

# THE SWARM INTELLIGENCE HANDBOOK



**RHYS FISHER**  
WITH FLOW

# Swarm Intelligence: A Tactical Handbook To Agentic Advantage

Lessons from Ant Colonies, Wolfpack Admirals, and  
StarCraft Champions for Leading Distributed AI at Scale

Rhys Fisher

This book is available at

<https://leanpub.com/agentic-swarms-tactical-field-guide>

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# How to Win with Agentic Swarms: A Tactical Field Guide

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## **3.2 Learning from Nature's Adapters**

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### **Bee Democracy: Better Decisions Under Uncertainty**

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### **The Stop Signal: Why Killing Bad Ideas Fast Matters as Much as Generating Good Ones**

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### **Emergent Specialization: Let Roles Evolve Based on What Works**

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## **3.3 Mission Command: Adaptation Through Autonomy**

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### **Commander's Intent: Goals, Not Procedures**

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### **How Mission Command Enables Local Adaptation**

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### **The Prerequisites: Trust, Competence, Shared Mental Models**

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### **When to Tighten Control vs. When to Loosen It**

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## **3.4 The Meta-Game: Reading and Shaping the Competitive Landscape**

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### **How Competitive Metas Evolve and Cycle**

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### **The Metagame Clock**

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## **Strategy Simulation and Testing**

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## **Shaping the Landscape: Proactive Adaptation**

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## **3.5 Navigating Fitness Landscapes with Agent Swarms**

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## **Rugged vs. Smooth: When Incremental Improvement Fails**

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## **The Adjacent Possible: Exploring Strategic Options Faster**

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## **Simulated Annealing: Controlled Randomness to Escape Local Optima**

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## **Portfolio Approaches: Running Multiple Strategies Simultaneously**

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## 3.6 The Adaptation Playbook

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### **Tactical Playbook A1: Rapid Experimentation Engine**

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### **Tactical Playbook A2: Competitive Meta-Analysis System**

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### **Tactical Playbook A3: Strategy Stress-Testing Framework**

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### **Tactical Playbook A4: Emergent Role Discovery Process**

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## **Quick-Reference Card 4: Adaptation Readiness Assessment**

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### **Dimension 1: Exploration Capacity (Max: 25)**

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### **Dimension 2: Signal Quality (Max: 25)**

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### **Dimension 3: Decision Speed (Max: 25)**

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### **Dimension 4: Strategic Robustness (Max: 25)**

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### **Dimension 5: Organizational Learning (Max: 25)**

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### **Scoring Interpretation**

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### **Dimension Radar**

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### **Chapter Summary**

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# Chapter 4: REPLICATE–Scaling Intelligence Operations

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## Strategic Context

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## Key Findings

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## 4.1 The Economics of Cognitive Replication

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### Near-Zero Marginal Cost vs. Linear Cost of Hiring

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### The Jagged Frontier: Which Tasks Replicate Well

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## **Total Cost of Ownership: The Full Picture**

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## **When to Build vs. Buy**

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## **4.2 Architecture for Scale**

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## **The Coordination Hierarchy: Stigmergy > Direct > Centralized**

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## **Slime Mold Lessons: Resource-Efficient Networks**

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## **The Stigmergic Infrastructure Imperative**

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## **LLM Framework Selection Guide**

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## 4.3 The Production Engine

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### **Termite Construction Principles**

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### **From Build Orders to Deployment Strategies**

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### **Supply Management: Capacity Planning**

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## 4.4 Scaling Patterns and Anti-Patterns

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### **Pattern: Single Process First, Then Replicate**

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### **Pattern: Horizontal vs. Vertical Scaling**

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### **Pattern: Scale Through Diversity, Not Quantity**

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### **Anti-Pattern: Scaling Before the Single-Agent Process Works**

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### **Anti-Pattern: Centralized Bottlenecks**

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### **Anti-Pattern: The Bag of Agents**

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### **Anti-Pattern: Ignoring Supervision Cost**

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## **4.5 The Replication Playbook**

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### **Tactical Playbook R1: Single-Process-to-Swarm Migration**

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## **Tactical Playbook R2: Agent Economy Design**

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## **Tactical Playbook R3: Build vs. Buy Decision Framework**

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## **Tactical Playbook R4: Scaling Readiness Checklist**

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## **Quick-Reference Card 5: Agent Economics Calculator**

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### **Purpose**

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### **Input Table**

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### **Calculations**

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## Decision Rules

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## Sensitivity Checks

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## Cost-Exchange Ratio (CER) Quick Check

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## Chapter Summary

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# Chapter 5: MOBILIZE–Coordinated Execution

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## Strategic Context

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## Key Findings

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## 5.1 The Coordination Problem

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### Why Independent Agents Fail

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### The Coordination Cost Curve

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## Three Coordination Mechanisms

