SimTable

AI in WUI Wildfire Reference Guide

Company Notes

Chapter 14: The Distributed Intelligence Layer

14. SimTable: From Simulation to Collective Action

When Every Actor on an Incident Becomes Part of Distributed Cognition

14.0 BLUF: The Gorilla You Did Not See

SimTable is not a simulation tool. It is a **Distributed Intelligence Layer** that transforms how humans think together during wildfire incidents. While competitors ask “where is the fire?” and “where will it go?”, SimTable asks the harder question: **“How do we achieve collective action when every second counts?”**

- **The Architecture:** Agent-Based Modeling (ABM) where fire, crews, traffic, and citizens are autonomous agents. Behavior emerges from interactions—not prescribed rules. This is AI that adapts in real-time.
- **The AI Breakthrough:** Computer vision calibrates camera poses by tracking stars at night and matching terrain against DEMs. AlertWildfire, citizen, FIRIS, air attack, and satellite feeds become geospatial vectors. Annotations appear as AR overlays. Known GIS shows up in cameras.
- **The Network Effect:** Realtime.Earth enables Decentralized AI—every actor (crew, citizen, aircraft, satellite) becomes part of distributed cognition feeding collective intelligence and enabling collective action.
- **The Training Loop:** ML continuously trains fire spread models by comparing observed progressions against slope, fuel, and weather. The system measures actual spread rates and local wind vectors from camera observations. Every incident improves the model.
- **The Receipts:** U.S. Senate Technology Expo (2019). Time Magazine 50 Best Inventions. Los Alamos National Laboratory EOC. CAL FIRE captain training. Deployed during January 2025 LA fires. Active in 11 states and 3 countries.

14.1 The Problem: From Data Integration to Distributed Cognition

The wildfire technology market has focused on generating more data: more cameras, more satellites, more sensors, more predictions. The implicit assumption is that better data leads to better decisions.

This assumption is wrong.

The constraint is not data. The constraint is **cognition**—the ability to synthesize disparate information streams into coordinated action. An incident commander facing the Palisades Fire had access to AlertWildfire cameras, FIRIS infrared, satellite imagery, weather models, and predictive spread simulations. The problem was not lack of information. The problem was:

Fragmented Feeds	Each camera, aircraft, and satellite exists as an isolated data stream with no common reference frame
Static Predictions	Fire behavior models run on servers; they do not learn from what crews and cameras observe in real-time
Centralized Bottleneck	Information flows up to IC, decisions flow down. Citizens and crews are data sources, not cognitive participants
Training-Operations Gap	Systems used for training differ from systems used during incidents; muscle memory does not transfer

SimTable's insight, crystallized after the Yarnell Hill tragedy: **every actor on an incident—from the IC to the citizen with a smartphone—is a potential node in a distributed cognitive network.** The question is not "how do we collect more data?" but "how do we enable collective intelligence and collective action?"

14.2 The Tech Stack: Agent-Based AI for Collective Action

This is what you are actually buying when you deploy SimTable:

1. Agent-Based Fire Propagation (The Emergent Behavior Engine)

SimTable models fire as a population of autonomous **agents**—computational entities that interact with terrain, fuel, weather, and each other. This is fundamentally different from deterministic spread calculations:

- Fire agents follow local rules (heat transfer, fuel consumption, wind response) but produce emergent global behavior
- Spotting, fire whirls, and pyroconvection emerge from agent interactions—they are not hard-coded
- Users interact in real-time: place crews, cut lines, drop retardant. The agent population responds immediately
- Initial attack and extended attack simulations model resource agents making autonomous decisions

The result: training scenarios feel like real incidents because behavior emerges rather than follows scripts.

2. AI Georectification (Star-Tracking + DEM-Matching)

This is SimTable's proprietary breakthrough that transforms cameras from "pictures of fire" into "geospatial intelligence." The problem: a camera shows smoke, but where exactly? Traditional approaches require manual calibration. SimTable's AI automates this:

Star-Tracking (Night Calibration):

- Computer vision identifies star positions in night-sky camera frames
- Known star catalogs provide precise celestial coordinates

- Camera pose (position, orientation, focal length) is computed from star matches
- Calibration persists; camera movement triggers recalibration

DEM-Matching (Terrain Calibration):

- Digital Elevation Models provide 3D terrain reference
- AI matches visible terrain features (ridgelines, valleys) to DEM
- Every pixel in camera frame maps to real-world coordinates
- Fire perimeters drawn on camera become geospatial vectors

The Output:

- Annotations on any camera feed become GIS layers automatically
- Known GIS features (roads, structures, hydrants) appear as AR overlays in camera views
- 3D smoke plumes are reconstructed from multiple camera angles
- Fire spread rates measured directly from camera observations

This works across **heterogeneous feeds**: AlertWildfire fixed cameras, citizen smartphone video, FIRIS aircraft infrared, air attack observations, satellite imagery. One common geospatial reference frame.

