UGSO

System Resilience Super-Standard

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Function: This standard embodies the binding resilience principles that govern acceptable system behaviour under uncertainty, stress, degradation, adaptation, recovery, and end-of-life, preserving governability, predictability, and bounded behaviour across the system lifecycle.

System Role: It serves as the foundational resilience constraint within the Unified Governance Architecture, against which downstream standards and protocols are evaluated when system behaviour carries real-world consequence.

Supersedes: UGC-0000125 – System Resilience Super-Standard

Change Summary (This Version) : The super-standard has been promoted to Final Draft.

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1. Purpose

This super-standard defines the foundational principles that govern system resilience across lifecycle progression, uncertainty, and change. It establishes how systems are expected to behave as conditions evolve, assumptions drift, stresses accumulate, and when intervention is required to preserve governability or prevent uncontrolled outcomes.

System resilience, in this context, concerns the capacity of systems to remain governable, predictable, and correctable throughout their lifecycle. It addresses how systems sustain essential function, adapt to changing conditions, contain failure, recover from disruption, and progress toward end-of-life without creating unmanaged risk or deferred obligation.

The purpose of this standard is to ensure that long-term system behaviour, including degradation, maintenance, adaptation, recovery, and end-of-life, follows documented and foreseeable pathways within defined bounds.

This super-standard provides a common resilience frame applicable across physical, socio-technical, and governance systems where future behaviour carries material, ecological, societal, or infrastructural consequence. It articulates resilience at the level of principle rather than implementation, enabling consistent interpretation without prescribing domain-specific solutions.

2. Scope

This super-standard applies to systems whose behaviour under uncertainty, stress, adaptation, or lifecycle progression carries material, ecological, societal, or infrastructural consequence.

Applicability is determined by the nature and scale of real-world impact and by the extent to which a system exercises operational influence.

The scope includes:

- Physical systems and infrastructure whose operation, degradation, recovery, or removal affects land, resources, safety, or long-term obligations.
- Socio-technical systems in which physical assets are coupled with organizational, operational, or control structures.
- Governance and decision systems that exercise operational influence over real-world assets, processes, or outcomes, including systems that gate deployment, continuation, intervention, or decommissioning.

This super-standard addresses the following behavioural dimensions across the system lifecycle:

- Continuity of essential function under variable conditions.
- Predictability of performance, degradation, and response within defined bounds.
- Capacity for adaptation and correction without loss of control.
- Containment of failure and prevention of cascading effects.
- Recoverability, replacement, and restart where required.
- Progression toward end-of-life without unmanaged risk or deferred obligation.
- Ongoing governability and intelligibility for decision-makers across extended horizons.

This standard establishes behavioural and structural expectations. Domain-specific materials, processes, and technical implementations are governed by relevant standards, which may reference this super-standard for resilience principles.

3. Definitions

3.1. System

A bounded arrangement of physical, socio-technical, or governance elements that acts in the world and produces real-world effects through operation, decision, or control.

3.2. Resilience

The capacity of a system to remain governable, predictable, and correctable as conditions change, stresses accumulate, assumptions drift, or lifecycle phases progress.

3.3. Governability

The condition in which a system remains intelligible to decision-makers and subject to effective direction, correction, and accountability without reliance on improvisation or exceptional measures.

3.4. Predictable Behaviour

System behaviour that follows documented or bounded pathways such that future states, responses, and obligations can be anticipated within defined limits.

3.5. Bounded Behaviour

System behaviour constrained within known and acceptable limits, including performance, degradation, failure modes, and recovery actions.

3.6. Continuity

The ability of a system to sustain essential function within defined thresholds under variable or degraded conditions.

3.7. Degradation

A progressive change in system performance or condition that follows expected pathways and remains within defined bounds.

3.8. Controlled Degradation

Degradation that occurs in a foreseeable manner, preserves essential function where required, and does not trigger cascading failure or unmanaged harm.

3.9. Failure

The loss or impairment of a system function beyond defined thresholds.

3.10. Failure Containment

The capacity of a system to localize failure and prevent its propagation to adjacent components, systems, or environments.

3.11. Adaptation

A deliberate and governed modification of a system in response to changing conditions, knowledge, or requirements, carried out without loss of control or coherence.

