How ORSIVA Assesses Orbital Risk

An overview of the methodology, data sources, and regulatory basis. Exact calibration is proprietary.

1. WHAT ORSIVA MEASURES

ORSIVA continuously monitors every satellite in a fleet across five risk dimensions and produces a single score (0–100, lower = safer) along with a decision verdict and financial exposure estimate.

- **Orbital risk** — natural decay, disposal readiness, compliance
- **Economic exposure** — time remaining before the compliance window closes
- **Cost of delay** — how much the score worsens if the operator waits
- **Collision risk** — annual background Pc for the orbital regime
- **Financial exposure** — expected loss P10 / P50 / P90 in USD

2. DATA INPUTS

ORSIVA combines public orbital data with operator-supplied telemetry. Where telemetry is unavailable, conservative estimates are used and flagged clearly.

Altitude & orbital elements	Public TLE (CelesTrak / Space-Track)
Disposal strategy	Operator-declared
Fuel remaining	Operator telemetry · estimated if absent
Battery state of health	Operator telemetry · estimated if absent
Asset value	Operator-supplied or market rate
Mass & cross-section	Optional · sharpens decay & Δv estimates

3. ORBITAL LIFETIME MODEL

Natural decay lifetime is estimated from a tabulated altitude-to-lifetime lookup derived from the US Standard Atmosphere / CIRA exponential density model. When operator-supplied mass and cross-sectional area are available, a ballistic-coefficient correction adjusts the estimate: a denser, smaller satellite stays in orbit longer; a lighter, larger-area satellite decays faster. Solar flux variability is not currently modelled — at solar maximum, actual decay may be 2–5× faster.

4. DISPOSAL SUCCESS PROBABILITY

A satellite-class-specific probability of successful disposal is computed from the strategy type (passive decay, active burn, drag sail), remaining propellant, battery state of health, mission age relative to design life, and recent manoeuvre history. Each factor degrades the baseline probability according to proprietary calibration curves derived from historical disposal outcomes.

5. REGULATORY COMPLIANCE CHECK

ORSIVA tests each satellite against three jurisdictions simultaneously:

FCC 5-year rule	US license holders — active since 2022
ESA Zero Debris	5-year clearance standard — active
IADC 25-year guideline	International baseline — all operators

A compliance FAIL on FCC or ESA adds risk points and triggers the financial exposure calculation. ORSIVA tracks regulatory changes and updates the compliance layer after expert review.

6. THE ORSIVA SCORE

The ORSIVA Score is a weighted blend of three components, each normalised to 0–100. Weights reflect the relative importance of each dimension for LEO satellite operators. The exact weights are proprietary but the components are:

- **Orbital risk (majority weight)** — risk score across 5 factors / 12
- **Economic urgency (second weight)** — how close to the compliance deadline
- **Cost-of-delay (third weight)** — decision lag risk multiplier

The score is monotonically increasing with risk: 0 is safest. Bands: LOW 0–24 · WATCH 25–44 · ELEVATED 45–69 · HIGH 70–100.

7. DECISION VERDICTS

Four verdicts are issued based on the composite risk score:

INITIATE Act now — compliance window closing or disposal capability ins
PREPARE Begin disposal planning — flag for next operations cycle
ESCALATE Elevated risk — escalate to mission director or regulator
CONTINUE No action required — monitor on standard cadence

8. EXPECTED LOSS MODEL

Financial exposure is modelled as three independent components, each with a separate regulatory or financial basis:

- **Asset stranding** — residual satellite value forfeited on disposal failure
- **Regulatory exposure** — enforcement risk calibrated to FCC/ESA/UK precedents
- **Collision liability** — third-party liability under OST Article VII

The output is expressed as P10 / P50 / P90 using a Monte Carlo uncertainty envelope. P90 is the capital-at-risk figure used by insurers and risk managers. Exact coefficients are proprietary; the regulatory basis for each component is available on request under NDA.

9. COLLISION PROBABILITY (PC)

Annual background collision probability is estimated from orbital regime spatial density data (ESA MASTER-2009 model) and adjusted for congestion level and manoeuvre history. This is a background-flux figure, not a conjunction-specific probability. Operators should use conjunction screening services (LeoLabs, Space-Track) in parallel — ORSIVA will integrate conjunction data as a first-class input in a future release.

10. KEY LIMITATIONS

- Health parameters are estimated where operator telemetry is unavailable.
- Solar flux variability is not modelled (F10.7 index).
- Validated for LEO (200–1,400 km). MEO / GEO require separate models.
- Pc is background flux, not conjunction-specific.
- ORSIVA is advisory — it does not issue manoeuvre commands.
- Calibration is updated periodically; scores may shift between releases.

11. VALIDATION & BACKTEST

The scoring engine has been backtested against the 2009 Iridium-33 / Cosmos-2251 collision. Using orbital states available at the time, ORSIVA would have issued an INITIATE verdict for Cosmos-2251 continuously from 1995, and for Iridium-33 approximately 40 months before the February 2009 collision, when its propellant dropped below the deorbit-capable threshold. No conjunction warning system flagged either satellite in advance.

12. REGULATORY & DATA SOURCES