, age, clock error and outage.

Derivation and evidence: Validated end-to-end budget and adverse service tests.

Release test: Required quality, delay and integrity conditions all pass.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P12 Human and protective response

Required scope and values: User/task, representative conditions, essential steps, feasible intervention, health-support interface and emergency resources.

Derivation and evidence: Specialist criteria and observed performance.

Release test: Every essential protection is effective; no invented universal physiological limit.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P13 Contamination and samples

Required scope and values: Relevant substances/particles, pathway, limit, method/detection, custody, cleanliness, containment and receiving.

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P14 Software, AI and models

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

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

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P15 Security and command authority

Required scope and values: Identities, roles, privileges, keys/trust, target, validity window, command sequence, integrity and interruption response.

Derivation and evidence: Written test authorisation and deployed workflow validation.

Release test: No prohibited authority or unverified command state is accepted.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P16 Reliability and availability

Required scope and values: Population, exposure, failure definition, observation, dependencies, confidence model, downtime and maintenance exclusions.

Derivation and evidence: Prospective statistical design plus engineering mechanism evidence.

Release test: The actual demonstrated bound meets the approved claim; zero failures is not zero risk.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P17 Logistics and environmental claims

Required scope and values: Identity, amount, units, condition, losses, allocation, lifecycle boundary, factor provenance and exclusive attributes.

Derivation and evidence: Reconciled custody/quantity records and separate suitability/statement evaluation.

Release test: Quantity and claim integrity pass independently of technical eligibility.

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

P18 Decision, continuity and terminal duties

Required scope and values: 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.

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

For each actual entry retain: parameter ID; definition; value/range or state; unit; inclusivity; condition/phase/mode; source evidence; uncertainty/dependence; calculation/method version; owner; independent review; genuine approval; change trigger.

Annex AP — Adverse-case and boundary challenge library

NORMATIVE TEST-COVERAGE REQUIREMENT; SCENARIOS ARE SYNTHETIC

Before relying on a local decision-support or technical workflow, select every relevant challenge below and add application-specific adverse cases. Define expected behaviour before execution, record actual observations and defects, correct them and repeat the original failing case plus regression. These tables are a test design, not completed test results.

Test	Challenge	Required state / response
AP01	Undefined mission domain Domain present but not assessed.	HOLD Complete applicability and technical basis before release.
AP02	Missing criterion A required temperature or performance limit is TBD.	HOLD Approve an evidence-based parameter before evaluation.
AP03	Post-result threshold change Limit relaxed after observing a failed result.	FAIL / HOLD Retain original failure; use formal prospective change and new evidence.
AP04	Wrong object evidence Valid report concerns another serial or build.	HOLD Resolve identity; do not transplant the result.
AP05	Wrong configuration Loaded software differs from the tested baseline.	HOLD Assess differences and complete required verification.
AP06	Missing calibration A critical channel has no valid calibration for the run.	HOLD Review method validity and prior affected outputs.
AP07	Uncertainty overlap Coverage interval crosses the inclusive limit.	HOLD Apply the full-interval rule; do not round into PASS.
AP08	Inclusive equality Valid interval ends exactly at an inclusive bound.	PASS for that criterion Apply equality consistently; other gates remain separate.
AP09	Entire interval outside Valid interval lies wholly beyond a bound.	FAIL Contain and disposition; retain the original result.
AP10	Negative uncertainty Entered uncertainty is negative.	HOLD Reject invalid input and investigate the calculation source.
AP11	Invalid numeric value NaN, infinity or text enters a quantitative predicate.	HOLD Do not replace invalid input with zero.
AP12	Unapproved N/A Missing equipment is labelled not applicable.	HOLD Restore applicability and complete required evidence.
AP13	Open minor at grant All other conditions pass, one in-scope minor remains open.	NO GRANT Verify closure before initial, renewed or extended outcome.

Test	Challenge	Required state / response
AP14	Open critical concern A credible essential protection issue exists.	PROTECT / HOLD Immediate protection; retain established notification/status clocks.
AP15	Missing panel member Two of three required panel members vote yes.	NO VALID PANEL Replace or defer; two approvals do not substitute.
AP16	Conflicted reviewer Reviewer designed the applicant-specific solution.	BLOCK ASSIGNMENT Use an eligible independent reviewer.
AP17	Expired role authority A person was unauthorised at the event time.	HOLD / IMPACT REVIEW Later renewal does not validate historical unauthorised work.
AP18	Failed essential skill High average score but essential task failed.	NO ROLE AUTHORISATION Remediate and perform valid direct reassessment.
AP19	Mixed evidence status Received evidence is automatically marked accepted.	HOLD Require purpose-specific competent validity review.
AP20	Stale event data Recently received packet contains old event information.	HOLD Apply event-age and timing-uncertainty criteria.
AP21	Wrong reference frame Position is interpreted in an unverified frame.	HOLD Validate transformation and related uncertainty.
AP22	Command transmitted only Transmission log is offered as physical completion.	NOT COMPLETE Require accepted terminal-state evidence.
AP23	Duplicate command A repeated transaction can repeat a consequential action.	BLOCK / DEFECT Validate sequence, identity and duplicate handling safely.
AP24	Simulator connected to live target Synthetic command data could reach a real asset.	STOP TEST Isolate the environment and verify no live effects.
AP25	Infeasible human intervention Round-trip and response delay exceed the hazard window.	FAIL CONTROL Do not credit the human step as timely protection.
AP26	Energy positive, peak power inadequate Energy capacity passes but required power is unsupported.	NO RELEASE Evaluate the separate power predicate.
AP27	Reserve counted twice One reserve supports two simultaneous critical needs.	HOLD Reconcile allocations and obtain sufficient real resources.
AP28	Thermal equation in Celsius Fourth-power calculation uses Celsius.	INVALID / HOLD Recompute in kelvin and assess affected conclusions.
AP29	Free-space-only link claim Important atmospheric or implementation losses omitted.	HOLD Complete and validate the actual end-to-end budget.
AP30	Zero failures means zero risk Small trial set is labelled failure-free indefinitely.	REJECT CLAIM Use a valid bounded inference and mechanism evidence.

Test	Challenge	Required state / response
AP31	Assumed independent redundancy Both backups depend on one unassessed shared service.	HOLD Evaluate common causes and real alternative capability.
AP32	Dose quantities mixed Device absorbed dose and a different quantity are summed.	INVALID / HOLD Keep compatible quantities and effects distinct.
AP33	Terrestrial process automatically transferred Changed environment has no qualification basis.	HOLD Review differences and perform required remote-environment qualification.
AP34	Unobservable hidden property Telemetry does not measure or validly infer an essential property.	HOLD Provide suitable evidence or restrict the output claim.
AP35	Unknown reuse history A successful functional test is used to reset item life.	REJECT LIFE CLAIM Retain unknown history and require valid life/condition evidence.
AP36	Sample chain broken Receiving sample cannot be linked to original container.	HOLD Resolve identity and contamination/custody consequences.
AP37	Receiving facility not ready Return-chain acceptance depends on a planned future facility.	BLOCK DEPENDENT COMMITMENT Establish actual accepted receiving capability.
AP38	Resource yield without quality Mass yield is presented as usable product output.	HOLD Separately verify material and functional eligibility.
AP39	Partial inventory labelled complete footprint Mandatory lifecycle categories omitted.	REJECT UNQUALIFIED CLAIM Correct boundary and complete applicable statement evidence.
AP40	Exclusive attribute allocated twice Same eligible quantity supports duplicate exclusive claims.	HOLD Resolve allocation and affected public statements.
AP41	AI evaluation leakage Evaluation items overlap improperly with training/tuning.	HOLD Rebuild independent evaluation and reassess claimed performance.
AP42	Adaptation outside envelope Model changes without impact and release controls.	RESTRICT USE Restore an accepted boundary and complete renewed assurance.
AP43	Expired credential reprinted A new PDF date is used to revive status.	NO RESTORATION Preserve expiry; require actual authorised renewal.
AP44	Appeal during suspension Appeal receipt is used as automatic reinstatement.	NO AUTOMATIC CHANGE Keep protection and expiry while independent remedy proceeds.
AP45	Backup available, links missing Application runs but evidence relationships are broken.	HOLD ASSURED USE Reconcile semantic integrity before acceptance.