3.12. Correction

An intervention undertaken to restore governability, compliance, or bounded behaviour when deviations are identified.

3.13. Intervention

A deliberate action taken to modify, stabilize, or redirect system behaviour in order to preserve governability or prevent uncontrolled outcomes.

3.14. Recoverability

The capacity of a system to be restored, reconfigured, or transitioned following disruption or degradation using planned and feasible means.

3.15. Restart

The restoration of essential system function following interruption or controlled shutdown.

3.16. End-of-Life

The phase in which a system transitions out of active operation and toward removal, replacement, or reconfiguration without creating unmanaged risk or deferred obligation.

3.17. Deferred Obligation

A future requirement, liability, or intervention arising from earlier design, deployment, or governance decisions that was not explicitly planned or bounded at the time.

4. Core Resilience Principles

This section defines the core resilience principles that govern acceptable system behaviour across the full lifecycle of operation, stress, degradation, recovery, adaptation, and end-of-life.

The following principles define the behavioural conditions that systems must satisfy in order to be considered resilient within the governance architecture:

1. Systems shall remain governable, intelligible, and subject to effective direction throughout their lifecycle.
2. Systems shall exhibit predictable behaviour that follows documented and bounded pathways.
3. Continuity of essential function shall be maintained within defined thresholds under variable conditions:
    - **Controlled Degradation:** When degradation occurs, it shall remain progressive, bounded, and intelligible.
    - **Failure Containment:** Failures shall remain localized and shall not propagate across system boundaries.
    - **Capacity for Correction:** Systems shall permit timely and effective correction when deviations are identified.
    - **Recoverability:** Systems shall support recovery, reconfiguration, or orderly transition following disruption or degradation.
    - **Restart Capability:** Systems shall support restart of essential function within defined windows.
    - **Adaptation Without Loss of Control:** Systems shall accommodate change through governed adaptation that preserves coherence and accountability.
    - **Lifecycle Completion:** Systems shall progress toward end-of-life through defined and governable pathways.
    - **Constraint Awareness:** System behaviour, decisions, and adaptations shall remain grounded in physical, material, and operational limits.
    - **Demonstrable Conformance:** Conformance with these principles must be demonstrable in practice through observable system behaviour and accountable verification.

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5. Non-Derogable Resilience Principles

The following principles are mandatory and non-waivable:

1. Governability
2. Predictable behaviour
3. Failure containment
4. Controlled degradation
5. Capacity for correction
6. Recoverability
7. Lifecycle completion
8. Demonstrable conformance

6. Interpretation & Application

The principles defined in this super-standard apply across domains and system types and are to be interpreted according to consequence.

Application shall be proportionate to system impact. Systems with greater material, ecological, societal, or infrastructural consequence are expected to demonstrate correspondingly higher levels of robustness, predictability, and governability.

Domain standards may elaborate resilience expressions appropriate to their context, provided application preserves the behavioural intent and practical effect of the Core Resilience Principles.

7. Precedence & Conflict Resolution

Where multiple standards apply to a single system, this super-standard provides the reference point for interpreting interactions, overlap, or tension between requirements.

Interpretive decisions taken at the point of application shall preserve system governability, predictability, and bounded behaviour in the specific operational context.

Where downstream requirements affect system behaviour under stress, adaptation, degradation, recovery, or end-of-life, those requirements shall be read in alignment with the Core Resilience Principles defined in this super-standard.

Where interpretation alone does not resolve a conflict, resolution shall follow the applicable system governance procedures.

8. Amendment & Evolution

This super-standard inherits its amendment, stability, and evolution rules from UGA-1000.

Clarifications and refinements may improve legibility and coherence without altering the intent or effect of the Core Resilience Principles.

Changes that would modify meaning, scope, precedence, or applicability constitute structural amendments and are governed at the Unified Governance Architecture level.

9. Position in the Governance Architecture

This super-standard sits within the Unified Governance Architecture as a foundational resilience reference for systems whose behaviour under uncertainty carries real-world consequence.

It derives authority, amendment control, and precedence from UGA-1000 and provides a consistent resilience frame for downstream standards and protocols.

Appendix A – Change Log

A.1. Versions

Version 1.0

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