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## 5.2 Nature's Coordination Playbook

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### Reynolds Rules: Three Rules That Look Like a Plan

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### The 6-7 Neighbor Rule

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### Stigmergy: The Environment As Coordinator

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### The Power of Simple Rules

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## 5.3 Mission Command for Agent Swarms

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## **From Befehlstaktik to Auftragstaktik**

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## **Translating Commander’s Intent Into Agent System Design**

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## **The Autonomy Spectrum**

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## **When to Tighten and When to Loosen**

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## **5.4 Team Composition and Role Design**

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### **The Draft Phase: Why Composition Beats Talent**

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### **The Five Agent Roles**

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## **Specialist vs. Generalist Agents**

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## **Dynamic Role Assignment**

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## **The Informed Minority Principle**

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# **5.5 The Human-Agent Operating Model**

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## **The Supervisory Control Problem**

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## **Oversight Ratios by Scale**

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## **The 70/30 Supervision Split**

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## **Defense-in-Depth Oversight**

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## **Escalation Protocols: When Agents Surface Decisions to Humans**

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## **5.6 The Mobilization Playbook**

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### **Tactical Playbook M1: Agent Team Composition Guide**

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### **Tactical Playbook M2: Coordination Protocol Selection**

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### **Tactical Playbook M3: Mission Command Implementation**

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### **Tactical Playbook M4: Human-Agent Operating Rhythm Design**

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## **Quick-Reference Card 6: Coordination Protocol Selection Matrix**

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### **Decision Matrix**

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### **Protocol Quick Reference**

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### **Three Decision Rules**

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## **Cross-Domain Evidence Weaving**

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## **What Goes Wrong: Five Coordination Failure Modes**

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## **Chapter Summary**

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# Chapter 6: SUSTAIN–Resilience, Governance, and the Long Game

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## Strategic Context

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## Key Findings

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## 6.1 The Sustainability Challenge

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### Why Most Swarm Projects Die After the Pilot

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### From Experiment to Institution

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## **The Antifragility Imperative**

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## **6.2 Resilience Engineering for Agent Swarms**

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### **Designing for Failure**

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### **The Resilience Triad**

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### **The Immune System Model: Distributed Threat Detection**

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### **Testing Resilience: Chaos Engineering for Agent Swarms**

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### **Resilience Maturity Model**

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## 6.3 Governance and Risk Management

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### **Governance Is a Deployment Accelerator, Not a Compliance Burden**

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### **The Three-Tier Governance Framework**

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### **Risk Tier Decision Matrix**

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### **Regulatory Compliance: The Window Is Closing**

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### **Accountability: Who Decides What Agents Can Do?**

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### **Ethical Guardrails: What Agents Must Never Do**

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## 6.4 Continuous Improvement Systems

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### **The After-Action Review: Learning from Every Swarm Operation**

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### **Replay Analysis: What Gaming Coaches Teach Us**

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### **Performance Metrics That Actually Matter**

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### **Building Institutional Memory**

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### **ROI Tracking and Executive Reporting**

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## 6.5 Organizational Evolution

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## **New Roles for the Agent Era**

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## **From Supervising People to Orchestrating Human-Agent Teams**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Culture Change: Building the Mindset**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Career Paths in the Agent Era**

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## **The Change Management Playbook**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **6.6 The Sustainability Playbook**

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## **Tactical Playbook SU1: Resilience Audit Checklist**

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## **Tactical Playbook SU2: Governance Framework Template**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Tactical Playbook SU3: Continuous Improvement Loop Design**

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## **Tactical Playbook SU4: Organizational Readiness Assessment**

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## **Quick-Reference Card 7: Governance Readiness Scorecard**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

### **Dimension 1: Risk Classification (Items 1-5)**

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### **Dimension 2: Controls & Monitoring (Items 6-10)**

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### **Dimension 3: Human Oversight (Items 11-15)**

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### **Dimension 4: Accountability & Audit (Items 16-20)**

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### **Dimension 5: Continuous Improvement (Items 21-25)**

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### **Dimension 6: Organizational Readiness (Items 26-30)**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

### **Scoring Guide**

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### **Radar Chart Template**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

### **Cross-Domain Evidence Weaving Points**

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### **Chapter Summary**

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# PART II: REFERENCE MATERIALS

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## Appendix A: Implementation Timeline

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## The Convergent Evolution of Distributed Intelligence

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## Pre-1800s: The Foundations

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## 1940s-1950s: Distributed Warfare and Game Theory

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## 1960s-1970s: Information Warfare and Biological Insight

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## 1980s: Self-Organization and Computational Swarms

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **1990s: Ant Colonies, Complexity, and Network-Centric Warfare**