3. ML Training Loops (Continuous Model Improvement)

SimTable's fire spread models are not static—they learn from every incident:

- **Observed vs. Predicted:** Camera-derived fire perimeters are compared against model predictions
- **Local Wind Vectors:** Smoke direction from cameras provides actual wind at fire location—often different from nearest weather station
- **Spread Rate Calibration:** Time-stamped perimeters yield empirical spread rates by fuel type and slope
- **Feedback Integration:** Model parameters adjust based on accumulated observations

The more incidents SimTable supports, the more accurate its predictions become. This is **data gravity** that competitors cannot replicate without equivalent deployment scale.

4. Evacuation Simulation (Least-Action Pathway ABM)

Evacuation modeling uses the same agent-based approach applied to traffic:

- Household agents spawn based on occupancy probability, resident count, vehicle count
- Demographic variation: retirees, tourists, school-age populations have different behaviors
- Agents navigate using least-action pathways—optimizing against real-time congestion
- Road network agents model capacity constraints and bottleneck emergence
- Fire progression agents create dynamic threat zones that influence routing

The system identifies congestion chokepoints **before they occur**, enabling proactive resource positioning.

5. Realtime.Earth (The Decentralized AI Platform)

This is where SimTable transcends simulation into **Distributed Intelligence**:

- **Decentralized Architecture:** Browser-based, runs on phones and tablets across disparate networks
- **Collective Contribution:** Citizens, crews, aircraft, satellites all feed the common operating picture
- **Real-Time Synchronization:** Data from any location, any time, merges automatically
- **Bidirectional Flow:** Information flows up AND down; every actor sees what IC sees

The philosophical shift: traditional incident management treats field personnel as *data sources*. Realtime.Earth treats them as **cognitive participants** in distributed intelligence.

14.3 AI Truth-in-Labeling: Why “Agent-Based” Is the Key

Here is what “AI” means in SimTable’s case—and why it matters:

Agent-Based Modeling	Autonomous computational agents (fire, crews, traffic, citizens) interact according to local rules. Global behavior EMERGES from interactions. This is why SimTable scenarios feel realistic—you cannot script emergence.
Computer Vision (Georectification)	Star-tracking identifies celestial reference points. DEM-matching aligns terrain features. Together they compute camera pose and enable pixel-to-coordinate transformation across heterogeneous feeds.
Machine Learning (Training Loops)	Fire spread models continuously improve by comparing predictions against camera-observed progressions. Local wind vectors, spread rates, and fuel response parameters are calibrated empirically.
Decentralized AI (Collective Intelligence)	Every actor contributes observations. Every actor receives synthesized intelligence. The network learns; the network acts. This is distributed cognition, not centralized analysis.

Why Agent-Based Matters:

Traditional simulation uses deterministic rules: “if wind > 20 mph and slope > 30%, then spread rate = X.” This produces predictable, repeatable—and unrealistic—scenarios.

Agent-based modeling produces **emergent behavior**: fire agents interact with fuel agents, weather agents, and terrain agents. Spotting occurs when conditions align—not when a rule fires. Crews encounter situations they have never seen in scripted training.

This is why SimTable training transfers to real incidents: the cognitive load of managing emergent behavior in simulation matches the cognitive load of managing emergent behavior in reality.

14.4 Case Studies: Distributed Intelligence in Action

Case Study: Kincade Fire (2019) — Multi-Source Georectification

Context: 77,758 acres in Sonoma County. PG&E power shutoffs. Massive evacuation. Multiple camera networks, citizen footage, air attack observations—all showing different angles of the same fire.

The Distributed Intelligence Approach:

- AI georectified AlertWildfire cameras, crowd-sourced citizen video, and incident maps to common reference
- Star-tracking calibration enabled precise camera pose computation
- Fire perimeters from multiple cameras merged into single geospatial layer
- Simulated fire progression overlaid on observed progression for real-time model validation

The Output: Synthesized live camera feeds showing interpolated fire progression with annotations automatically converted to GIS vectors.

Receipt: *“Stephen is using real-time, crowd-sourced images of the Kincaid Fire in CA, georectifying all the images to a 3D model, incorporating weather and geo-terrain information to predict and update the pathway of the fire.”*

Case Study: Los Angeles Fires (January 2025) — Operational Deployment

Context: Palisades and Eaton fires. 57,000+ acres. 18,000+ structures destroyed. The deadliest California fires in modern history.

