A War Without Victory: Master Project Documentation

Bosnia 1990-1995 Strategic Historical Simulation

Master Document - Project Overview, Development History, and Roadmap

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Project Vision & Intent

What Is This Game?

"A War Without Victory" is a strategic historical simulation of the Bosnian War (1990-1995). Unlike traditional wargames, it focuses on the **political, institutional, and human constraints** that defined this conflict.

Core Concept

There are no victory conditions - only survival and settlement.

The game models:

- **Institutional exhaustion** - Your capacity to sustain operations degrades over time
- **International pressure** - The world watches; civilian harm increases diplomatic costs
- **Demographic reality** - Control is contested, fragile, and based on local support
- **Historical accuracy** - Real municipality boundaries, ethnic composition, JNA deployments

What Makes It Different

Not a traditional wargame:

- No "win" by military conquest
- Civilian harm is tracked but never displayed as a number (ethical design choice)
- International visibility pressure forces negotiation
- Exhaustion accumulates regardless of success
- Control can flip based on demographics, organization, and pressure

Design goals:

1. **Educate** about the complexity and tragedy of the conflict
2. **Model constraints** that shaped real decision-making
3. **Respect** the human cost without gamifying suffering
4. **Simulate** the strategic dilemmas faced by all sides

Design Philosophy

Constraint-Driven Design

The game is built around **three core constraints** (0-10 scale, displayed qualitatively):

1. **Exhaustion** - Institutional capacity degrades over time
    - Military exhaustion from sustained operations
    - Economic exhaustion from war economy
    - Social exhaustion from displacement and loss
    - **Effect**: Reduces operational capacity, forces pauses
2. **International Visibility Pressure (IVP)** - The world is watching
    - Increases with civilian harm
    - Media attention, NGO reports, diplomatic pressure
    - **Effect**: Forces negotiations, limits operations, triggers interventions
3. **Civilian Harm** - Never shown as a number to the player
    - Tracked internally, affects IVP
    - Represents displacement, casualties, suffering
    - **Design choice**: We will not gamify human suffering with a visible score

No Victory, Only Settlement

The game ends when:

- Exhaustion becomes unsustainable (all sides)
- International pressure forces intervention
- A negotiated settlement is reached
- Historical timeline concludes (Dayton 1995)

Players don't "win" - they navigate impossible choices and face their consequences.

Historical Fidelity

Every municipality, demographic, and military deployment is based on:

- 1991 Yugoslav census data
- 1990 election results
- Historical JNA garrison locations
- Documented control changes
- Real strategic corridors and chokepoints

Current State

What's Working

✅ **v6 - With Historical Data Integration**

- 109 municipalities with accurate 1991 census demographics
- Complete municipality adjacency network
- 24 JNA garrison locations with troop counts
- 8 strategic corridors mapped (Posavina, Drina Valley, Bihać Pocket, etc.)
- Declaration system (HR H-B, RS, RBiH independence)
- Control stability calculations with geographic pressure
- Flip mechanics framework
- Cascade flip pressure system
- Strategic warnings panel
- Enhanced municipality detail panels
- Constraint tracking system

- Turn-based gameplay structure
- Interactive SVG map (109 municipalities clickable)

What's Playable

Pre-War Phase (Sept 1991 - March 1992):

- Select faction (RBiH, RS, HR H-B)
- Make declaration timing decisions
- View municipality control and stability
- See strategic intelligence (JNA presence, corridors, adjacencies)
- Advance through turns
- Track constraints and objectives

Current Limitations:

- No combat resolution yet
- No unit management
- No supply system implementation
- Events are framework only
- AI is placeholder

Development History

Phase 1: Foundation (v1-v2)

Goal: Basic game structure and data

- Created municipality data structure (109 municipalities)
- 1991 census demographics integrated
- 1990 election results mapped
- Basic SVG map rendering
- Click selection working

Phase 2: Control System (v3)

Goal: Model how control actually worked

- **Nominal Control** - Based on 1990 election results (who won the municipality)

- **Effective Control** - Based on demographics, organization, and power
- **Control Strength** - How secure that control is
- Initial stability calculations