Test	Challenge	Required state / response
AP46	Equal migration counts, wrong records Source/destination totals match but identities differ.	FAIL MIGRATION CHECK Reconcile records, versions, links and meaning.
AP47	Lost contact labelled disposed No terminal-state evidence supports the claim.	UNKNOWN / HOLD Publish the actual uncertainty and retain remaining duties.
AP48	Closure without receiving custodian Records and unresolved obligations have no accepted owner.	INCOMPLETE CLOSURE Obtain lawful receiving custody and duty acceptance.

AP.1 Execution and acceptance record

For each challenge record the actual system or method version, requirement, preconditions, input, expected response, execution steps, observed response, raw evidence, tester, validity, defect, affected prior outputs, correction, retest and acceptance. Tests with unavailable expected outcomes or invented observations are incomplete. An essential unresolved failure blocks the dependent release. The test environment shall not issue live credentials or commands.

Annex AQ — Definitions, units and interpretation controls

NORMATIVE DEFINITIONS FOR TECHNICAL APPLICATION

These definitions supplement Clause 2 without merging its distinct outcome classes. All quantities and time conventions shall be declared in the actual record.

Term	Defined meaning
Acceptance predicate	An explicit logical condition applied to valid evidence and approved parameters to determine an identified requirement state.
Actual authority	A genuine, scoped and current entitlement to perform the recorded action; a title, template or software permission alone is insufficient.
All-space domain coverage	A requirement to examine every relevant space environment and activity in the applicability catalogue; not an unrestricted certificate or a claim that unknown phenomena are solved.
Application schedule	The controlled mission-, object- and method-specific completion of scope, parameters, evidence, competence and decision rules.
Attribute criterion	A defined observable state or behaviour with explicit acceptance conditions rather than a numerical limit.
Bounded inference	A conclusion limited to the population, configuration, environment, period and model supported by its evidence.
Common cause	A single condition or dependency capable of defeating more than one apparently separate function or evidence source.
Conformity state	PASS, FAIL, HOLD or approved N/A for an identified requirement. Operational UNKNOWN is not a favourable conformity state.
Contemporaneous record	A record attributable to actual work and event time; a later reconstruction must be identified as such.
Coverage interval	An interval with a stated uncertainty and coverage interpretation; not automatically a posterior probability that one item conforms.
Decision replay	Independent reconstruction of a result from the same frozen inputs, criteria, methods, evidence and authority.
Degraded mode	An explicitly defined non-nominal operating state with its own permitted functions, limits and protective requirements.
End-of-life duty	An identified terminal or continuing obligation for assets, materials, environment, users, records or authorised monitoring.
Essential control	A mandatory protective, integrity or independence function whose absence blocks the dependent positive conclusion.

Term	Defined meaning
Evidence validity	Fitness of information for the actual object, configuration, period, method and inference; distinct from whether the information shows success.
FAIL	Valid evidence demonstrates the stated acceptance predicate is not satisfied.
HOLD	A positive conclusion is unavailable because applicability, authority, method, evidence, uncertainty or an essential definition is unresolved.
Instance result	An outcome limited to a identified item, lot, event, test or historical statement; no assumed ongoing technical validity.
N/A	Independently approved non-applicability because the trigger and retained responsibility are genuinely absent.
Operational domain	The environment, configuration, users, conditions and behaviours within which the released capability is demonstrated.
PASS	The approved requirement predicate is satisfied by valid relevant evidence within the stated boundary.
Protective state	A defined state intended to protect people or essential assets, distinct from continued achievement of the mission objective.
Qualification	Demonstration of a defined capability or envelope; not routine acceptance of every produced unit.
Remote completion	A supported final-state conclusion using defined direct, instrument-derived or validated inferential evidence from an inaccessible activity.
Reserve ownership	Explicit allocation of a resource reserve to a need and authority so that simultaneous uses cannot claim it twice.
Semantic integrity	Preservation of record meaning, identity, configuration, relationships, units, time basis, authority and history.
Synthetic example	Invented inputs used to teach or test a calculation or workflow; not empirical performance, an actual applicant or an approval.
Technical concession	A separately authorised bounded disposition of a known departure; it does not change the original failed criterion into conformity.
Terminal state	The actual final or current status after mission completion, loss or retirement, including explicitly unverified conditions.
Validated model domain	The outputs, inputs and conditions for which model credibility has adequate evidence.
Version control	Retained identities and change history for technical records and configurations, even when the publication displays no numbered change label.
Verification versus use validation	Verification addresses specified requirements; use validation addresses suitability for the intended task and environment. The relevant sense must be declared.

AQ.1 Units and numerical meaning

Quantity	Unit / convention	Required control
Length / position	m; km only with explicit conversion	State frame, origin and epoch for coordinates; do not mix unit systems.
Time	s; h=3,600 s; conventional duration day=86,400 s	Declare time scale, event/receipt basis and calendar conventions. Civil-time leap adjustments are not erased by a duration conversion.
Temperature	K for thermodynamic equations; °C for stated measured scales	T[K]=t[°C]+273.15. Use kelvin in fourth-power radiation equations.
Power and energy	W=J/s; Wh=3,600 J	Power capability and stored energy are separate requirements.
Mass and quantity	kg; counts for discrete items	A mass balance is not an identity or suitability proof.
Frequency	Hz=s^-1	Specify bandwidth and acquisition response when a method relies on dynamic data.
Acceleration	m/s^2; g only with declared conversion	Here conventional g=9.80665 m/s^2 for unit conversion, not local gravity on a body.
PSD	$(m/s^2)^2/Hz$ or g^2/Hz	Integrating over Hz gives acceleration variance; do not confuse amplitude spectrum and PSD.
Pressure / stress	Pa=N/m^2	Declare absolute/gauge reference and temperature where relevant; pressure test limits are application-specific.
Absorbed dose	Gy=J/kg	Declare material and location. Different radiation quantities and mechanisms are not interchangeable.
Data quantity	bit; byte=8 bit; decimal GB=10^9 byte	State whether storage is decimal or binary and whether overhead/reserves are included.
Logarithmic quantities	dB ratios; dBW referenced to 1 W; dBi antenna reference	Only combine compatible ratios and reference quantities; validate the link/noise convention.
Angles	rad; degrees only with stated conversion	Frame, orientation and direction conventions are part of the evidence.
Probability and fraction	Dimensionless value in [0,1]	State population, exposure, model and dependence; percentage is not universal assurance.
Uncertainty	Same unit as the measured output; variance in squared units	Differentiate standard uncertainty, expanded uncertainty and coverage factor.

