

AstroSentinel

Space Intelligence & Mission Simulation Platform | Visualize. Predict. Protect.

AstroSentinel is a graphical space operations platform for satellite and constellation awareness, conjunction analysis, collision-risk assessment, and maneuver scenario planning. Planned resilience simulations explore how environmental hazards and communication disruptions could affect satellite missions.

Primary use cases

Use case	What AstroSentinel enables	Business value
1. Orbital visualization	Interactive visualization of satellites, trajectories, and constellations.	Faster situational awareness and operator comprehension.
2. Conjunction screening	Identify close approaches and prioritize potential collision events.	Focus attention on the highest-risk encounters.
3. Collision probability analysis	Estimate collision risk when suitable orbital states and uncertainty data are available.	Support more defensible safety decisions.
4. Maneuver planning	Explore candidate avoidance maneuvers, delta-v, and post-maneuver trajectories.	Balance collision reduction, fuel, and mission impact.
5. What-if mission scenarios	Compare alternate orbits, maneuver timing, and constellation changes.	Improve operational planning before taking action.
6. Fleet-wide risk monitoring	Review conjunctions and risk across multiple spacecraft.	Reduce manual workload for growing constellations.
7. Space environment resilience	Explore hypothetical environmental events, including radiation-related space hazards.	Assess mission exposure and contingency options.
8. Interference impact analysis	Model high-level effects of communication outages, jamming, or directed-energy exposure on mission availability.	Improve continuity and recovery planning.
9. Reports and audit trail	Capture assumptions, scenario results, and operator decisions.	Support reviews, coordination, and accountability.
10. Mission-control integration	Import ephemerides and conjunction messages; export analyses through APIs.	Fit into existing flight operations workflows.

Three high-value operational scenarios

Scenario 1 | Avoid a potential collision

An operator receives a conjunction alert. AstroSentinel visualizes the encounter, compares risk estimates, and evaluates alternative avoidance maneuvers and their mission consequences.

Scenario 2 | Manage a growing LEO constellation

A fleet operator reviews conjunction exposure across dozens of satellites, prioritizes events, and explores coordinated

maneuver plans while accounting for fuel and follow-on encounters.

Scenario 3 | Assess mission resilience

A mission planner tests hypothetical space-environment and communications-disruption scenarios to understand operational impacts and compare contingency responses.

Recommended MVP priorities

1. Trustworthy orbital inputs: support public orbital data plus operator-supplied ephemerides and standard conjunction messages.
2. Collision screening and risk: visualize close approaches; calculate probability only when appropriate uncertainty information is available.
3. Maneuver analysis: compare candidate maneuvers, delta-v, future trajectories, and secondary conjunctions.
4. Operator workflow: intuitive 3D views, event prioritization, alerts, and reproducible reports.
5. Integrations and validation: connect to mission-control workflows and benchmark astrodynamics calculations against trusted reference cases.

Product evolution

Module	Focus	Primary buyers
Observe	Visualization, tracking, conjunction awareness	Small and midsize satellite operators
Maneuver	Collision-risk decisions and avoidance scenario analysis	Constellation and flight operations teams
Resilience (planned)	Environmental hazards, communications disruption, mission continuity scenarios	Commercial risk teams and government programs

Market positioning and differentiation

Initial market: commercial LEO satellite operators, especially smaller fleets without extensive in-house flight dynamics teams. Additional markets: constellation operators, mission services providers, insurers/risk analysts, and government programs.

Core differentiator: convert complex orbital data into an intuitive, visual decision-support workflow - from conjunction detection through maneuver comparison and documented operational decisions.

Product value proposition: AstroSentinel helps satellite operators understand orbital risk, evaluate safe maneuver options, and plan for mission disruptions in increasingly congested space environments.

Product maturity note: orbital visualization, collision detection, and maneuver-path exploration are described as alpha capabilities; advanced environmental and threat-related what-if simulations are planned. Operational use requires independent model validation and appropriate data quality.