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## **2000s: Biological Validation and Network Science**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **2010s: Convergence Begins**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **2018-2020: AI Swarms Enter Competition**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **2020s: Military-Scale Drone Swarms**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **2024-2025: Multi-Agent Systems Science Matures**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **2026: The Convergence**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Looking Forward: 2026-2028**

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## **Appendix B: Situation-Based Index**

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## **Competitive Scenarios**

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## **Strategic Planning Scenarios**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Technical Architecture Scenarios**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Cross-Domain Principle Reference**

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## **Appendix C: Quick-Reference Cards**

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## **Card Directory**

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## **Card Usage Guide**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Quick-Reference Card 1: Swarm Readiness Scorecard**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Quick-Reference Card 2: Sensing Architecture Blueprint**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Quick-Reference Card 3: Tempo Assessment Calculator**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Quick-Reference Card 4: Adaptation Readiness Assessment**

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## **Quick-Reference Card 5: Agent Economics Calculator**

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**Quick-Reference Card 6: Coordination Protocol Selection Matrix**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

**Quick-Reference Card 7: Governance Readiness Scorecard**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

**Quick-Reference Card 8: Cognitive Bottleneck Mapper**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

**Quick-Reference Card 9: Build vs. Buy Decision Matrix**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

**Quick-Reference Card 10: Mission Command Translation Worksheet**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

**Quick-Reference Card 11: Agent Team Composition Canvas**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

**Quick-Reference Card 12: Resilience Audit Checklist**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

### **Quick-Reference Card 13: After-Action Review Template**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

### **Quick-Reference Card 14: SWARMS Strategy Canvas**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

### **Tactical Playbook Directory**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Appendix D: Source Bibliography**

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### **Swarm Intelligence Biology**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

### **Military Doctrine**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

### **Competitive Gaming and AI**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentic-swarms-tactical-field-guide>.

## **Multi-Agent Systems Science**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Business Strategy Under AI Acceleration**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Complexity Science**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Production Systems and Frameworks**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

## **Regulatory and Governance**

This content is not available in the sample book. The book can be purchased on Leanpub at <https://leanpub.com/agentive-swarms-tactical-field-guide>.

# Writing in Markua

Writing in Markua is easy! You can learn most of what you need to know with just a few examples.

To make *italic text* you surround it with single asterisks. To make **bold text** you surround it with double asterisks.

## Section One

You can start new sections by starting a line with two # signs and a space, and then typing your section title.

### Sub-Section One

You can start new sub-sections by starting a line with three # signs and a space, and then typing your sub-section title.

## Including a Chapter in the Sample Book

At the top of this file, you will also see a line at the top:

```
1 {sample: true}
```

Leanpub has the ability to make a sample book, which interested readers can download or read online. If you add this line above a chapter heading, then when you publish your book, this chapter will be included in a separate sample book for these interested readers.

## Links

You can add web links easily.

Here's a link to the [Leanpub homepage](#).

## Images

You can add an image to your book in a similar way.

First, add the image to the “Resources” folder for your book. You will find the “Resources” folder under the “Manuscript” menu to the left.

If you look in your book’s “Resources” folder right now, you will see that there is an example image there with the file name “palm-trees.jpg”. Here’s how you can add this image to your book:



If you want to add a figure title, you put it in quotes:



**Figure 1. Palm Trees**

If you want to add descriptive alt text, which is good for accessibility, you put it between the square brackets:



**Figure 2. Palm Trees**

You can also set the alt text and/or the figure title in an attribute list:



**Figure 3. Palm Trees**

Finally, if no title is provided, and the `alt-title` document setting is the default of `all`, the alt text will be used as the figure title instead of as alt text.



**Figure 4. Palm Trees**

You can set the important document settings at Settings > Generation Settings.

## **Lists**

### **Numbered Lists**

You make a numbered list like this:

1. kale
2. carrot
3. ginger

### **Bulleted Lists**

You make a bulleted list like this:

- kale

- carrot
- ginger

## Definition Lists

You can even have definition lists!

### **term 1**

definition 1a

definition 1b

### **term 2**

definition 2

## Page Breaks

We don't recommend that you manually break pages, since that is brittle and can lead to unexpected formatting if you edit text earlier in your chapter and forget about the manual page breaks. But if you really want to add a page break, you use the `{pagebreak}` directive on a line by itself, with blank lines above it and below it.

## Code Samples

You can add code samples really easily. Code can be in separate files (a “local” resource) or in the manuscript itself (an “inline” resource).

### Local Code Samples

Here’s a local code resource:

**Figure 5. Hello World in Ruby**

---

```

1  require 'time'
2
3  # This is just some pointless code so you can see the syntax highlighting...
4  def display_info
5      pi = Math::PI.round(10)
6      time_last_year = (Time.now - 365 * 24 * 60 * 60).getlocal("-08:00")
7      formatted_time = time_last_year.strftime("%Y-%m-%d %H:%M:%S")
8      puts "Pi to 10 decimal places: #{pi}"
9      puts "The time 1 year ago in Pacific Time: #{formatted_time}"
10 end

```

---

### Inline Code Samples

Inline code samples can either be spans or figures.

