Logistics and inventory: knowing exactly what the base owns

Guiding question

Concrete → interfaces → measurement → calculation → failure → recovery.

Course map

The real phenomenon → Vocabulary and problem boundary → Course-specific system view → Mathematical relationship and reading the symbols → Worked calculations and interpretation

1 — The real phenomenon

Logistics turns tonnes of cargo into capability available at the right place and time. Lots, shelf life, storage conditions, consumption, compatible parts and critical reserves must be known. A component that is physically present but cannot be found or has expired is not really available.

The guiding question is: Why does inventory become a survival system when the next cargo is far away? Reasoning starts with the physical or operational function before introducing the mathematical relationship. The goal is not to accumulate terminology, but to know which quantity changes, why it changes and what becomes hazardous when it leaves its domain. For “Logistics and inventory: knowing exactly what the base owns”, the first task here is therefore to identify the mechanism specific to this subject before searching for an equation or reference value.

2 — Vocabulary and problem boundary

In “Logistics and inventory: knowing exactly what the base owns”, distinguish the phenomenon, available measurement, any command, the margin and the success criterion. The calculation boundary states what is included and excluded; without that boundary, a percentage, mass or time may be mathematically correct but wrong as an engineering conclusion. For “Logistics and inventory: knowing exactly what the base owns”, the chosen boundary also states what would otherwise be double-counted or omitted from a mission budget.

distance, network flow, power, pressurized volume, travel time, interface state and backup capacity

broken line, blocked logistics route, isolated zone, incompatible interface or backup capacity concentrated in the same location

layout mockups, segmented-network testing, rover campaigns and reconfiguration exercises

Equation - evidence - decision

Stock_fin = Stock_début + entrées − sorties

Failure to test: The reference failure is not a vague “broken component.” For “Logistics and inventory: knowing exactly what the base owns”, test in particular broken line, blocked logistics route, isolated zone, incompatible interface or backup capacity concentrated in the same location. Diagnosis asks which symptoms appear first, which are only consequences and which action preserves the most options.

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3 — Course-specific system view

This lesson does not reuse one generic picture for every subject. The system view follows cause → measured quantity → decision or physical response → limit for “Logistics and inventory: knowing exactly what the base owns”. The English text remains fully equivalent while large translated illustrations are intentionally deferred until their dedicated artwork is supplied. For “Logistics and inventory: knowing exactly what the base owns”, the system view must expose inputs, outputs, measured quantity and the consequence of drift without relying on a generic module diagram.

4 — Mathematical relationship and reading the symbols

Read aloud : ending stock equals opening stock plus receipts minus issues.

Before substituting numbers, write the unit of every term, state whether the relationship is a physical law, approximation or project indicator, and check dimensional consistency. This is especially important here because “Logistics and inventory: knowing exactly what the base owns” combines quantities that do not all have the same evidence status. For “Logistics and inventory: knowing exactly what the base owns”, this relationship is chosen because of the phenomenon under study; a different dominant quantity would require a different equation or model.

5 — Worked calculations and interpretation

120 + 40 − 55 = 105 units

105 ÷ 7 units/day = 15 days

36 issues/year ÷ 12 average units = 3 turns/year

1. 1. Stock 120 + 40 − 55 = 105 units Interpretation: this result is used only after comparison with units, margin and the scenario boundary for “Logistics and inventory: knowing exactly what the base owns”.
2. 2. Coverage 105 ÷ 7 units/day = 15 days Interpretation: this result is used only after comparison with units, margin and the scenario boundary for “Logistics and inventory: knowing exactly what the base owns”.
3. 3. Turnover 36 issues/year ÷ 12 average units = 3 turns/year Interpretation: this result is used only after comparison with units, margin and the scenario boundary for “Logistics and inventory: knowing exactly what the base owns”.

6 — What the formula does not contain

Operational table

Phenomena / sections:	3 — Course-specific system view ; 4 — Mathematical relationship and reading the symbols ; 5 — Worked calculations and interpretation
Relationship to revisit:	Stock_fin = Stock_début + entrées − sorties
Expected decision:	measure → compare with margin → choose nominal, degraded or stop

Check before continuing

Explain without rereading: 3 — Course-specific system view ; 4 — Mathematical relationship and reading the symbols ; 5 — Worked calculations and interpretation. State one measured quantity, one margin and one possible decision.

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The relationship “Stock_fin = Stock_début + entrées − sorties” does not by itself contain all of “Logistics and inventory: knowing exactly what the base owns”. It does not automatically tell us whether a sensor is valid, a structure is aging, a resource is accessible, a command arrives in time or a secondary failure removes margin. The example 120 + 40 − 55 = 105 units therefore remains a local calculation rather than a complete architecture.

To make the model useful, explicitly add the quantities that dominate this subject: distance, network flow, power, pressurized volume, travel time, interface state and backup capacity. We can then ask which variation truly changes the result, which is negligible and which forces an architectural change. For “Logistics and inventory: knowing exactly what the base owns”, this model limitation states exactly what a correct calculation still cannot establish about the real system.

7 — Instrumentation, observability and data quality

For “Logistics and inventory: knowing exactly what the base owns”, observability relies on distance, network flow, power, pressurized volume, travel time, interface state and backup capacity. Each datum has a unit, acquisition rate, uncertainty, timestamp and validity domain. A value arriving without context can be more dangerous than no measurement because it creates unjustified confidence.

Consistency is checked with at least one independent piece of information when the function is critical. A trend, physical balance or second measurement principle helps distinguish a real system change from a drifting sensor. For “Logistics and inventory: knowing exactly what the base owns”, the selected instrumentation must distinguish a real physical change from sensor drift or a bad state estimate.