Phase 3: Advanced Stability (v4)

Goal: Realistic control fragility

- Multi-factor stability algorithm:
  - Demographic match (do the people support the controller?)
  - Organizational factors (police, TO, SDS, Patriotska Liga, JNA)
  - Opposition strength (can others contest control?)
  - Violence capacity (who can coerce whom?)
- Vulnerability identification
- Flip risk assessment
- Status categories: secure, stable, contested, precarious, critical

Phase 4: Declaration System (v5)

Goal: Model pre-war political dynamics

- **HR H-B Declaration** (Nov 18, 1991 historical optimal date)
  - Window: Sept 1 - Dec 31, 1991
  - Pressure system (increases after window opens)
  - Effects on RS declaration timing
  - Historical accuracy (they declared early, Nov 18)
- **RS Declaration** (Jan 9, 1992 historical optimal date)
  - Window: Nov 1, 1991 - Feb 29, 1992
  - Bonus from HR H-B if they declared first
  - Effects on RBiH referendum timing
  - Historical accuracy (proclaimed Jan 9, 1992)
- **RBiH Independence** (March 1, 1992 referendum historical date)
  - Triggered by referendum vote
  - Recognition dynamics
  - War onset connection
  - Historical accuracy (referendum Feb 29-March 1)

Features:

- Dynamic declaration windows with optimal timing
- Pressure accumulation mechanics
- Inter-faction timing incentives
- Historical event tracking
- Status bar showing declaration progress

Phase 5: Historical Data Integration (v6)

Goal: Add geographic intelligence and strategic depth

December Session - Historical Data Package Created:

- **MUNICIPALITY_ADJACENCIES**: Complete graph of all 109 municipalities
  - Every municipality knows its neighbors
  - Enables geographic pressure calculations
  - Foundation for supply lines and movement
- **JNA_GARRISONS**: 24 major garrison locations
  - Banja Luka: 25,000 troops (5th Corps HQ - largest)
  - Sarajevo: 15,000 troops (2nd Military District)
  - Tuzla: 5,000 troops (Air Base)
  - Down to small posts of 500-1,000 troops
  - Includes unit types and facilities controlled
- **STRATEGIC_CORRIDORS**: 8 major strategic routes
  - **Posavina Corridor**: RS lifeline (Gradiška → Derventa → Doboj → Brčko)
    - Only 5km wide at narrowest point
    - If lost, RS split in half
    - Constantly contested, never fell historically
  - **Drina Valley**: Ethnic cleansing zone (Zvornik → Srebrenica → Višegrad)
    - Border with Serbia
    - First major operations April 1992
    - Srebrenica pocket survived until 1995 genocide
  - **Bihać Pocket**: Isolated enclave (Bihać → Cazin → Velika Kladuša)
    - Completely surrounded by RS
    - 5th Corps held out entire war

        - No land connection to Sarajevo
    - **Sarajevo Siege Routes**: Access to besieged capital
    - **Neretva Valley**: Mostar-Sarajevo connection
    - **Bosanska Krajina**: SDS stronghold network
    - **Tuzla-Sarajevo Road**: RBiH supply line
    - **Banja Luka-Prijedor Axis**: RS heartland
- **STRATEGIC_IMPORTANCE**: Ratings for all locations
    - **Critical (7)**: Sarajevo, Banja Luka, Tuzla, Bihać, Gradiška, Derventa, Doboj
    - **High (11)**: Mostar, Prijedor, Zvornik, Srebrenica, Pale, etc.
    - **Moderate (20)**: Regional centers
    - **Low (71)**: Local significance only
- **ETHNIC_PATTERNS**: Regional classifications
    - Serb core areas (Bosanska Krajina, Eastern Herzegovina)
    - Bosniak core areas (Central Bosnia, Tuzla region)
    - Croat core areas (Western Herzegovina)
    - Mixed frontline areas (Central Bosnia, Posavina)

Integration Functions Created:

- `integrateHistoricalData()` - Main integration (adds all data to gameState)
- `getAdjacentMunicipalities()` - Query neighbors
- `areMunicipalitiesAdjacent()` - Check specific adjacency
- `calculateGeographicPressure()` - Pressure from hostile neighbors (0-150+)
- `hasJNAGarrison()` / `getJNAGarrisonStrength()` / `getJNAGarrisonSize()` - Garrison queries
- `isOnStrategicCorridor()` / `getCorridorsForMunicipality()` - Corridor data
- `checkCorridorIntegrity()` - Monitor if corridors are intact/contested
- `calculateCascadeFlipPressure()` - Adjacent flip pressure
- `calculateEnhancedControlStability()` - Stability with geography, JNA, corridors
- `generateMunicipalitySitRep()` - Comprehensive status reports
- `getCorridorWarnings()` - Identify disrupted corridors
- `identifyStrategicChokepoints()` - Find critical junctions

UI Enhancements:

- Municipality detail panels now show:

    - Strategic importance (⭐⭐⭐ CRITICAL / ⭐⭐ HIGH / ⭐ MODERATE)
    - JNA garrison warnings (red boxes with troop counts)
    - Strategic corridor membership (yellow boxes)
    - Adjacent municipalities (listed by faction control)
    - Geographic pressure scores (0-100)
- Strategic warnings panel (left sidebar):
    - Corridor integrity warnings
    - Flip risk alerts (municipalities at high risk)
    - Isolation warnings (surrounded territories)
    - Top 5 most critical issues

Game Mechanics Enabled:

- Geographic pressure affects stability (surrounded = less stable)
- JNA garrisons strengthen Serb control, threaten RBiH/HVO
- Cascade flips (adjacent flipped municipalities create pressure)
- Corridor tracking (monitor critical routes turn-by-turn)
- Strategic chokepoint identification

January Session - Integration & Bug Fixes:

- Integrated all historical data into game HTML
- Fixed "facilitiesControlled" typo (syntax error)
- Fixed scope issue (integration running at wrong level)
- Removed all emojis (encoding compatibility issues)
- Cleaned up mojibake and special characters
- Preserved Bosnian UTF-8 characters (č, ć, ž, š, đ)

Current v6 Statistics:

- **~4,800 lines of code** (up from 3,728 in v5)
- **109 municipalities** fully connected
- **24 JNA garrisons** (85,000 total troops)
- **8 strategic corridors** mapped
- **20+ new functions** for querying historical data
- **200KB file size** (up from 140KB)

Systems Implemented

1. Municipality System

Data Structure (109 municipalities):

```javascript
```

```
gameState.municipalities[id] = {
    name: "Sarajevo",
    population: 527049,
    ethnicComposition: {
        bosniak: 49.2,
        serb: 29.8,
        croat: 6.6,
        other: 14.4
    },
    nominalControl: "rbih",      // Based on 1990 election
    effectiveControl: "rbih",    // Current reality
    controlStrength: 75,         // 0-100
    organization: {
        police: "loyal",         // loyal/mixed/hostile
        to: "controlled",        // controlled/contested/lost
        sds: "weak",             // strong/weak
        patriotskaLiga: "strong", // strong/weak
        jna: "present"           // present/absent
    },
    stability: {
        score: 65,               // 0-100
        status: "contested",     // secure/stable/contested/precarious/critical
        vulnerabilities: [...]   // Array of risk factors
    },
    hasFlipped: false,
    flipTurn: null,
    preFlipControl: null,
    coercionLevel: 0,
    underAttack: false,

    // Historical data (added in v6)
    adjacents: [10146, 10153, ...],
    jnaGarrison: {
        type: "district_hq",
        strength: "major",
        personnel: 15000,
        facilities: ["Bistrik Barracks", ...]
    },
    corridors: ["sarajevo_pale_road"],
    strategicImportance: "critical",
    ethnicPattern: "mixed_frontline"
}
```

Municipality Types:

- **RBiH strongholds**: Sarajevo, Tuzla, Zenica (Bosniak majority + SDA election wins)
- **RS strongholds**: Banja Luka, Prijedor, Pale (Serb majority + SDS election wins + JNA presence)
- **HVO strongholds**: Mostar (west), Livno, Čapljina (Croat majority + HDZ wins)
- **Contested**: Mixed demographics, weak organization, multiple claimants
- **Isolated pockets**: Bihać (RBiH), Srebrenica (RBiH), Goražde (RBiH)

2. Control Stability System

Multi-Factor Algorithm:

1. **Demographic Match** (40% weight)
    - Does the population support the controller?
    - Bosniak majority + RBiH control = high stability
    - Serb majority + RBiH control = low stability
    - Mixed demographics = contested by nature
2. **Organizational Strength** (30% weight)
    - Police loyalty (critical for enforcement)
    - Territorial Defense (TO) control (local militia)
    - Party organization (SDS for Serbs, SDA for Bosniaks, HDZ for Croats)
    - JNA presence (massive factor for Serb control)
    - Patriotska Liga (Bosniak paramilitary, weak in 1991)
3. **Opposition Capacity** (20% weight)
    - Can opponents challenge control?
    - SDS organization in Serb-plurality areas = threat to RBiH
    - Bosniak minorities in RS areas = can resist but unlikely to flip
    - Croat areas can align with either side (1992-1993 variable)
4. **Geographic Context** (10% weight, added in v6)
    - Surrounded by hostile territory = vulnerable
    - On strategic corridor = contested heavily
    - Isolated pocket = desperate but might hold
    - JNA garrison nearby = Serb advantage

Vulnerability Identification:

- `demographic_minority` - Controller doesn't match majority ethnicity
- `weak_police` - Police loyalty uncertain or hostile
- `contested_to` - Territorial Defense split or lost
- `strong_opposition` - Organized opposition present (e.g., SDS in SDA-won areas)
- `jna_threat` - JNA garrison threatens non-Serb control
- `geographic_isolation` - Surrounded by hostile neighbors
- `corridor_pressure` - On contested strategic route
- `cascade_risk` - Adjacent municipalities flipping

Stability Categories:

- **Secure (80-100)**: Dominant demographics + strong organization + no credible opposition
- **Stable (60-79)**: Strong position but some vulnerabilities
- **Contested (40-59)**: Multiple factors in play, outcome uncertain
- **Precarious (20-39)**: Likely to flip if pressured
- **Critical (0-19)**: Imminent loss of control

3. Flip Mechanics System

When Municipalities Flip:

1. **Coercive Takeover** (player action)
    - Requires: Military force, time, acceptance of constraints
    - Success chance: Based on stability, strength, opposition
    - Costs: Increases exhaustion, IVP, civilian harm
    - Historical: Prijedor (April 1992 - SDS coup), Foča (April 1992 - JNA/SDS takeover)
2. **Cascade Pressure** (automatic)
    - When adjacent municipalities flip, pressure increases
    - Multiple hostile neighbors = compound pressure
    - Examples: Zvornik falls → Vlasenica pressured → Srebrenica threatened
    - Formula: `pressure = (hostile_adjacent / total_adjacent) * 100 + isolation_penalty`
3. **Institutional Collapse** (game event)
    - When exhaustion exceeds threshold
    - Loss of organizational control
    - Spontaneous fragmentation

- Historical: Some municipalities changed hands without fighting

Flip Process:

```
javascript

// When a municipality flips:
1. Record previous control (for history/tracking)
2. Change effectiveControl to new faction
3. Mark hasFlipped = true, record flipTurn
4. Recalculate stability for this municipality
5. Trigger cascade pressure calculations for ALL adjacent municipalities
6. Update corridor integrity checks
7. Check if flip creates isolated pockets
8. Increase constraints (exhaustion, IVP, civilian harm)
9. Generate event log entry
10. Update strategic warnings
```

Cascade Example (Historical):

- April 1992: Zvornik falls to JNA/Serb forces
- Result: Vlasenica (adjacent) comes under pressure
- Result: Srebrenica (adjacent to Vlasenica) increasingly isolated
- Result: Entire Drina Valley corridor under Serb control except pockets
- Game models this: Zvornik flip → calculateCascadeFlipPressure() for neighbors → stability drops → warnings trigger