Quantity	Unit / convention	Required control
Environmental inventory	kg CO2e under a defined model and boundary	No factor in a synthetic example is valid for a real inventory.

AQ.2 Abbreviations

AI: artificial intelligence. APU: auxiliary power unit. BOL/EOL: beginning/end of life for the stated technical condition. CAB: conformity-assessment body. DoD: depth of discharge. EVA: extravehicular activity. FBO: fixed-base operator. FTE: full-time-equivalent staffing measure. MRO: maintenance, repair and overhaul. N/A: approved non-applicability. NDT: non-destructive testing. PNT: positioning, navigation and timing. PSD: power spectral density. RF: radio frequency. RMS: root mean square. UAS: unmanned aircraft system. UTC: Coordinated Universal Time. Every abbreviation remains subordinate to the exact scope and defined quantity.

Annex AR — Integrated release dossier and completeness checklist

NORMATIVE

This is the final integration check for an identified scope. It does not grant a universal all-space result. Every row requires actual evidence and a recorded competent conclusion.

ID	Review area	Actual evidence and blocking condition
AR01	Object and authority	The legal entity, actual performer, object, configuration, family/module, domain, phase/mode and responsible authority are unambiguous. No undefined essential scope or unavailable authority.
AR02	All-space applicability	All Annex AK domains and all relevant unlisted mechanisms have reasoned dispositions. No unexamined applicable domain or unsupported N/A.
AR03	Complete requirement set	Every triggered main-clause and normative-annex condition is indexed and allocated. No obligation removed through a shorter checklist or commercial scope summary.
AR04	Parameters	Every triggered Annex AO group has accepted actual values or observable attributes. No TBD, assumed universal limit or retrospectively changed threshold.
AR05	Environment and representation	Actual mission environment, article differences, modes, cumulative exposure and coupled effects are bounded. No unsupported analogy or missing critical environment.
AR06	People and independence	Evaluators, specialists, reviewers and decision functions meet actual scope, currency, conflict and availability rules. No nominal or expired role substitutes for demonstrated competence.
AR07	Methods and instruments	Methods, instruments, software, models, uncertainty, source access and test safety are valid for the intended inference. No invalid essential method, channel or unverified model.
AR08	Technical evidence	Original observations, configuration, data, calculations, adverse results and limitations are retrievable. No fabricated, selectively omitted or wrong-object evidence.
AR09	Calculations	Units, equations, assumptions, uncertainty, boundaries and unrounded results have been independently checked. Arithmetic correctness and physical validity are both established for their separate purposes.
AR10	Interfaces and resources	All essential technical and organisational interfaces and resource budgets are reconciled. No unallocated duty, incompatible interface or reserve double counting.

ID	Review area	Actual evidence and blocking condition
AR11	People and environment protection	Human, worker, planetary, contamination and public-interface duties are supported where triggered. No environmental metric or mission success offsets missing essential protection.
AR12	Findings and corrections	Every in-scope nonconformity required for a positive grant is verified closed; historical effects are addressed. No open minor, major or critical finding at grant, renewal or extension.
AR13	Independent decision	The frozen dossier, gate conjunction, panel rule where required and actual authority all support the outcome. No decision on own evaluation or vote substituting for evidence.
AR14	Claim and registry	The issued scope and public status match the real decision, restrictions and ongoing/instance basis. No unrestricted all-space, statutory or unevidenced external-acceptance claim.
AR15	Continuing controls	Surveillance, change, incident, expiry, restoration, appeal and notification controls use actual event history. No booking, payment, reprint or appeal automatically extends status.
AR16	Terminal duties and custody	Final-state criteria, remaining resources, receiving capability, records and residual obligations are accepted. No loss of contact relabelled as disposal or abandoned essential duty.

AR.1 Signed conclusion

The independent conclusion shall identify the exact dossier and profile, the supported scope, every restriction and excluded area, the applicable outcome class, the reviewer or panel, actual decision authority and event time. The record shall state whether each mandatory condition is fulfilled. A completed checklist is not the signature or authorisation itself. Names, dates and observations shall be entered only from genuine events.

AR.2 Publication versus operational completion

A readable and structurally complete publication is a document deliverable. It does not demonstrate completed consultation, technical adoption, field qualification, operator competence or an active accredited scope. Those results require the real records and decisions specified throughout this standard. The exact scope may be released only after all applicable gates have been fulfilled; unrelated development work may remain open without disguising an incomplete dependent capability.

Annex AS — Activity-based application guides

INFORMATIVE READING ROUTES — NO ADDITIONAL CONFORMITY REQUIREMENTS

Use these short routes to answer: “Which parts apply to my activity?” Select the actual evaluated object first, then combine the relevant family and cross-domain guide. The guides locate existing provisions; they do not replace full clause text, change a threshold or exempt an interface duty.

Route	Activity
AS.1	F01 — Management systems and organisational assurance
AS.2	F02 — Critical processes and identified products
AS.3	F03 — Laboratory, calibration and inspection work
AS.4	F04 — Education programmes and learner outcomes
AS.5	F05 — Airports and aerodromes
AS.6	F06 — Aircraft maintenance and technical services
AS.7	F07 — Ground operations and aviation support services
AS.8	F08 — Carbon, environment and climate assurance
AS.9	CROSS-DOMAIN — Space missions, payloads and ground segments
AS.10	CROSS-DOMAIN — Aircraft and integrated aviation products
AS.11	CROSS-DOMAIN — Defense and critical-industrial activities
AS.12	CROSS-DOMAIN — Digital systems, AI and assessment operators

For every route, record applicability rather than merely copying a list of clause numbers. A stated exclusion needs the actual activity and retained responsibility to be absent. The programme operator continues to apply its own governance and independent-decision controls even when an applicant has a narrow scope.

Controlling ASTRA provisions: 0.1–0.4; 1.3–1.6; 4.2; 62; Annexes A, C and AL.

AS.1 Management systems and organisational assurance

F01 / ACTIVITY GUIDE

Design, production, maintenance or distribution organisations seeking a bounded management-system outcome.

Define the evaluated scope

State the legal entity, sites, remote functions, activities, retained outsourced duties and the organisational profile. Separate the system claim from process, product, laboratory or personnel claims.

Reading layer	Applicable starting points
Common and family	0–2; 5–10; 11–16; 17; 27–31; 62; Annexes A–I, M, O and AL.
Technical and interface	32–33, 41, 48–49 and 54–58 when the actual work triggers them. A claim of AF 9100 conformity additionally requires its complete applicable assessment under 17.1.

Start with one complete trail

Complete the applicability record, process map and obligations register. Assemble a completed internal audit, management review and one authentic output trail through order, execution, acceptance and corrective feedback.

Evidence to assemble

Scope and site matrix; process ownership; internal audit and review; source/configuration trail; independent outcome and continuing-status record.

Claim boundary: An organisational result does not approve every product, process, method or employee. Absence of design ownership does not exclude control of supplied design data.

Filled illustration: AT.1. These are reading routes; the full triggered requirements remain controlling.

