

VORTYX



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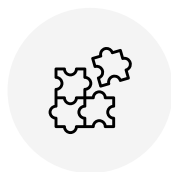
Real-time neural combinatorial optimization for mission-ready scheduling

Department of War and Intelligence Community missions now operate across proliferated constellations, diverse sensors, and thousands of time-sensitive targets. Traditional scheduling tools cannot keep up. Even 20 tasks can generate 2.4 quintillion possible sequences, forcing classical solvers into hours of computation. This is far too slow for today's operational tempo.

The consequences are clear:



Inefficient asset utilization



Missed mission opportunities



Delayed response to emerging threats



Loss of decision advantage

VORTYX represents a paradigm shift: adaptive, intelligent scheduling that delivers decision advantage at mission speed.

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Key benefits

Scales effortlessly with mission growth

- Add new assets or payload types with no code rebuild
- Handles expanding constellations without increased compute time
- Architecture designed for evolving and multi-domain mission sets

Superior schedule quality

- Priority weighted reward functions maximize mission value
- Learns true scheduling strategy, not memorized rules or templates
- 10x faster than classical solvers while preserving high-quality outcomes

Optimal schedules in seconds, not hours

- 6ms per scheduling decision
- 160+ allocations per second
- Proven scale across 5,000 tasks

Instant adaptation to real-time conditions

- Automatically replans as intelligence updates arrive
- Dynamically responds to satellite anomalies, environmental constraints, and shifting priorities

How VORTYX works

Neural Combinatorial Optimization (NCO)

VORTYX applies next-generation AI techniques that combine deep reinforcement learning with attention-based neural networks. Through millions of training scenarios, the system learns to bypass low-value paths and jump directly to high-quality solutions without evaluating every permutation.

Modular, extensible architecture

- **TRL 9 NASA GMAT** integration for high-fidelity orbit modeling
- **GPU-accelerated** visibility and access calculations
- **ModSim constraint engine** for RF, look-angle, and sensor-specific feasibility
- **Config-driven design** (JSON/YAML) for rapid onboarding of assets and payloads
- **Hierarchical constraint propagation** ensures consistency across assets, payloads, and resources

Successfully tested at scale:

- 5,000 tasks on 40 commercial satellites
- Multi-day mission timelines (5+ days)

The future of autonomous operations

“AI can fundamentally alter the landscape of satellite constellation management by providing more adaptive, robust, and cost-effective solutions.”

– ESA ConstellationAI Project

Why VORTYX outperforms traditional approaches

Greedy schedulers

Fast, but produce low-quality results and break under complex constraints

Classical optimization

High-quality answers but extremely slow, brittle, and difficult to scale and adapt

VORTYX NCO

- Generates schedules in seconds instead of hours
- Maintains high schedule quality at large scale
- Adapts seamlessly across mission domains

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