Subspace Lattice

Official Rules

Interstellar Warp Gaming Federation
Digital Defiance

Rules version `hybrid-fleet` (shipping default) / `hybrid` / `hybrid-spool`
Defaults as of 2026-07
Hosted at `lattice.iwgf.org`
TEI shared with Warp via `warp12-engine`

Space isn't empty — it's unclaimed. Outside your Sensor Net, a Beam has nothing to lock a shot along and might as well be unarmed. Cross into the enemy's glow and the problem reverses: their net has you now, Target Locked to a single crawling step. Even the seams where both nets bleed together — Contested Space — answer to neither side. Out here, you don't just sail through a sector; you weave the Subspace Lattice through it, thread by thread, and make it yours.

Setting (flavor, non-normative). The fiction frames Sector 11, a dead zone shattered by a collapsed stellar core. The pieces are a signal fleet: the **Command Hub** is your flagship and power anchor, **Escorts** are relay pickets that carry the network outward, **Beams** are dreadnoughts that can only fire while riding an active net, and **Infiltrators** are folding-drive strike craft that jump independent of any signal. The center **Gravity Well** is an *Anomalous Core* singularity. None of this changes play; the full briefing is in `docs/story.md`. Everything below is normative.

Abstract

Subspace Lattice is a two-player strategy game on an 11×11 sector grid. It combines individual piece movement with territory projected by a **Sensor Net**. Online play and local AI use **hybrid-fleet** (Integration Hold, Contested Space, late activation, Initiative Relay). Legacy **hybrid** (instant sector win, mirrored setup) and **classic** (chess-like, no Sensor Net movement effects) remain for sims and regression. This document describes Sensor Net play; fleet knobs are in Section 9.

Digital skill uses the same **TEI** (Tactical Efficiency Index) as Warp 12 (Section 12) across the IWGF product family.

Contents

1 Players and turn order

Two players, **White** and **Black**, each command a fleet. White moves first. Players alternate turns. On a turn, a player must move exactly one of their pieces according to the movement rules in Section 6.

2 The board

- The board is an 11×11 grid of *coordinates* (x, y) with $0 \leq x, y \leq 10$.
- The center cell $(5, 5)$ is a **Gravity Well**.
- Gravity Wells **block**: pieces may not occupy them or path through them. They have no other geometric effects.

3 The fleet

Each side begins with eight pieces:

Piece	Count	Symbols (White / Black)
Command Hub	1	K / king-style hub
Escort	3	pawn-style
Infiltrator	2	knight-style
Beam	2	rook-style

White deploys along the low-y edge (near $y = 0$); Black mirrors on the far rank ($y = 10$). Exact starting coordinates match the engine setup. Under `hybrid-fleet`, White also receives Initiative Relay Escorts (Section 9).

Figure 1: Opening setup under `hybrid`: mirrored fleets, no Initiative Relay. White along $y = 0$ (bottom of the capture); Gravity Well at $(5, 5)$.

Figure 2: Shipping `hybrid-fleet` opening. Highlighted Escort at $(5, 3)$ is White's Initiative Relay—forward compensation for the first move.

Capturing an enemy piece is done by landing on its coordinate (subject to legal movement). The captured piece is removed from the board.

4 Sensor Net (Sovereign Space)

Distance on the Sensor Net uses **Chebyshev** (king-move) metric:

$$d((x_1, y_1), (x_2, y_2)) = \max(|x_1 - x_2|,\ |y_1 - y_2|).$$

4.1 Radiation

Source	Effect
Command Hub	Always radiates radius $R_{\text{hub}} = 3$.
Escort	Radiates radius $R_{\text{escort}} = 1$ only if *linked* to its Command Hub (see below).
Beam / Infiltrator	Do not radiate.

A player's **Sensor Net** (also called **Sovereign Space**) is the set of all coordinates within any of that player's radiating radii. Occupied squares are included. Gravity Wells may fall inside a radius but are excluded from Sector Integration counting (Section 8).

4.2 Linking

Friendly pieces form a link graph: two friendly pieces are connected if their Chebyshev distance is at most $L = 2$ (`linkDistance`).

Start a breadth-first search from the Command Hub through that graph. Every Escort in the connected component is **linked** and radiates. Escorts outside the component do not expand the net.

Figure 3: Linked White Escorts projecting Sensor Net / Sovereign Space (blue tint). Coverage follows the Hub through the escort chain.