SimTable Deployment:

- Real-time fire progression modeling on 3D terrain at Harvard Visualization Lab
- Interactive scenario testing: What if we position resources at Point A vs. Point B?
- Historical progression reconstruction for after-action analysis
- Demonstration of camera-to-GIS workflow for emergency managers

Receipt: *“Guerin’s ingenious tool has been employed numerous times during real-life emergencies, including the Los Angeles fires in January 2025.” — Harvard Graduate School of Design*

Case Study: CAL FIRE San Diego — Captain Decision Training

Context: Fire captains must make life-and-death decisions under pressure. Traditional training uses scripted scenarios that do not capture real-world complexity.

The Agent-Based Training Approach:

- SimTable combined with Fire Studio for scenario development
- County-specific terrain, fuel models, and structure data

- Emergent fire behavior—captains face situations they cannot anticipate
- Same platform used for training and operational support

Receipt: *“Constant training is crucial for our captains because they are responsible for leading and managing firefighters during emergencies. Being able to make critical decisions under pressure ultimately saves lives and property.” — CAL FIRE/County of San Diego*

Case Study: Pima County EOC — Distributed Coordination

Context: Pima County (Tucson) Emergency Operations Center needed real-time coordination across agencies during multi-hazard incidents.

The Realtime.Earth Integration:

- SimTable installed in EOC with Realtime.Earth distributed platform
- Field personnel connect via mobile devices on any available network
- Common operating picture shared across dispatch, fire, law enforcement, EMS
- Evacuation zones visualized against traffic simulation

Receipt: *“EM Trainer Eddie Lopez and Operations Manager Sandra Espinoza are pushing the envelope of real-time coordination during emergencies for citizens of Tucson and Pima County.”*

14.5 Comparative Matrix: Detection vs. Prediction vs. Collective Action

The wildfire AI market has three distinct layers. Understanding where SimTable fits is critical for procurement strategy.

Dimension	Detection Platforms	Prediction Platforms	SimTable (Distributed Intelligence)
Core Question	Is there fire here?	Where will fire go?	How do we act together?
AI Type	Computer Vision (image classification)	Physics + ML (spread modeling)	ABM + CV + ML + Distributed
Data Flow	Cameras → Alerts	Models → Predictions	Network ↔ Network (bidirectional)
Human Role	Verify alerts	Interpret predictions	Participate in collective cognition
Training Use	Limited	Separate systems	Same platform (training = operations)
Emergent Behavior	No (classification)	Partial (physics bounds)	Yes (agent-based)
Camera Integration	Proprietary networks	Consumes outputs	Georectifies any feed
Best For	Early detection	Utility risk decisions, PSPS	Incident coordination, training, community engagement

Key Insight: SimTable does not compete with detection or prediction platforms. **It is the layer that enables collective action on the intelligence they produce.** Detection tells you where. Prediction tells you what's next. SimTable helps the network decide what to do about it—together.

21. Profile: SimTable (The Distributed Intelligence Layer)

Category	Distributed Intelligence / Agent-Based Simulation / Collective Action
Founded	2010 (Santa Fe, New Mexico)
Leadership	Stephen Guerin (Founder & CEO)—50+ complex adaptive systems projects
Affiliations	Santa Fe Institute Faculty; Harvard Associate, Earth & Planetary Sciences (2023-24)
Key Customers	CAL FIRE, Los Alamos National Lab, Texas A&M Forest Service, Pima County EOC, agencies in 11 states, Australia (NSW, Queensland, Victoria)
Recognition	Time Magazine 50 Best Inventions (2011); U.S. Senate Energy Committee Technology Expo (2019); ESRI Silver Partner
Platform	Realtime.Earth (browser-based distributed intelligence)

The Thesis

As AI proliferates across wildfire technology, the market is saturating with detection alerts and prediction outputs. The emerging bottleneck is not *generating insights*—it is **coordinating action on those insights**.

SimTable is positioned at this bottleneck. While other platforms produce data, SimTable enables humans to **think together** about that data. This is the layer that converts intelligence into collective action.

The deeper thesis: **Distributed cognition is the next frontier of wildfire AI.** Centralized platforms (one brain processing all data) cannot scale to the complexity of modern mega-fires. Decentralized intelligence (every actor as cognitive participant) can. SimTable's Realtime.Earth architecture is built for this future.

The Moat

1. **Star-Tracking Georectification IP:** The AI pipeline that calibrates camera poses using celestial observations and DEM-matching is proprietary. Competitors would need to replicate years of computer vision development to match this capability.
2. **Complexity Science Heritage:** Founded from Santa Fe Institute ecosystem with 15+ years of agent-based modeling expertise. This is not a startup pivoting into fire—it is deep domain knowledge applied to wildfire.