AS.2 Critical processes and identified products

F02 / ACTIVITY GUIDE

Manufacturers, special-process owners and suppliers qualifying a process or seeking a result for an identified product configuration, lot or serial.

Define the evaluated scope

Separate process qualification from product acceptance. Fix the actual site, equipment, material/geometry family, essential-variable window, software and intended output.

Reading layer	Applicable starting points
Common and family	0–2; 5–16; 18; 27–31; 62; Annexes A–I, M, W and AL.
Technical and interface	32–33, 41–43, 48, 55 and 77 for manufacturing, verification and life evidence. Add the relevant aerospace or space clauses only where the product's intended use triggers them.

Start with one complete trail

Approve the complete qualification matrix before trials. Map every essential variable and hidden property to the monitoring, acceptance and excursion response that can establish it.

Evidence to assemble

Qualified-window dossier; representative and adverse trials; material genealogy; run history; characteristic accountability; release and requalification record.

Claim boundary: A machine or process qualification is not approval of every output. NDT and materials-testing competence use F03 rather than a duplicate process-family claim.

Filled illustration: AT.2. These are reading routes; the full triggered requirements remain controlling.

AS.3 Laboratory, calibration and inspection work

F03 / ACTIVITY GUIDE

Testing, calibration and inspection providers demonstrating competence for defined methods, ranges, conditions and locations.

Define the evaluated scope

Identify the legal provider, method family, item/material, measurand or defect class, range, conditions, site, uncertainty capability, signatories and independence relationship.

Reading layer	Applicable starting points
Common and family	0–2; 5–16; 19; 25 where relevant; 27–31; 62; Annexes A–I, M, O, P and AL.
Technical and interface	42 and 77 for verification campaigns; Annex T for the actual verification domain; Annex AO, P06 and P07 for specimen/setup and metrology. Space test work may additionally trigger 35, 63–65 and Annex AK.

Start with one complete trail

Select one narrow method. Freeze the scope and acceptance rule, verify equipment and competence, trace a representative request-to-report case, then challenge an adverse result and a record-recovery failure.

Evidence to assemble

Scope/range schedule; method verification or validation; calibration and uncertainty; custody; raw data; report; comparison evidence; witnessed case and independent decision.

Claim boundary: A technical report is separate from accreditation of its issuer. A successful calculation or a single reference check is not proof of all-method competence.

Filled illustration: AT.3 and AT.9. These are reading routes; the full triggered requirements remain controlling.

AS.4 Education programmes and learner outcomes

F04 / ACTIVITY GUIDE

Universities, colleges and training providers seeking recognition of a named programme, level, curriculum, delivery location and mode.

Define the evaluated scope

Identify the programme and award, entry/completion routes, campuses, partners, language and delivery mode. Separate institutional identity from the programme outcome and each learner's competence.

Reading layer	Applicable starting points
Common and family	0–2; relevant 5–16; 20; 27–31; 52; 62; Annexes A–E, G–J, M and AL.
Technical and interface	7, 8, 10, 39, 44–47 and 54 for practical supervision, remote learning, digital tools, learner protection and task safety where triggered.

Start with one complete trail

Map each completion outcome to teaching, direct assessment, essential steps and an accountable owner. Review authentic delivery and learner work across every claimed completion route.

Evidence to assemble

Programme self-study; outcome/curriculum map; valid rubrics; representative learner records; moderation; staff/resource evidence; improvement and teach-out records.

Claim boundary: Attendance, credits and a showcase project do not establish every outcome. Without adequate completed delivery evidence, 20.9 permits only a bounded developmental readiness report.

Filled illustration: AT.4. These are reading routes; the full triggered requirements remain controlling.

AS.5 Airports and aerodromes

F05 / ACTIVITY GUIDE

Airport or aerodrome operators seeking recognition of defined site capability and operational interfaces.

Define the evaluated scope

Identify the legal operator, aerodrome boundary, infrastructure, included functions, operating characteristics, actual permissions, tenants and retained contractor responsibilities.

Reading layer	Applicable starting points
Common and family	0–2; relevant 5–16; 21; 27–31; 62; Annexes A–E, G–I, K, M, AD and AL.
Technical and interface	34, 39, 47, 50–51 and 54 for installation, human, utility, digital and emergency interfaces. Use F08 for a separate environmental statement. Special facilities need their dedicated profile.

Start with one complete trail

Build an operator-to-provider interface map. Trace one airside defect from discovery through restrictions, communication, repair, verification and authorised restoration.

Evidence to assemble

Site baseline; inspection and defect history; temporary works; emergency exercises; tenant handovers; utility/digital recovery; exact capability statement.

Claim boundary: The result is not an operating licence. Tenants, handlers, airlines, vertiports and spaceports are not automatically included in an ordinary aerodrome outcome.

Filled illustration: AT.5. These are reading routes; the full triggered requirements remain controlling.

AS.6 Aircraft maintenance and technical services

F06 / ACTIVITY GUIDE

Line/base, engine/APU, component, structures/modification, technical asset support and storage/end-of-life providers.

Define the evaluated scope

Complete the entity + facility/station + aircraft/engine/component family + task + limitations tuple. Distinguish direct maintenance from advice and design responsibility.

Reading layer	Applicable starting points
Common and family	0–2; relevant 5–16; 22; 27–31; 49; 62; Annexes A–I, K, M, AC–AD and AL.
Technical and interface	33–34, 39, 41–44, 47–48 and 55 for configuration, human factors, technical methods, parts and life. F02/F03 evidence supports relevant processes and tests without granting those outcomes automatically.

Start with one complete trail

Select one complete work package. Reconcile current instructions, removed/installed items, life history, tools, authorisations, interrupted work, independent checks and customer handover.

Evidence to assemble

Facility/type/task list; current-data check; work records; parts and life ledger; interruption handover; verification; actual release and continuing-support records.

Claim boundary: ASTRA capability recognition is not a maintenance release, a design privilege or an employer's personal task authorisation. Overhaul does not reset unknown life history.

Filled illustration: AT.6. These are reading routes; the full triggered requirements remain controlling.

AS.7 Ground operations and aviation support services

F07 / ACTIVITY GUIDE

Providers of G01–G09 station-level handling, cargo, energy, ground equipment, cabin services, FBO coordination, navigation support, digital or authorised security services.

Define the evaluated scope

Define the provider, headquarters functions, each station, service track, actual tasks, equipment, customer instructions, local variations and subcontractors.

Reading layer	Applicable starting points
Common and family	0–2; relevant 5–16; 23; 27–31; 51; 62; Annexes A–I, K, M, AD and AL.
Technical and interface	39, 43, 47–48, 50 and 54–56 for human, energy, cyber, custody and service-continuity dependencies. Add another family only for its separately claimed outcome.

Start with one complete trail

Trace a representative local service transaction through acceptance, performance, exception, handover and corrected outcome. Include peak, interrupted or shift-change work and an actual receiving party.

Evidence to assemble

Station/service matrix; local-variation file; competence; equipment compatibility; custody/transaction records; incident extent; independent capability decision.

Claim boundary: Headquarters manuals do not establish every station's capability. A coordination package does not imply direct performance, airline operating approval or public security powers.

Filled illustration: AT.7. These are reading routes; the full triggered requirements remain controlling.