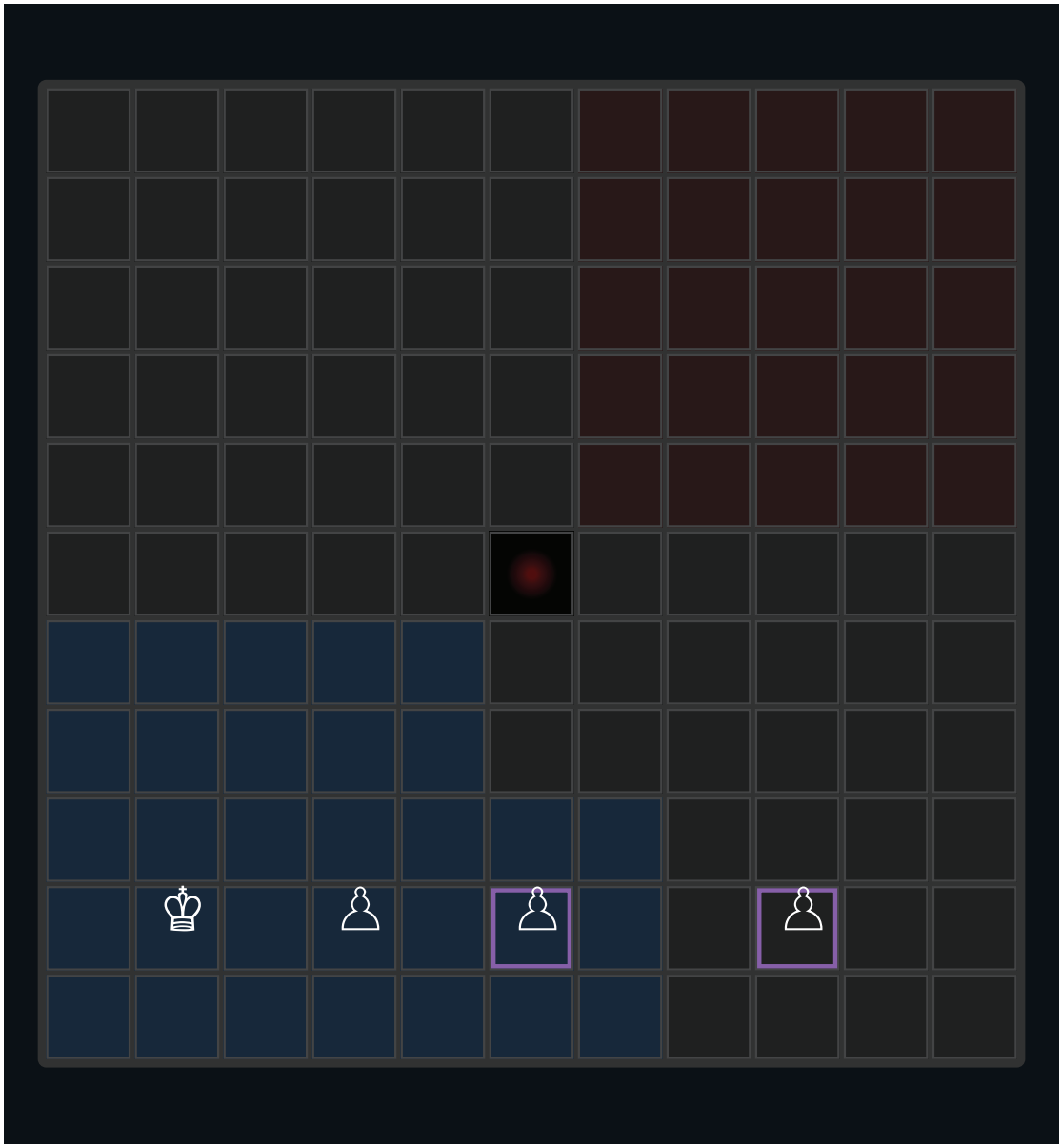

Figure 4: Broken relay: the Escort at $(8, 1)$ is more than two squares from the linked chain ending at $(5, 1)$, so it is dark and does not radiate. Closing the gap restores coverage.

5 Target Lock

A piece is **Target Locked** (engine term: `detected`) if its current coordinate lies in the *opponent's* Sensor Net.

While Target Locked, the piece loses special movement and may only move **one orthogonal step** (up, down, left, or right), regardless of type.

Figure 5: White Infiltrator (highlighted) sits inside Black's Sensor Net and is Target Locked: warp is suppressed; only one orthogonal step is legal.