A span looks like `puts "hello world"` this.

A figure looks like this:

```

1  require 'time'
2
3  # This is just some pointless code so you can see the syntax highlighting...
4  def display_info
5      pi = Math::PI.round(10)
6      time_last_year = (Time.now - 365 * 24 * 60 * 60).getlocal("-08:00")
7      formatted_time = time_last_year.strftime("%Y-%m-%d %H:%M:%S")
8      puts "Pi to 10 decimal places: #{pi}"
9      puts "The time 1 year ago in Pacific Time: #{formatted_time}"
10 end

```

You can also add a figure title using the title attribute:

**Figure 6. Hello World in Ruby**


---

```

1 require 'time'
2
3 # This is just some pointless code so you can see the syntax highlighting...
4 def display_info
5   pi = Math::PI.round(10)
6   time_last_year = (Time.now - 365 * 24 * 60 * 60).getlocal("-08:00")
7   formatted_time = time_last_year.strftime("%Y-%m-%d %H:%M:%S")
8   puts "Pi to 10 decimal places: #{pi}"
9   puts "The time 1 year ago in Pacific Time: #{formatted_time}"
10 end

```

---

## Tables

You can insert tables easily inline, using the GitHub Flavored Markdown (GFM) table syntax:

Header 1	Header 2
Content 1	Content 2
Content 3	Content 4 Can be Different Length

Tables work best for numeric tabular data involving a small number of columns containing small numbers:

Central Bank	Rate
JPY	-0.10%
EUR	0.00%
USD	0.00%
CAD	0.25%

Definition lists are preferred to tables for most use cases, since reading a large table with many columns is terrible on phones and since typing text in a table quickly gets annoying.

## Math

You can easily insert math equations inline using either spans or figures.

Here's one of the kinematic equations  $d = v_i t + \frac{1}{2} a t^2$  inserted as a span inside a sentence.

Here's some math inserted as a figure.

$$\left| \sum_{i=1}^n a_i b_i \right| \leq \left( \sum_{i=1}^n a_i^2 \right)^{1/2} \left( \sum_{i=1}^n b_i^2 \right)^{1/2}$$

**Figure 7. Something Involving Sums**

## Headings

Markua supports both of Markdown's heading styles.

The preferred style, called atx headers, has the following meaning in Markua:

```

1 {class: part}
2 # Part
3
4 This is a paragraph.
5
6 # Chapter
7
8 This is a paragraph.
9
10 ## Section
11
12 This is a paragraph.
13
14 ### Sub-section
15
16 This is a paragraph.
17
18 #### Sub-sub-section
19
20 This is a paragraph.
21
22 ##### Sub-sub-sub-section
23
```

```

24 This is a paragraph.
25
26 ##### Sub-sub-sub-sub-section
27
28 This is a paragraph.

```

Note the use of three backticks in the above example, to treat the Markua like inline code (instead of actually like headers).

The other style of headers, called Setext headers, has the following headings:

```

1 {class: part}
2 Part
3 ====
4
5 This is a paragraph.
6
7 Chapter
8 =====
9
10 This is a paragraph.
11
12 Section
13 -----
14
15 This is a paragraph.

```

Setext headers look nice, but only if you're only using chapters and sections. If you want to add sub-sections (or lower), you'll be using atx headers for at least some of your headers. My advice is to just use atx headers all the time. (The `{class: part}` attribute list on a chapter header to make a part header does actually work with Setext headers, but it's really ugly.)

Note that while it is confusing and ugly to mix and match using atx and Setext headers for chapters and sections in the same document, you can do it. However, please don't.

## Block quotes, Asides and Blurbs

Block quotes are really easy too.

—Peter Armstrong, *Markua Spec*

Asides are useful for longer text.  
But typing them like this isn't fun.

Asides can be written this way, since adding a bunch of A> stuff at the beginning of each line can get annoying with longer asides.

Blurbs are useful

Blurbs are useful

There are many types of blurbs, which will be familiar to you if you've ever read a computer programming book.



This is a discussion.

You can also specify them this way:



This is a discussion



This is an error.



This is information.



This is a question. (Not a question in a Markua course; those are done differently!)



This is a tip.



This is a warning.



This is an exercise. (Not an exercise in a Markua course; those are done differently!)

## Good luck, have fun!

If you've read this far, you're definitely the right type of person to be here!

Our last piece of advice is simple: once you have a couple chapters completed, publish your book in-progress!

This approach is called Lean Publishing. It's why Leanpub is called Leanpub.

If you want to learn more about Lean Publishing, read [this](#) or watch [this](#).