AS.8 Carbon, environment and climate assurance

F08 / ACTIVITY GUIDE

Organisations presenting environmental capability or specific historical/prospective statements, and bodies assessing those statements.

Define the evaluated scope

Select capability recognition, historical verification, prospective validation or verifier competence. State entity, assets, period, functional boundary, methodology and intended users.

Reading layer	Applicable starting points
Common and family	0–2; relevant 5–16; 24; 25.5 for a verifier; 27–31; 53; 62; Annexes A–I, L–M and AL.
Technical and interface	Actual C01–C06 modules; AO-P17 for activity/factor, custody and allocation records; 48 and 56 for data provenance. Technical product eligibility remains a separate decision.

Start with one complete trail

Approve boundary, method, data access, assurance level and materiality before substantive work. Reconcile activity data, factors, units, estimates, exclusions and ownership of exclusive attributes.

Evidence to assemble

Engagement; inventory or plan; evidence and factors; uncertainty; misstatements/corrections; independent statement; custody and precise public wording.

Claim boundary: A plan is not an achieved reduction. Availability of a low-carbon attribute does not make the complete service zero-emission. An inventory does not establish product safety.

Filled illustration: AT.8. These are reading routes; the full triggered requirements remain controlling.

AS.9 Space missions, payloads and ground segments

CROSS-DOMAIN / ACTIVITY GUIDE

Mission owners, spacecraft and payload developers, ground-service providers and supporting supply or verification functions.

Define the evaluated scope

There is no ninth space family. Select the actual F01–F08 outcome and combine all triggered mission domains, lifecycle phases, configurations and retained interfaces.

Reading layer	Applicable starting points
Common and family	0–2; role-specific common and family provisions; 32–33, 35–39, 55 and 62–80 as triggered; Annexes U, Y, AK, AL, AO and AR.
Technical and interface	Use all relevant AK01–AK32 domain decisions, including unlisted mechanisms. Use Annex T for verification and Annexes AA–AB for digital or cyber dependencies.

Start with one complete trail

Freeze the mission/object boundary and phase/mode matrix. Assign every interface and reserve. Complete AO parameter groups before validation or an irreversible-action gate.

Evidence to assemble

Domain applicability; environment and configuration; interface owners; verification matrix; mission budgets; remote observability; independent gate and terminal-duty records.

Claim boundary: A mission plan, publication or command acknowledgement is not physical completion. No unrestricted all-space claim follows from passing one subsystem or one nominal environment.

Filled illustration: AT.9 for evidence mechanics; Annex AM for synthetic budgets. These are reading routes; the full triggered requirements remain controlling.

AS.10 Aircraft and integrated aviation products

CROSS-DOMAIN / ACTIVITY GUIDE

Aircraft, UAS, advanced-air-mobility and installed-equipment organisations across development, supply, integration and support.

Define the evaluated scope

Select F01 for the system, F02 for a process/product result, F03 for provider competence and F06 for maintenance capability, according to the claim actually requested.

Reading layer	Applicable starting points
Common and family	Relevant 0–31; 32–34, 39, 41–49, 54–55 and 62; Annexes U, W, X, Z, AA–AC, AL, AO and AR.
Technical and interface	Apply 50–51 to ground/service interfaces and 63–80 only when actual space-purpose responsibilities exist. Installation effects require their own evidence.

Start with one complete trail

Map as-designed, as-built, as-tested and as-maintained configurations. Trace each essential installation characteristic to representative evidence and the responsible release authority.

Evidence to assemble

Product/installation scope; configuration reconciliation; material/process evidence; actual test results; human-interface validation; support/life records and bounded release.

Claim boundary: An organisational certificate or component bench test is not whole-aircraft acceptance or an operating permission. Scope-specific statutory approvals remain separate.

Filled illustration: AT.2 and AT.6. These are reading routes; the full triggered requirements remain controlling.

AS.11 Defense and critical-industrial activities

CROSS-DOMAIN / ACTIVITY GUIDE

Lawfully authorised defense, land, maritime and critical-industrial organisations applying quality, safety and evidence controls.

Define the evaluated scope

Select the actual family and evaluated object. Identify controlled-information access, specialist permissions, platform configuration and the party retaining each technical and operational duty.

Reading layer	Applicable starting points
Common and family	Relevant 0–31; 32–33, 40–43, 47–49, 54–55 and 62; Annexes U, W, AC, AL, AO and AR.
Technical and interface	Add aviation, space, human or digital provisions only when triggered by actual interfaces. Restricted energy and other hazardous operations remain within specialist procedures and authority.

Start with one complete trail

Separate contractual acceptance, technical evidence approval, information access and operating permission. Establish authorised independent review before relying on protected evidence.

Evidence to assemble

Exact scope/permissions; controlled access; specialist competence; design and manufacture trace; life and support evidence; independent review and claims boundary.

Claim boundary: A defense designation is not an exemption from evidence requirements. This standard contains no weapon construction, targeting, tactical employment or restricted handling instructions.

Filled illustration: AT.2 for process control and AT.6 for life-history logic. These are reading routes; the full triggered requirements remain controlling.

AS.12 Digital systems, AI and assessment operators

CROSS-DOMAIN / ACTIVITY GUIDE

Software, model, autonomous-function and digital-service providers, or organisations operating assessments and public status records.

Define the evaluated scope

Map the digital function to its actual family, object, deployed configuration and claim. An assessment operator additionally declares each activity and its independent authority under Clause 25.

Reading layer	Applicable starting points
Common and family	Relevant 5–16; selected family; 25–31 as responsible; 44–47, 56–58, 62 and 78 where space-related; Annexes M, O, AA–AB, AE–AF, AL and AR.
Technical and interface	Use AO-P14–P15 for digital identity, model domain and command authority; add service and human-response controls where a digital output affects them.

Start with one complete trail

Establish the build/model/data identity, intended decisions, restrictions, evidence provenance, update controls and accountable human review. Test missing data, wrong configuration and invalid authority.

Evidence to assemble

Use-case/domain record; independent evaluation; critical-scenario results; role/conflict matrix; update and recovery logs; original evidence and decision replay.

Claim boundary: An automated score or fluent generated explanation cannot independently grant ASTRA status. Restored connectivity does not demonstrate restored evidence integrity.

Filled illustration: AT.7 and AT.9. These are reading routes; the full triggered requirements remain controlling.

Annex AT — Filled application records and decision examples

INFORMATIVE — ALL ENTITIES, RECORDS AND OBSERVATIONS IN THIS ANNEX ARE SYNTHETIC

These completed illustrations show what an evidence trail looks like and how a bounded conclusion follows from it. They are not pilot results, authentic signatures, live certificates or records of real organisations. EX-prefixed identifiers and relative case steps are demonstration labels.

Example	Reading purpose
AT.1	F01 — One organisation, bounded system outcome
AT.2	F02 — Process excursion and hidden-property hold
AT.3	F03 — Filled uncertainty-aware measurement decision
AT.4	F04 — Attainment is not an attendance count
AT.5	F05 — Aerodrome defect, restriction and restoration
AT.6	F06 — Interrupted maintenance and retained life history
AT.7	F07 — Available service versus correct service
AT.8	F08 — Partial inventory with bounded wording
AT.9	End-to-end F03 case from scope selection to blocked grant and corrected evidence

Actual cases require the full common record payload in Annex M, the technical-profile fields in Annex C, the triggered parameter groups in Annex AO and the independent outcome in Annex AR. The short examples deliberately show limits or blocked conclusions rather than imply that a few completed rows establish a full accreditation.