6 Movement

Unless Target Locked (Section 5), pieces move as follows.

Piece	Normal	If Target Locked
Command Hub	One step in any of the eight directions	One orthogonal step
Escort	One orthogonal step	One orthogonal step
Infiltrator	**Warp** to any coordinate that is empty or enemy-occupied and *not* inside the enemy Sensor Net. Path is ignored (may jump). Under `hybrid-spool`, warps use Navigational Target Lock (Section 7).	One orthogonal step
Beam	Orthogonal rook slide: clear path (no pieces or Gravity Wells between). *Every* intermediate square and the destination must lie in the **own** Sensor Net.	One orthogonal step

A piece may not move onto a friendly piece or a Gravity Well. Moving onto an enemy piece captures it.

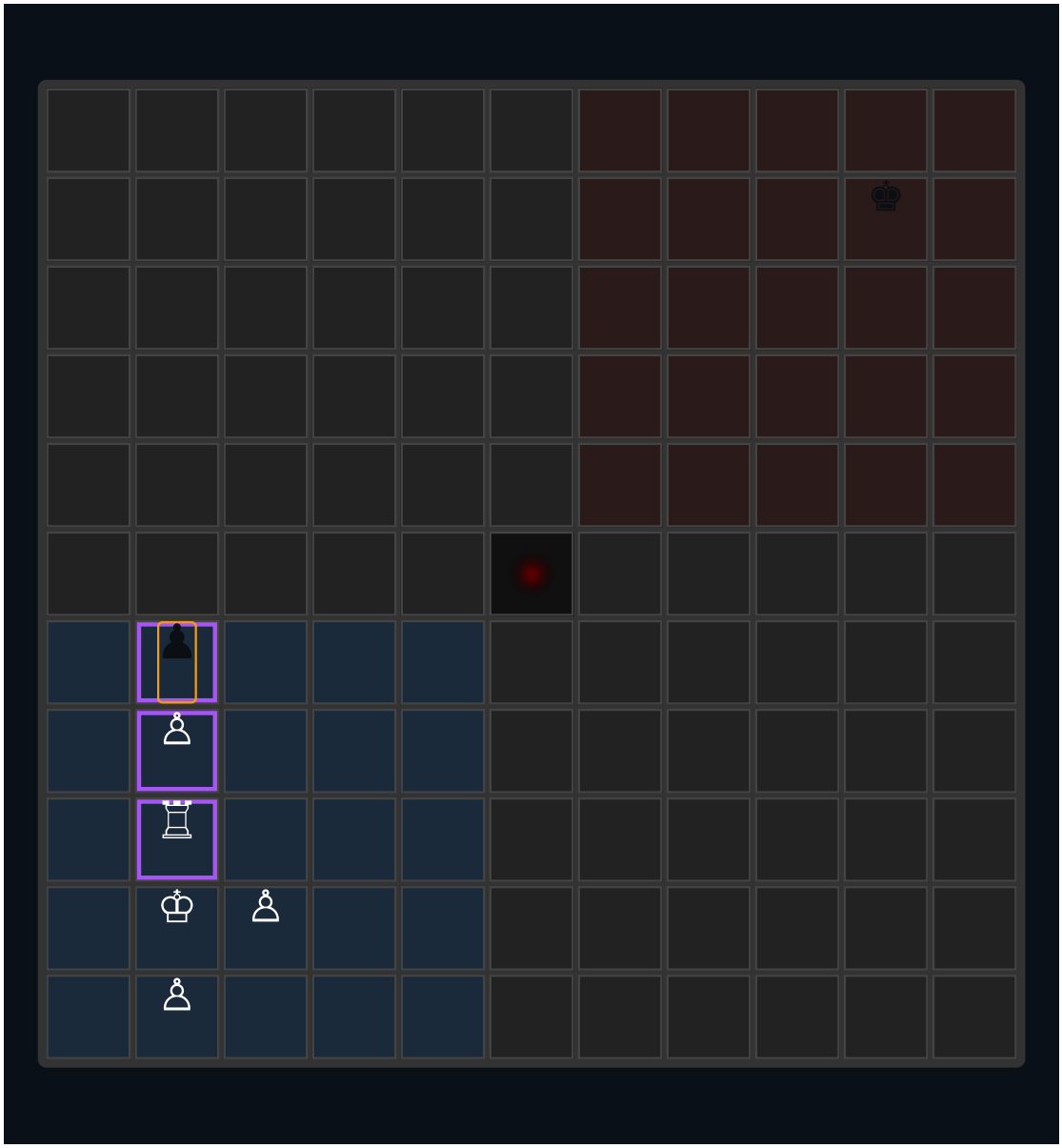

Figure 6: Beam lane: highlighted path must stay inside White's own Sensor Net. Beams cannot slide through empty space outside coverage.

