

MO-006

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Statement

Crucible SHALL perform the applicable [Operational Lifecycle](#) activities for each [Infrastructure Environment](#) from initial [Infrastructure Deployment](#) through [Retirement](#) while preserving the applicable environment state, history, [Provenance](#), [Evidence](#), and [Traceability](#).

Source Statement

The system SHALL support infrastructure lifecycle management from initial deployment through retirement.

Source

Crucible System Requirements Specification, Version 1.1 Draft, Mission Objectives, MO-006.

Assessment

The source statement expresses the approved mission objective but does not provide a fully testable formulation.

The following Specification Discipline and Authoring findings apply:

- **The system** does not use the defined system name
- **Support** is a weak verb that does not identify the behavior [Crucible](#) performs
- **Infrastructure lifecycle management** does not identify the lifecycle activities, managed information, responsible components, or required outcomes
- **Initial deployment** does not identify the event that begins the managed lifecycle
- **Retirement** does not identify the required termination, archival, preservation, or resource disposition activities
- The source statement does not identify which environment records must remain available throughout and after the lifecycle
- The source statement does not define the acceptance criteria for lifecycle transitions
- The source statement does not distinguish the lifecycle of an [Infrastructure Environment](#) from the lifecycle of a [Baseline](#), [Machine Image](#), or other [Artifact](#)

The normalized Statement replaces the weak verb with **perform**, identifies the managed [Infrastructure Environment](#), bounds the lifecycle from initial deployment through retirement, and identifies the information that must remain preserved.

Rationale

An [Infrastructure Environment](#) changes throughout its [Operational Lifecycle](#).

After initial [Infrastructure Deployment](#), an organization may need to:

- Validate the deployed environment
- Apply configuration changes
- Update [Machine Images](#)
- Apply security updates
- Reassess compliance
- Reconcile environment state
- Recover failed operations
- Restore an environment from a backup
- Roll back an unsuccessful change
- Replace or upgrade components
- Preserve operational and compliance records
- Retire the environment and dispose of its resources

Without controlled lifecycle management, an environment may diverge from its approved [Baselines](#), lose [Traceability](#), accumulate configuration drift, or retain resources after the environment is no longer authorized.

[Crucible](#) coordinates lifecycle activities through controlled [Crucible Descriptions](#), versioned [Baselines](#), recorded lifecycle transitions, validation activities, and preserved [Evidence](#).

Each lifecycle transition should preserve the relationship among:

- The affected [Infrastructure Environment](#)
- The applicable [Crucible Description](#)
- The selected [Baseline](#) revisions
- The prior environment state
- The resulting environment state
- The authorized lifecycle action
- The actor or automated process that initiated the action
- The resulting [Evidence](#)

Applies To

This requirement applies to:

- [Crucible](#)
- [Crucible Descriptions](#)
- [Infrastructure Environments](#)
- [Operational Lifecycle](#)
- [Baselines](#)
- [Baseline Composition](#)
- [Image Layers](#)
- [Infrastructure Baselines](#)

- [Machine Images](#)
- [Infrastructure Deployment](#)
- [Provisioning](#)
- Environment validation
- Environment state
- Lifecycle transitions
- Configuration changes
- State reconciliation
- Backup and restoration
- Recovery
- Upgrades
- Rollback
- Compliance reassessment
- [Retirement](#)
- Resource disposition
- [Provenance](#)
- [Evidence](#)
- [Traceability](#)
- [Connected Environments](#)
- [Disconnected Environments](#)
- [Air-Gapped Environments](#)
- [CI/CD Pipelines](#)

Verification

1. Verification SHALL confirm that each tested [Infrastructure Environment](#) has a unique identifier
2. Verification SHALL confirm that the lifecycle record identifies the initial [Infrastructure Deployment](#)
3. Verification SHALL confirm that each tested lifecycle transition has a unique identifier
4. Verification SHALL confirm that each tested lifecycle transition identifies the applicable lifecycle activity
5. Verification SHALL confirm that each tested lifecycle transition identifies the prior environment state
6. Verification SHALL confirm that each tested lifecycle transition identifies the resulting environment state
7. Verification SHALL confirm that each tested lifecycle transition identifies the applicable [Crucible Description](#)
8. Verification SHALL confirm that each tested lifecycle transition identifies the applicable [Baseline](#) revisions
9. Verification SHALL confirm that each tested lifecycle transition records the actor or automated process that initiated the action
10. Verification SHALL confirm that each tested lifecycle transition records the execution result
11. Verification SHALL confirm that each successful lifecycle transition satisfies the applicable acceptance criteria
12. Verification SHALL confirm that each failed lifecycle transition preserves the last valid environment state or records the incomplete state
13. Verification SHALL confirm that recovery or rollback restores the environment to a defined valid state
14. Verification SHALL confirm that compliance reassessment records the applicable [Compliance Findings](#)