No example value is pre-approved for a real product, mission, site, learner or environmental statement. Validity of actual inputs, methods and authority remains a separate requirement.

AT.1 F01 — One organisation, bounded system outcome

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Entity / activity	EX-ORG-01; one site; build-to-print bracket manufacture.
Requested result	Organisational system assessment; not product or laboratory accreditation.
Responsible interfaces	Customer retains product design; manufacturer owns process planning, supplied-data checks and error escalation.
Evidence set	EX-IA-01 internal audit; EX-MR-01 management review; EX-WO-014 representative order; EX-NCR-02 finding.

Check	Illustrated evidence or calculation	Recorded consequence
Supplied-design exclusion	Product design not owned; process-design and data-review duties remain applicable.	Bounded N/A only
System readiness	Completed audit and management review appear in the synthetic case record.	PASS for the stated check
Open finding	One in-scope minor finding remains without verified closure.	FAIL / open finding
Overall grant	Other favourable results do not close EX-NCR-02.	No positive grant

Reasoned conclusion

Hold the requested initial outcome until the finding is verified closed. A system approval, when eventually supported, remains limited to EX-ORG-01 and its evaluated site and activities.

Controlling ASTRA provisions: 17.1–17.4; 1.3–1.5; 5; 62; Annexes A, C and AL.

AT.2 F02 — Process excursion and hidden-property hold

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Object	EX-PRC-02; one bonding process at EX-SITE-B; material family M-EX and geometry G-EX.
Controlled basis	EX-PROFILE-02, version 1; actual numeric process window would be fixed by the process authority.
Run and population	EX-RUN-017; units B017-01 to B017-12; complete input-lot and operator links.
Synthetic observation	The run log records an essential-variable excursion. Exterior inspection is satisfactory.

Check	Illustrated evidence or calculation	Recorded consequence
Run-window conformity	The recorded essential-variable excursion breaches the approved case window.	FAIL
Hidden-property evidence	The exterior inspection cannot establish the affected bond property.	HOLD
Affected population	All 12 linked units remain segregated pending a capable technical disposition.	Containment required
Unrelated process result	A later conforming run does not establish the earlier 12 units.	No retrospective PASS

Reasoned conclusion

Do not release the affected units from visual appearance alone. Determine extent, authorise a technically capable investigation, preserve original results and apply requalification rules where triggered.

Controlling ASTRA provisions: 18.1–18.8; 41; 62; Annex W.

AT.3 F03 — Filled uncertainty-aware measurement decision

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Record / object	EX-TR-03; specimen EX-DIM-003; one outside diameter; no population claim.
Prospective example criterion	Inclusive 9.950 mm ≤ diameter ≤ 10.050 mm. These are synthetic case values, not aerospace limits.
Result and model	Corrected y = 10.044 mm; u1 = 0.003 mm; u2 = 0.004 mm; independent components; example k = 2.
Method / authority	EX-MET-01, version 1; competence and calibration records are illustrative references, not actual authorisations.

Check	Illustrated evidence or calculation	Recorded consequence
Combined standard uncertainty	$\sqrt{0.003^2 + 0.004^2} = 0.005$ mm.	Arithmetic
Expanded uncertainty	$U = 2 \times 0.005 = 0.010$ mm.	Arithmetic
Accepted interval	[10.034, 10.054] mm overlaps the upper limit 10.050 mm.	HOLD
Interpretation	Nominal y is inside the specification; the full interval is not.	Not accepted; not a proven defect

Reasoned conclusion

Keep acceptance on HOLD. Do not retest until a favourable reading appears. Any improved method or repeat plan needs prospective justification; original observations and the original conclusion remain in the record.

Controlling ASTRA provisions: 9.4–9.5; 19.6; 62.3–62.7; Annexes G, AL and AM.Q01–Q02.

AT.4 F04 — Attainment is not an attendance count

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Programme	EX-EDU-04; one aviation-measurement course; curriculum v1; one location and one declared completion route.
Outcome	EX-LO-03: recognise an invalid measurement and stop an unsupported release.
Synthetic cohort	40 assessed learners; 34 meet the defined outcome; 6 require further learning and reassessment.
Essential-step rule	An essential integrity step cannot be offset by a high overall course score.

Check	Illustrated evidence or calculation	Recorded consequence
Attainment calculation	34 / 40 = 0.85 = 85%.	Outcome-specific result
Learner EX-L017	Knowledge and general practical scores are favourable; essential integrity step failed.	No task competence claim
Completion route	Assess real work for each included delivery/completion route; this example covers only one.	No blanket programme inference
Improvement loop	Define remediation, equivalent reassessment and follow-up evidence.	Record actual results later

Reasoned conclusion

Report 85% only as the illustrated cohort outcome. It is not a universal ASTRA passing threshold, proof that all learners are competent or permission to issue professional licences.

Controlling ASTRA provisions: 20.3–20.5; 20.8–20.10; 52; Annex J.

AT.5 F05 — Aerodrome defect, restriction and restoration

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Object	EX-APT-05; one aerodrome operator; declared airside inspection and defect-management functions.
Record links	EX-DEF-005 → EX-RESTRICT-005 → EX-WORK-005 → EX-VERIFY-005.
Synthetic event	An inspection identifies a lighting defect affecting an included operating condition.
Interface owner	The operator owns operational restrictions and communication; the repair contractor owns the assigned repair work.

Check	Illustrated evidence or calculation	Recorded consequence
Immediate control	Apply the airport-specific protective restriction and required communication.	Protection before restoration
Repair completion	A contractor work ticket states repair complete.	Evidence received
Restoration evidence	Independent verification for the affected condition has not yet been recorded.	HOLD restoration
Tenant boundary	A tenant's unrelated capability is not evaluated by the operator's defect record.	Separate scope

Reasoned conclusion

Do not restore the affected capability solely on a repair ticket. Verify the correct condition, close the defect and obtain actual authorised restoration. The example creates no runway or emergency-response thresholds.

Controlling ASTRA provisions: 21.1–21.8; 50; 54; Annexes K and AD.

AT.6 F06 — Interrupted maintenance and retained life history

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Work package	EX-MRO-06; component replacement at EX-STATION-01; exact type and task in the case scope.
Removed / installed item	REM-006 removed; INST-006 installed; both require traceable identity and eligibility.
Synthetic discrepancy	INST-006 has a satisfactory bench-test report but incomplete prior life history.
Interruption record	Shift handover retains incomplete task, temporary equipment and independent-check requirements.

Check	Illustrated evidence or calculation	Recorded consequence
Identity and test report	Report matches INST-006 and the stated bench method.	Only that evidence is relevant
Life eligibility	Required exposure history is incomplete.	HOLD
Task completion	A final signature cannot establish omitted independent checks.	HOLD
Release authority	Capability recognition is separate from the employer's actual release privilege.	Verify separately

Reasoned conclusion

Hold the dependent maintenance release until authorised life/condition disposition, task completion and independent checks are demonstrated. A successful bench test or overhaul label does not reset unknown life.

Controlling ASTRA provisions: 22.1–22.6; 49; Annexes K and AC.