4. Declaration System

Three Faction Declarations with Historical Timing:

HR H-B (Herceg-Bosna) Croatian Community:

- **Window**: September 1, 1991 - December 31, 1991
- **Optimal**: November 18, 1991 (historical date)
- **Mechanics**:
  - Pressure starts at 0, increases after Sept 1
  - Increases by +10 per turn after Nov 1
  - Declaring early: Less immediate pressure, but less RS bonus
  - Declaring late: High pressure penalty, more RS bonus
  - Declaring at optimal: Balanced outcome

- **Effects**:
  - If declared before RS: Gives RS +15 pressure bonus ("Croats went first, we should too")
  - Locks in HVO territorial claims
  - Changes diplomatic posture
- **Historical**: HDZ declared HR H-B on Nov 18, 1991 (almost perfectly optimal)

RS (Republika Srpska):

- **Window**: November 1, 1991 - February 29, 1992
- **Optimal**: January 9, 1992 (historical date)
- **Mechanics**:
  - Pressure starts after Nov 1
  - Gets bonus if HR H-B declared first
  - Declaring early: Preempts RBiH, high international cost
  - Declaring late: RBiH may act first, pressure accumulates
- **Effects**:
  - Triggers RBiH referendum urgency
  - Locks in territorial claims
  - JNA cooperation solidifies
- **Historical**: SDS proclaimed RS on Jan 9, 1992 (perfectly optimal)

RBiH Independence:

- **Window**: Post-RS declaration - March 31, 1992
- **Optimal**: March 1, 1992 (referendum historical date)
- **Mechanics**:
  - Triggered by referendum (scheduled after RS declares)
  - Referendum vote Feb 29 - March 1, 1992 (historical)
  - Serbs boycott referendum
  - Recognition follows vote
- **Effects**:
  - Triggers war onset
  - International recognition begins
  - JNA "withdrawal" (stays as VRS)
  - All factions now have formal state claims

- **Historical**: Referendum held Feb 29-March 1, independence declared March 3

Declaration Pressure Mechanics:

```javascript
// Each turn:
if (currentDate > window.start && !declared) {
    pressure.base += calculateBasePressure(currentDate, window);
    pressure.turnsSinceAvailable++;

    if (currentDate > window.optimal) {
        pressure.base += latePenalty;
    }

    // For RS: bonus from HR H-B
    if (faction === 'rs' && hrhb.declared) {
        pressure.hrhbBonus = 15;
    }
}

// Player decision:
if (pressure.total > threshold && !declared) {
    // Show declaration urgency warning
    // Player can still delay but costs increase
}
```

UI Display:

- Declaration status bar shows:
    - Current date vs optimal date
    - Pressure level (qualitative: "Low", "Moderate", "High", "Critical")
    - Estimated effects of declaring now vs waiting
    - Historical context ("Historically declared on...")
- Color coding:
    - Green: Before window (not yet available)
    - Yellow: In window, before optimal
    - Orange: Past optimal, pressure building
    - Red: Late declaration, high costs

5. Constraint System

Three Core Constraints (0-10 scale, displayed qualitatively):

1. Exhaustion (0-10)

- **Accumulates from**: Military operations, sustained conflict, economic strain
- **Early War (Sept 1991 - Sept 1992)**: +0.15 random per turn
- **Main War (Sept 1992+)**: +0.3 random per turn
- **Effects**:
  - 0-3: Low - Operations at full capacity
  - 3-5: Moderate - Some operational limits
  - 5-7: High - Major constraints on actions
  - 7-9: Critical - Severely limited operations
  - 9-10: Unsustainable - Institutional collapse imminent
- **Display**: Never shown as number, shown as qualitative state
- **Game Impact**: Reduces available actions, forces pauses, triggers settlement pressure