8 — Phenomenon-specific failures and recovery

The reference failure is not a vague “broken component.” For “Logistics and inventory: knowing exactly what the base owns”, test in particular broken line, blocked logistics route, isolated zone, incompatible interface or backup capacity concentrated in the same location. Diagnosis asks which symptoms appear first, which are only consequences and which action preserves the most options.

The degraded mode must be defined before failure: minimum function, allowable duration, consumed stock, crew action, abort condition and return-to-nominal criterion. That sequence is topic-specific and cannot be replaced by one universal paragraph about redundancy. For “Logistics and inventory: knowing exactly what the base owns”, the degraded mode is defined around the minimum function specific to this subject, with an abort threshold and a return-to-nominal condition.

Operational table

Phenomena / sections:	7 — Instrumentation, observability and data quality ; 8 — Phenomenon-specific failures and recovery
Relationship to revisit:	Stock_fin = Stock_début + entrées − sorties
Expected decision:	measure → compare with margin → choose nominal, degraded or stop

Check before continuing

Explain without rereading: 7 — Instrumentation, observability and data quality ; 8 — Phenomenon-specific failures and recovery. State one measured quantity, one margin and one possible decision.

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9 — NASA / reference case

The operational case is treated as a production or service chain: input resource, machine, intermediate storage, quality control, maintenance and final user. NASA ISRU, autonomy and manufacturing work helps separate a technology demonstration from a truly available Mars industrial capability.

The case is used only within what it actually demonstrates. Flight measurement, human-system standard, component test and architecture study are different kinds of evidence; the text therefore states what is observed, calculated, simulated or still prospective. For “Logistics and inventory: knowing exactly what the base owns”, the cited NASA case is used as targeted evidence for this phenomenon and is never turned into one universal Mars architecture.

10 — Architecture trade

A good solution for “Logistics and inventory: knowing exactly what the base owns” does not maximize one metric. Compare nominal performance, mass, energy, simplicity, maintenance, crew time, common dependencies and recoverability. An option that improves 105 ÷ 7 units/day = 15 days can still be rejected if it makes failure detection or repair much harder.

The trade is recorded together with its assumptions. If environment data, mass or mission cadence changes, we know which conclusions must be recomputed instead of silently preserving an obsolete choice. For “Logistics and inventory: knowing exactly what the base owns”, the trade is evaluated against the interfaces actually touched by this subject rather than a generic list of desirable qualities.

11 — Demonstration, testing and success criteria

The evidence strategy for “Logistics and inventory: knowing exactly what the base owns” combines layout mockups, segmented-network testing, rover campaigns and reconfiguration exercises. Every test records exact hardware, software, configuration, environment, tolerances and success criterion. A successful demonstration outside the mission domain does not replace qualification inside it.

Evidence grows by levels: analytical relationship, simulation, component, subsystem, integrated system, duration and failure. This hierarchy prevents one spectacular test from being presented as validation of the whole mission. For “Logistics and inventory: knowing exactly what the base owns”, demonstration must reproduce the constraints that make this phenomenon difficult; a spectacular test outside the mission domain is insufficient.

Operational table

Phenomena / sections:	9 — NASA / reference case ; 10 — Architecture trade ; 11 — Demonstration, testing and success criteria
Relationship to revisit:	Stock_fin = Stock_début + entrées − sorties
Expected decision:	measure → compare with margin → choose nominal, degraded or stop

Check before continuing

Explain without rereading: 9 — NASA / reference case ; 10 — Architecture trade ; 11 — Demonstration, testing and success criteria. State one measured quantity, one margin and one possible decision.

Logistics and inventory: knowing exactly what the base owns

12 — Decision exercise

Situation: revisit “Logistics and inventory: knowing exactly what the base owns” with a 20% increase in the most penalizing quantity from the first worked example while one measurement or backup path is unavailable.

Situation: revisit “Logistics and inventory: knowing exactly what the base owns” with a 20% increase in the most penalizing quantity from the first worked example while one measurement or backup path is unavailable. Expected answer: recompute the relationship, identify remaining margin, check whether observability is still adequate, and decide whether degraded operation remains acceptable. Multiplying by 1.2 is not enough if the variation also changes interfaces or limits.

13 — What to retain without over-generalizing

14 — Topic-specific primary sources

These references directly document the phenomenon, technology or human constraint addressed in this lesson. They do not by themselves define an official Mars architecture. For “Logistics and inventory: knowing exactly what the base owns”, the bibliography is deliberately targeted to this page so that readers can trace each claim back to the relevant primary document.

Topic-specific primary sources

NASA NTRS — Human Exploration of Mars: Preliminary Lists of Crew Tasks - https://ntrs.nasa.gov/citations/20190001401

NASA — Systems Engineering Handbook - https://www.nasa.gov/reference/systems-engineering-handbook/

NASA Safety and Mission Assurance — Reliability and Maintainability - https://sma.nasa.gov/sma-disciplines/reliability-and-maintability

Operational table

Phenomena / sections:	12 — Decision exercise ; 13 — What to retain without over-generalizing ; 14 — Topic-specific primary sources
Relationship to revisit:	Stock_fin = Stock_début + entrées − sorties
Expected decision:	measure → compare with margin → choose nominal, degraded or stop

Check before continuing

Explain without rereading: 12 — Decision exercise ; 13 — What to retain without over-generalizing ; 14 — Topic-specific primary sources. State one measured quantity, one margin and one possible decision.