7 Navigational Target Lock (`hybrid-spool`)

Experimental rules version sharing hybrid Sensor Net defaults. An Infiltrator warp requires two turns:

1. **Spool.** Announce a currently legal warp destination. The piece does not move. The turn ends.

2. **Execute.** On a later turn of yours, the only legal action for that Infiltrator is the locked coordinate. If it remains legal, the warp (and any capture) resolves. If it has become illegal (e.g. swallowed by the enemy Sensor Net), the jump fails: the Infiltrator stays put and the turn is still consumed.

8 Victory

The game ends when any of the following occurs after a move:

1. **Surgical Strike.** Capture the enemy Command Hub. The capturer wins.
2. **Sector Integration.** After your move, your Sensor Net covers at least $\rho = 0.45$ (45%) of all non–Gravity-Well coordinates. You win immediately. Let N be the number of non-well cells and C the number of those cells in your Sensor Net; you win if $C/N \geq \rho$.
3. **No legal moves.** The opponent has no legal moves. You win.

Figure 7: Surgical Strike threat: White Escort adjacent to the Black Command Hub. Capturing the Hub ends the battle immediately.

Design intent (not a separate win rule). Surgical Strike is the primary tactical resolution. Sector Integration is a **forcing clock**: it rewards sustained net expansion and punishes

endless turtling, but it is not meant to be a fifty–fifty coin-flip with hub hunting. Simulation scorecards prefer configurations where Sector Integration accounts for roughly 25–40% of decided games. The clock's health is verified by *ablation*: with the sector path disabled under paired seeds, self-play must degrade measurably (more deadlocks, longer grinds) — see `docs/adr/005-functional-clock-gate.md`. Notably, working clock pressure mostly cashes out as *faster hub captures*, so sector wins need not be the slowest win type. Defaults change only through the human gate (Section 10).

9 Fleet default (`hybrid-fleet`)

Online rooms and local AI use `hybrid-fleet`. The mechanics below remain gated by human playtest (`docs/playtest-fleet-checklist.md`) before treating them as the sole "official hybrid" in marketing copy. Track A production sims (2026-07-21) passed fairness under $\rho = 0.45$ / hold 1 / contested / activation 100 / Initiative Relay 1 (White 45% / Black 55%, sector 30%, OpenSkill sep 13.3).

Legacy `hybrid` keeps instant sector wins and a mirrored setup.

Integration Hold (`sectorHoldPlies` $= K$). Sector Integration no longer wins instantly. Coverage $\geq \rho$ must persist for K consecutive plies (either side's). Each side has a streak counter that ticks on every ply its coverage holds and resets to zero when coverage drops below ρ; a side wins when its counter reaches K, so the opponent always has $K - 1$ plies to break the net. If both counters reach K together, neither wins while the tie persists; this prevents the activation ply from granting a hidden color advantage. The clock resolves when only one side still meets its hold. $K = 0$ restores the instant win.

Contested Space (`contestedCellsNeutral`). A coordinate covered by *both* Sensor Nets counts for *neither* side's Sector Integration coverage. Projecting your net into the opponent's territory directly stalls their clock (and resets their Integration Hold streak if it drops them below ρ).

Figure 8: Contested Space: where White and Black nets overlap (purple), cells count for neither side's Sector Integration coverage.

Late-game activation (`sectorActivationPly` $= A$). The Sector Integration clock is **disarmed** before A completed plies: no sector wins occur and Integration Hold streaks do not accrue. From ply A onward, normal coverage/hold rules apply. $A = 0$ arms the clock from the start.

Initiative Relay (`firstPlayerRelayCount` $= N$). The first player begins with N additional Escorts placed forward of the opening formation and linked through the central Escort. This is a visible seat compensation for the structural first-mover disadvantage observed under equal-strength play. $N = 0$ restores the mirrored setup.