3. **Training-Operations Continuum:** Same platform serves training and real incidents. Agencies build muscle memory on the system they will use when lives are at stake. This creates stickiness competitors cannot match with separate training products.
4. **Distributed Architecture:** Realtime.Earth runs on any device, any network, anywhere. Centralized cloud platforms fail in austere conditions; distributed platforms degrade gracefully.
5. **ML Training Data Gravity:** Every incident improves fire spread models. Competitors without equivalent deployment scale cannot accumulate this empirical calibration data.

Diligence Checklist

- Georectification Accuracy: What is measured error between camera-derived coordinates and ground truth? How does accuracy vary by camera type and distance?
- ML Model Validation: How are fire spread predictions validated against observed progressions? What is prediction accuracy by fuel type and weather condition?
- Network Resilience: How does Realtime.Earth perform under degraded connectivity? What is minimum bandwidth for functional coordination?
- Revenue Mix: Hardware (tables) vs. software (platform) vs. services (training)? What is margin structure by segment?
- Competitive Response: How defensible is star-tracking IP? What prevents well-funded competitors from replicating?

Scorecard: SimTable

Agent-Based Modeling	Excellent (15+ years, emergent behavior, real-time interaction)
AI Georectification	Excellent (Star-tracking + DEM-matching, proprietary)
Distributed Intelligence	Excellent (Realtime.Earth, network-agnostic, bidirectional)
ML Training Loops	High (Continuous calibration from observed progressions)
Training Utility	Excellent (Training = Operations continuum)
International Scalability	High (Australia deployments, browser-based platform)

Red Team Pass: SimTable

The "Hard Truth" Audit

The Pitch: *"We enable distributed cognition and collective action for wildfire response."*

The Reality:

- **Conceptual Complexity:** "Distributed cognition" and "collective intelligence" are powerful concepts but difficult to sell. Buyers understand "detection" and "prediction." SimTable must translate sophisticated ideas into procurement language.
- **Hardware Component:** The physical sand table creates differentiation and memorable demos, but also creates scaling friction. Manufacturing, shipping, installation are not SaaS dynamics.
- **Market Education Required:** The value proposition requires buyers to understand why coordination matters as much as detection. Some agencies are still focused on "more cameras" rather than "better synthesis."
- **Integration Partnerships:** SimTable claims to integrate with AlertWildfire, but partnership depth varies. Some platforms may view SimTable as competitive rather than complementary.
- **Competitive Pressure:** Well-funded detection (Pano) and prediction (Technosylva) players could add coordination features. SimTable must stay ahead on distributed architecture.

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The Hard Truths

- Value proposition requires market education
- Hardware limits pure software scaling
- Brand recognition lags better-funded competitors
- Partnership dynamics need clarification

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The Verdict: Strong Signal

SimTable occupies a genuinely unique position: the **Distributed Intelligence Layer** that enables collective action on AI-generated insights. The star-tracking georectification is defensible IP. The agent-based modeling heritage is deep and validated. The training-operations continuum is a real competitive advantage.

The risk is go-to-market: can they translate technical sophistication into buyer urgency before larger players add coordination features?

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Falsifiable Statements (What Has to Be True)

- Star-tracking georectification must produce coordinates accurate enough for tactical decisions (< 50m error at operational ranges)
- Agent-based fire models must produce emergent behaviors that match observed fire complexity
- ML training loops must demonstrably improve prediction accuracy with accumulated incident data

- Realtime.Earth must function reliably under degraded network conditions typical of active incidents
- Training-operations continuum must reduce time-to-competency vs. agencies using separate systems

Pilot Blueprint (90 Days, Minimal Drama)

- **Pick one geometry:** Fire agency with existing camera network seeking better coordination, or EOC wanting distributed incident management
- **Baseline:** Document current camera utilization, coordination workflow, training approach, and incident decision speed
- **Deploy:** Install SimTable with Realtime.Earth; integrate available camera feeds via AI georectification; train operators
- **Test:** Run tabletop with emergent scenarios; support real incident or large exercise with distributed coordination
- **Measure:** Compare coordination quality, decision speed, camera utilization, and training transfer vs. baseline
- **Decide:** Scale if distributed intelligence demonstrably improves collective action; stop if value is unclear

The Bottom Line

The wildfire AI market is flooded with companies generating data.

SimTable is building something different: **the infrastructure for collective action.**

When every camera feed becomes a geospatial layer, when every actor becomes a cognitive participant, when every incident improves the model—

that is Distributed Intelligence.

And that may be the layer that matters most.

— *End of SimTable Inserts* —

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