15. Verification SHALL confirm that backup and restoration preserve the applicable environment configuration, state, and records
16. Verification SHALL confirm that [Retirement](#) terminates or transfers the applicable infrastructure resources according to the approved retirement criteria
17. Verification SHALL confirm that [Retirement](#) preserves the records required by the applicable retention policy
18. Verification SHALL confirm that the lifecycle record preserves [Provenance](#), [Evidence](#), and [Traceability](#) from initial deployment through retirement

Verification may include:

- Initial deployment tests
- Environment validation tests
- Configuration change tests
- State reconciliation tests
- Compliance reassessment tests
- Upgrade tests
- Upgrade rollback tests
- Failed operation recovery tests
- Backup tests
- Restoration tests
- Baseline revision transition tests
- [Machine Image](#) replacement tests
- Deployment history inspection
- Lifecycle record inspection
- [Retirement](#) tests
- Resource disposition inspection
- Record retention inspection
- Connected environment demonstrations
- Disconnected environment demonstrations
- [Air-Gapped Environment](#) demonstrations
- End-to-end [CI/CD Pipeline](#) tests

The verification record SHALL identify:

1. The tested [Infrastructure Environment](#)
2. The environment identifier
3. The applicable [Operational Lifecycle](#) activities
4. The initial deployment record
5. The tested lifecycle transitions
6. The prior environment states
7. The resulting environment states
8. The applicable [Crucible Descriptions](#)
9. The applicable [Baseline](#) revisions
10. The initiating actors or automated processes
11. The applicable acceptance criteria
12. The execution results
13. The recovery or rollback results
14. The applicable backup and restoration records
15. The applicable [Compliance Findings](#)
16. The retirement record

17. The resource disposition results
18. The applicable retention policy
19. The retained records
20. The generated [Evidence](#)

Outgoing Traceability

This requirement is realized by:

- [OR-001 through OR-005](#)
- [FR-CFG-001 through FR-CFG-005](#)
- [FR-IMG-001 through FR-IMG-006](#)
- [FR-DEP-001 through FR-DEP-007](#)
- [FR-AG-001 through FR-AG-005](#)
- [FR-COMP-001 through FR-COMP-010](#)
- [FR-DSO-001 through FR-DSO-006](#)
- [FR-BAS-001 through FR-BAS-004](#)
- [FR-DEPC-001 through FR-DEPC-005](#)
- [LOG-001 through LOG-007](#)
- [REL-001 through REL-005](#)
- [MAINT-001 through MAINT-005](#)
- [DATA-001 through DATA-005](#)
- [KVP-003 — Improve deployment repeatability](#)
- [KVP-004 — Improve compliance consistency](#)
- [KVP-005 — Reduce configuration drift](#)
- [KVP-007 — Reduce total cost of ownership for platform infrastructure](#)

This requirement also relates to:

- [5. Descriptions, Composition, and Baselines](#)
- [6. Machine Images and Image Layers](#)
- [7. Infrastructure and Deployment](#)
- [8. Dependencies and Air Gap Operations](#)
- [9. Compliance and Security](#)
- [10. Reproducibility, Provenance, and Traceability](#)

Referenced By

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Backlinks identify incoming references but do not define the semantics of each relationship. Referencing pages should identify whether the relationship represents realization, refinement, verification, dependency, or another defined traceability relationship.

ConOps Relationship

The Crucible Concept of Operations describes Phase 1 as a [CI/CD Pipeline](#) integrated command-line utility that performs build, compliance, dependency capture, and deployment activities.

The Phase 1 workflow:

- Retrieves controlled and versioned inputs
- Composes selected [Baselines](#)
- Builds and hardens [Machine Images](#)
- Captures dependencies and [Compliance Findings](#)
- Performs [Infrastructure Deployment](#)
- Executes predeployment and postdeployment activities
- Records deployment and compliance results
- Tears down environments when they are no longer required

The ConOps primarily describes initial deployment and related Phase 1 execution. The broader [Operational Lifecycle](#) also includes modification, reassessment, recovery, restoration, upgrade, rollback, and [Retirement](#) activities required by this mission objective.

Delivery Phase

Phase 1 and subsequent phases

Implementation Status

Not Assessed

Implementation status requires verification of the applicable [Operational Lifecycle](#) activities from initial [Infrastructure Deployment](#) through [Retirement](#).

Requirement Status

Draft

The source System Requirements Specification identifies Version 1.1 as a draft.

Notes for Editors

This requirement page should retain the stable requirement identifier `MO-006`.

Changes to the Statement SHALL preserve the approved intent of the source requirement.

Material changes should receive review and should update the related outbound traceability, verification criteria, acceptance criteria, and source records.

The Source Statement should preserve the original wording from the controlling System Requirements Specification.

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Last update: 2026/07/15 12:54