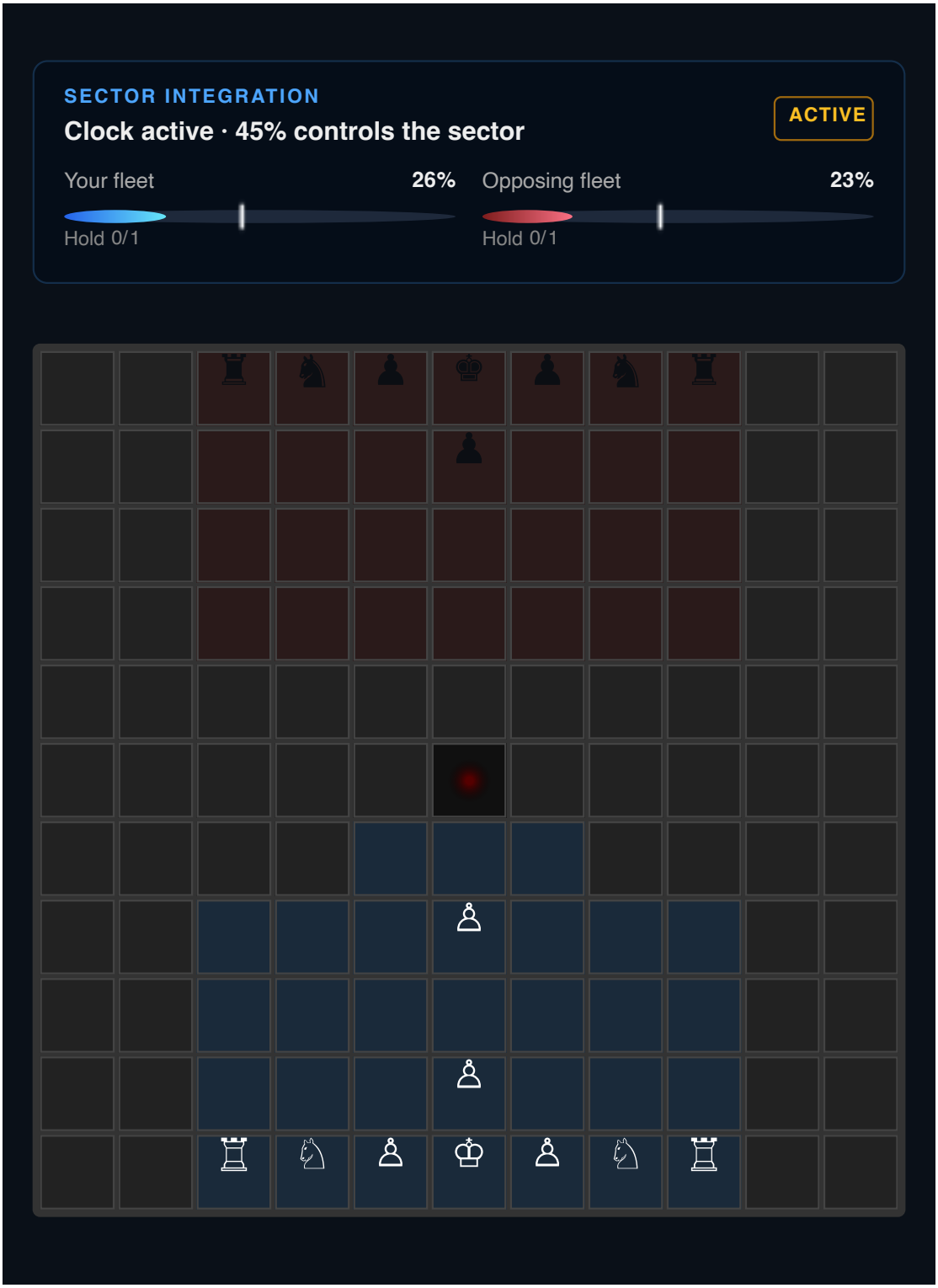

Figure 9: Objective HUD with the Sector Integration clock armed (ply past activation). Coverage bars show each fleet's progress toward ρ.

10 Configurable parameters

The engine exposes these knobs (defaults shown). Evolution and sims may sample alternate values under a frozen `rulesVersion`; shipping defaults change only after human review of scorecards (`docs/adr/002-evolution-human-gate.md`).