AT.7 F07 — Available service versus correct service

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Service	EX-G08-07; digital operational support at EX-STATION-01; one stated service window.
Synthetic window	1,000 h; available 960 h; unavailable 40 h.
Integrity condition	20 h of available time supplied unacceptable information under the declared case criterion.
Data records	EX-EVT-07; source timestamps; configuration history; classified outage/correctness intervals.

Check	Illustrated evidence or calculation	Recorded consequence
Availability	960 / 1,000 = 96%.	Availability measure
Available and correct	960 − 20 = 940 h; 940 / 1,000 = 94%.	Correct-service measure
Assured-use decision	Restored access does not close the incorrect-information interval.	Investigate and HOLD affected use
Network claim	One station’s record does not demonstrate all stations.	Bound the scope

Reasoned conclusion

Keep both denominators and outcomes visible. Reconcile affected recipients, configuration and recovery integrity before restoring assured use. Neither example percentage is a universal service acceptance target.

Controlling ASTRA provisions: 23.1; 23.9; 23.11; 51; 56; Annex AM.Q09.

AT.8 F08 — Partial inventory with bounded wording

SYNTHETIC FILLED EXAMPLE / NOT AN ACTUAL ASSESSMENT

Record field	Illustrative completed value
Statement	EX-ENV-08; one facility; one completed 12-month reporting window; selected energy-related sources only.
Synthetic activity A	Purchased electricity: 100,000 kWh × illustrative factor 0.400 kg CO2e/kWh.
Synthetic activity B	Fuel: 5,000 L × illustrative factor 2.50 kg CO2e/L.
Explicit exclusions	Other direct sources, value-chain categories and tenant/aircraft activity are outside this partial demonstration.

Check	Illustrated evidence or calculation	Recorded consequence
Electricity subtotal	100,000 × 0.400 = 40,000 kg CO2e.	40.0 t CO2e
Fuel subtotal	5,000 × 2.50 = 12,500 kg CO2e.	12.5 t CO2e
Selected-source sum	52,500 kg CO2e = 52.5 t CO2e.	Partial arithmetic only
Claim review	No independently substantiated factor suitability, full boundary or verification engagement is supplied.	No verified inventory claim

Reasoned conclusion

Permitted example wording: “Synthetic partial calculation for two selected sources: 52.5 t CO2e.” Do not describe this as a complete verified footprint, an achieved reduction or a net-zero result.

Controlling ASTRA provisions: 24.1–24.3; 24.8–24.10; 53; Annex L.

AT.9 F03 — End-to-end case and traceable decision

SYNTHETIC WALKTHROUGH — NO REAL LABORATORY, PILOT OR ACCREDITATION RESULT

Case EX-CASE-DIM-01 illustrates one narrow laboratory inspection activity: measurement of an identified outside diameter on a non-flight demonstration part. The case follows a request, profile, measurement, adverse finding, independent review and controlled follow-up. It does not represent a live F03 profile.

Scope field	Filled case definition
Applicant / site	EX-LAB-01 / EX-SITE-01; illustrative technical-provider relationship.
Object / method	EX-PART-001; one outside diameter; EX-MET-DIM-01, version 1.
Requested scope	Demonstrate evidence handling for this method and object only. No other materials, locations or methods are included.
Criterion	[9.950, 10.050] mm, inclusive; full-interval rule agreed before observation.
Records	EX-APP-01 → EX-PROFILE-01 → EX-PLAN-01 → EX-RAW-01 → EX-TR-01 → EX-NCR-01 → EX-REVIEW-01.
Role separation	Evaluator E1; technical reviewer R1; any accreditation decision requires the actual three independent eligible members and full gate evidence.

Applicability decisions

Provision	Case application	Decision
1.3 and Annex C	Fix object, location, method, period, limitations and responsibility.	Applicable
8–10 and 19	Equipment, method, data and provider competence for this exact task.	Applicable
20–24	No education, airport, maintenance, ground or environmental outcome requested.	Bounded exclusions need actual independent review
62 and Annex AL	Evidence validity before a numeric classification.	Applicable
Annex P / AR	Actual scope activation and final independent decision.	Not supplied by this illustration

Controlling ASTRA provisions: 1.3–1.6; 9; 19; 62; Annexes C, G, M, P, AL and AR.

AT.9.1 Measurement, adverse evidence and correction

SYNTHETIC VALUES — ORIGINAL STATES REMAIN IN THE RECORD

Item	Case record
Original corrected value	10.044 mm; standard components 0.003 mm and 0.004 mm, assumed independent; example k = 2.
Original accepted interval	U = 0.010 mm; [10.034, 10.054] mm.
Original measurement state	HOLD: uncertainty interval overlaps the upper boundary. No physical defect conclusion is established by that overlap alone.
Additional integrity finding	EX-NCR-01: one data-export path omitted the configuration identifier needed to resolve the report to its specimen.
Immediate action	Retain EX-RAW-01 and EX-TR-01; prevent acceptance; review other reports using the same export mapping.
Corrective evidence design	Repair the export mapping; validate normal, missing and wrong-configuration cases; obtain authentic repeated execution and independent review in an actual deployment.

A later result is a separate evidence event

Suppose a prospectively approved improved method is then used under EX-PLAN-02, with corrected y = 10.043 mm and justified U = 0.004 mm. The interval [10.039, 10.047] mm is wholly within the same example limits. That one measurement predicate is PASS. The new method must be valid for this use; all original observations remain visible. The later result does not erase the earlier HOLD or itself close EX-NCR-01.

This is not permission to keep measuring until a value passes. Method changes and repetitions need a predetermined technically justified plan with every attempt retained.

Controlling ASTRA provisions: 9.2, 9.5, 9.7; 10.1–10.3; 14; 19.11; 62.3–62.7; Annex AL.

AT.9.2 Independent review and bounded outcome

SYNTHETIC DECISION RECORD / NO LIVE GRANT

Gate	Available in the illustration	Consequence
Scope / criteria	The case definition and prospective example limits are stated.	Case-definition check only
Measurement	The later interval meets the one illustrated diameter criterion.	One predicate PASS
Equipment / method competence	No authentic facility, method-validation or role dossier is supplied here.	HOLD actual reliance
Finding closure	The required closure evidence is designed but not reported as executed.	Open; grant blocked
Panel and authority	No actual panel, operator appointment or active profile is supplied.	No accreditation decision
Final public record	No certificate number, accreditation mark or active registry entry.	Illustration only

Recorded conclusion: the synthetic case demonstrates how individual requirement states, report integrity, corrective action and independent authority remain separate. It does not demonstrate the competence of a real laboratory. An actual grant could be considered only after every required gate is supported, all in-scope nonconformities are verified closed and the competent independent decision is recorded.

Transferable evidence relationships

Application identifies the scope; the profile fixes criteria; the plan selects the object and method; raw data records what happened; the report retains the original conclusion; the finding records the integrity gap; the review checks closure and authority. Export and recovery must preserve this chain, not merely the file count.

Controlling ASTRA provisions: 3.4; 4.5; 14–16; 28; 62.5; Annexes O, P, AL and AR.

Annex AU — Expert review and controlled field-pilot protocol

INFORMATIVE IMPLEMENTATION PROTOCOL — NOT A REPORT OF COMPLETED WORK

This protocol provides a practical next step for evaluating one selected implementation end to end. It applies the existing technical, pilot and release gates in Clauses 4, 31, 59–62 and Annexes P, AP and AR. The suggested first scope is a narrow F03 dimensional-metrology or inspection method on non-flight demonstration articles at one site. The operator may select another scope after an equivalent consequence and feasibility review.

AU.1 Select a bounded first application

Decision	Complete before starting
Pilot object	One method family, one site, a stated measurand/range and a small clearly identified non-operational article population.
Excluded use	No flight release, life-critical acceptance, live accreditation, hazardous stress testing or public scope claim during the pilot.
Independent team	Method specialist, metrology/data reviewer and programme-decision reviewer with documented competence and conflicts. Actual assignments follow Annex D and the applicable panel rules.
Real records	Use authentic measurements and timestamps for the actual pilot. Keep synthetic adverse workflow cases separately labelled.
Prospective plan	Approve scope, criteria, sampling rationale, instrument suitability, uncertainty, safeguards, observation coverage and acceptance before collecting decision data.

The example choice limits practical risk while exercising scope definition, evidence generation, uncertainty, reporting, findings, independent review and recovery. It is a proposed starting boundary, not evidence that a profile is active or that every F03 method will perform similarly.

Controlling ASTRA provisions: 4.1–4.5; 8–10; 19; 26.1; Annexes C, D and P.

AU.2 Specialist review before field work

PRE-EXECUTION REVIEW / RECORD ACTUAL REVIEWERS AND DECISIONS

Review question	Evidence expected
Are the requirements evaluable?	Every applicable condition resolves to an object, responsibility, method, criterion and missing/failure consequence. Ambiguity has a recorded disposition.
Does the method support the claim?	Actual measurand, range, setup, access, biases, uncertainty, specimen representativeness and known limitations are reviewed by competent specialists.
Are the numerical rules correct for this use?	Recompute selected formulas independently; review units, covariance, coverage, rounding, inclusive boundaries and invalid inputs. Arithmetic and physical model suitability are reviewed separately.
Is the work safe and authorised?	Actual site authority, specimen suitability, equipment limits, protective arrangements, permissions and stop conditions are verified.
Is independence real?	No person independently accepts their own evaluated work. Competing duties, consultancy and other conflicts are addressed before assignment.
Can records support replay?	Raw data, configuration, method version, performer, time, calculations, findings and decisions remain linked through export and recovery.

Disposition of review comments

Record each comment with its affected requirement, consequence, responsible owner, agreed correction and closure evidence. An unresolved essential ambiguity, invalid model or missing permission stops dependent work. Technical changes follow the consultation and approval process in Clause 4.3; the pilot does not create an exception to that process.

Controlling ASTRA provisions: 4.2–4.4; 6–10; 62; Annexes C, G, P and AL.

AU.3 Execute normal, boundary and adverse trails

SEPARATE AUTHENTIC PHYSICAL OBSERVATIONS FROM SYNTHETIC WORKFLOW CHALLENGES

Trail	Execution focus
Normal evidence trail	Real request → scope → approved method → identified article → actual measurement → uncertainty → technical report → independent review.
Boundary measurement	Use a justified reference or safe specimen near the decision boundary. Preserve unrounded inputs and distinguish PASS, FAIL and HOLD under the approved rule.
Known invalid input	In a segregated test copy, challenge missing units, wrong specimen, expired authority or a corrupted data link. Confirm that unsupported acceptance is blocked.
Nonconforming work	Retain an authentic adverse result or a labelled test scenario. Trace extent, protection, root cause, correction, effectiveness and historical report impact.
Role and panel failure	Use isolated administrative scenarios to challenge conflict, insufficient technical coverage or an absent required panel member. No live status is issued.
Export and recovery	Restore a controlled copy, verify relationships and reconcile technical meaning and current status. File counts and successful restore messages are not sufficient.
Remedy and communication	Exercise a safe complaint/appeal scenario without changing protective status automatically. Retain receipt, responsibility and reasoned outcome.

Select all relevant challenges from Annex P and Annex AP and add method-specific cases. A paper walkthrough may test workflow logic, but it cannot replace the physical or professional demonstration needed for the method. Never create a dangerous operating condition merely to test a form.

Controlling ASTRA provisions: 4.4; 10.3–10.6; 13–16; 27; 62; Annexes P, AP and AR.

AU.4 Evidence, usability and disagreement measures

PROSPECTIVE PILOT MEASURES — NO UNIVERSAL PASS PERCENTAGE

Measure	Definition and interpretation
Requirement coverage	Applicable conditions with valid evaluated evidence / all applicable conditions. Show counts, missing conditions and every critical gap; no weighted score authorises release.
Decision reproducibility	Compare independent classifications from the same frozen inputs before discussion. Report the case count, disagreements and their causes, not only agreement percentage.
Record completeness	Check required fields and relationships against Annex M, C, AO and AR. A filled cell without authentic support remains incomplete.
Practical burden	Record actual productive evaluation, interruption, data reconstruction and rework effort. Separate travel, reporting and independent decision resources.
Reader usability	Ask representative users to select their route, locate the controlling clause and complete a record. Capture wrong turns, ambiguous terms and task time for improvement.
Method performance	Use the actual pre-agreed bias, precision, detection, uncertainty or other technical criteria. A favourable document score does not validate the measurement.

The programme owner and specialist reviewers define the real pilot population and acceptance conditions before execution. More representative evidence is needed when consequence, dependence, variability or disagreement makes the initial case selection inadequate. The protocol supplies no universal number of measurements, participant quota or agreement threshold.

Interpretation of a disagreement

Preserve each reviewer's original result. Identify whether the difference comes from scope, source data, configuration, criterion, unit, uncertainty, predicate or expertise. Correct the actual cause and replay an equivalent controlled case; consensus reached through discussion alone is not proof that the conclusion is technically correct.

Controlling ASTRA provisions: 4.4; 12.4; 29; 59.5; 62.7; Annexes F and AL.

AU.5 Pilot report and scope-release decision

ACTUAL RESULTS ARE ENTERED ONLY AFTER EXECUTION

Report field	Required content in the actual pilot report
Scope and objective	Entity/site; family; technical method; object and configuration; range; restrictions; no-use boundary.
Review team	Actual people, competence evidence, conflicts, assignments and independent roles.
Plan and execution	Approved criteria and version; authentic dates; sample and method rationale; raw results; witness coverage; departures and interruptions.
Adverse work	Selected challenges; expected versus observed states; logs; defects, root causes and corrections.
Limitations	Untested mechanisms, unobserved activities, unresolved assumptions and limits on inference.
Independent readiness	A reasoned conclusion for the exact proposed scope, including closure of blockers, remaining restrictions and actual authority.
Activation	Separate authorised release and registry entry only after all Clause 4.5 / Annex P gates are complete. No automatic activation from publication or this report template.

Readiness is not a portfolio-wide conclusion

A successful pilot can support the independently reviewed scope actually exercised. It does not validate every equation, programme family, mission domain or provider. Reuse of evidence for another scope needs a difference and representativeness analysis. Live applicants retain their own complete assessment and independent outcome.

No actual pilot report, expert signature, committee vote, accredited scope or deployment result is included in this publication. Those records arise from the real execution described above.

Controlling ASTRA provisions: 4.3–4.5; 15–16; 28; 31.3–31.4; Annexes P and AR.