Parameter	`hybrid`	`hybrid-fleet` (default)
`boardSize`	11	11
`hubSensorRadius`	3	3
`escortSensorRadius`	1	1
`linkDistance`	2	2
`sectorIntegrationRatio`	0.45	0.45
`infiltratorSpoolUp`	false	false
`sectorHoldPlies`	0 (instant)	1
`contestedCellsNeutral`	false	true
`sectorActivationPly`	0	100
`firstPlayerRelayCount`	0	1

Sim sample space for evolution still includes alternate hold / activation / relay values; see `packages/subspace-lattice/docs/evolution-lab.md`.

Asymmetric Komi (e.g. a higher ρ for White) is **not** required for the current fleet candidate: the Initiative Relay provides an explicit, board-visible alternative. Other seat compensations may still justify a later `rulesVersion`.

11 Classic mode (reference)

`classic` ignores Sensor Net for movement and Sector Integration. Movement is chess-inspired:

- Command Hub: one step any direction
- Escort: one orthogonal step
- Infiltrator: knight leap (2+1)
- Beam: unrestricted orthogonal rook slide (blocked by pieces/wells)

Wins: Surgical Strike or no legal moves only.

12 TEI (Tactical Efficiency Index)

Subspace Lattice uses the same TEI presentation layer as Warp 12 so a grade like `V67` means the same thing across IWGF products. The normative implementation is imported from `warp12-engine` (see `docs/adr/003-tei-grades.md`).

12.1 What TEI is

Backend ratings are OpenSkill Bayesian skill estimates (μ, σ). TEI is **display-only**: it never replaces the stored (μ, σ).

Term	Meaning
TEI	Grade string: letter + score, e.g. `V67`.
TEI Grade (letter)	Confidence from σ: **E** Elite, **V** Veteran, **C** Consistent, **I** Improving, **P** Provisional.
TEI Score (number)	Integer 0–99 from the conservative skill estimate $\mu - 3\sigma$, normalized on a shared population scale ($\min \mu = 10$, $\max \mu = 50$).

Letter transitions use **hysteresis** so small σ noise does not flicker the grade every match. New or uncertain ratings sit at **P**; more games tighten σ and improve the letter.

12.2 AI strength anchors

Local AI rated games update the human against fixed OpenSkill **anchors** (Warp points-track). UI strengths map as follows (display TEI at the anchor itself):

UI	Search	Track	(μ, σ)	Anchor TEI
Fast	Heuristic	Ensign	(13.5, 4.0)	`P0`
Normal	MCTS 50	Lieutenant	(24.5, 3.5)	`I10`
Strong	MCTS 200	Commander	(40.0, 3.0)	`I52`

These anchors are Lattice-calibrated (2026-07-21 hybrid-fleet ladder: `docs/sim-runs/evolve-20260721-ai` μ comes from measured self-play; σ is a tight known-opponent value so the TEI letter is not stuck provisional. Re-run `yarn calibrate:ai` after changing search budgets or shipping rules.

12.3 Federation commission (flavor)

Warp maps TEI strings to a naval commission ladder (Cadet through Fleet Admiral). Subspace Lattice may show the same commission flavor over TEI when the UI surfaces ranks; commission is **not** a second rating system and does not change update math.

12.4 Scope in this product

- **Simulations / ladders:** TEI is computed for agent ratings.
- **Local AI:** Fast / Normal / Strong map to Ensign / Lieutenant / Commander anchors; signed-in results write `latticeTei.localAi` and appear on Federation standings.
- **Online human vs human:** Rated sectors (unassisted) write `latticeTei.online` via `reportLatticeOnline` when the game ends; casual and assisted sectors do not update TEI.

13 Figure sources

Board captures in this document ship as SVG under `docs/figures/` (and PDF companions for `pdflatex`). Regenerate via `/harness/figures` (DOM→SVG `#figure-capture-root`); see `docs/figures/README.md`. Inline figures: 1, 2, 3, 4, 5, 6, 7, 8, 9.

14 Authority

Authoritative rules live in the shared engine package `@subspace-lattice/core` (`SubspaceLatticeEngine`) with `rulesVersion` on game state. Product host: `lattice.iwgf.org` on Firebase project `warp-12`.

- Hybrid Sensor Net: `docs/adr/001-hybrid-sensor-net.md`
- Evolution human gate: `docs/adr/002-evolution-human-gate.md`
- TEI / OpenSkill: `docs/adr/003-tei-grades.md`
- Infiltrator spool (`hybrid-spool`): `docs/adr/004-infiltrator-spool.md`
- Functional clock gate: `docs/adr/005-functional-clock-gate.md`
- Color-neutral sector ties: `docs/adr/006-color-neutral-sector-ties.md`