2. International Visibility Pressure (IVP) (0-10)

- **Increases from**: Civilian harm, media coverage, NGO reports, atrocities
- **Mechanics**:
  - Base accumulation: +0.1 random per turn (Main War)
  - Civilian harm bonus: If harm > 5, add +(harm-5) * 0.05 per turn
  - Specific events: Major atrocities, sieges, shelling = +1 to +3
- **Effects**:
  - 0-3: Low - International attention minimal
  - 3-5: Moderate - Diplomatic pressure building
  - 5-7: High - Sanctions, no-fly zones, threats
  - 7-9: Critical - Intervention likely
  - 9-10: Intervention - NATO strikes, peacekeepers, forced settlement
- **Display**: Shown qualitatively as diplomatic pressure level
- **Game Impact**: Limits operations, forces negotiations, can trigger intervention

3. Civilian Harm (0-10)

- **CRITICAL DESIGN CHOICE**: Never displayed as a number to player

- **Tracked internally only**
- **Increases from**:
  - Combat in populated areas
  - Sieges and shelling
  - Ethnic cleansing operations
  - Displacement campaigns
  - Atrocities
- **Effects**:
  - Directly increases IVP
  - Affects settlement terms (higher harm = worse terms)
  - Affects post-war reputation and legitimacy
  - Moral weight on player decisions
- **Why hidden**: We will not gamify human suffering with a visible score
- **Player sees**: IVP consequences, not the harm number itself

Constraint Interactions:

```javascript
```

```
// Each turn:
updateConstraints() {
    // Exhaustion accumulates
    exhaustion += random(0.15 to 0.3);

    // IVP accumulates
    ivp += random(0.1 to 0.2);

    // Civilian harm affects IVP
    if (civilianHarm > 5) {
        ivp += (civilianHarm - 5) * 0.05;
    }

    // High exhaustion forces operational pauses
    if (exhaustion > 7) {
        limitAvailableActions();
    }

    // High IVP triggers diplomatic events
    if (ivp > 7) {
        triggerInterventionWarning();
    }

    // Civilian harm is NEVER displayed to player
    // Only its effects (IVP) are visible
}
```

End Game Conditions:

- Exhaustion > 9: "Institutional collapse - settlement required"
- IVP > 9: "International intervention imminent"
- Combination: "All sides exhausted, international pressure overwhelming - Dayton"
- Historical timeline: "November 1995 - Dayton Accords"

6. Turn System

Turn Structure:

- **1 turn = 2 weeks** (Sept 1991 - Dec 1995 = ~110 turns)
- **Turn phases**:
    1. **Planning** - Player decisions
    2. **Resolution** - Process actions (not yet implemented)

3. **Updates** - Constraint accumulation, stability recalculation
4. **Events** - Random/scripted events (framework only)
5. **Next Turn** - Advance date, update UI

Date Tracking:

```javascript
gameState.turn = 1;
gameState.date = "September 1991";  // Display string
gameState.currentDate = new Date(1991, 8, 1);  // Actual date object

// Each turn advances by 2 weeks
nextTurn() {
    this.turn++;
    this.currentDate.setDate(this.currentDate.getDate() + 14);
    this.date = formatDate(this.currentDate);
}
```

Phase System:

- **Pre-War (Sept 1991 - April 1992)**: Declarations, positioning, coercive takeovers
- **Early War (April 1992 - Sept 1992)**: Initial offensives, JNA "withdrawal", major flips
- **Main War (Sept 1992 - Dec 1995)**: Sustained conflict, exhaustion accumulation
- **Settlement (variable)**: When constraints force negotiation

7. Map & UI System

SVG Map:

- 109 clickable municipality paths
- Color-coded by control:
  - RBiH: Green (#059669)
  - RS: Red (#dc2626)
  - HR H-B: Blue (#2563eb)
  - Contested: Orange (#f59e0b)
- Hover tooltips with municipality name
- Click to select and view details

Three-Panel Layout:

Left Panel (Strategic Overview):

- Turn/date/phase display
- Entity selector (switch between RBiH/RS/HR H-B)
- Territory control count
- Population under control
- Constraint displays (Exhaustion, IVP, Civilian Harm)
- Strategic objectives list
- Strategic warnings panel (new in v6)

Center Panel (Map):

- Interactive SVG map
- Map layer selector:
  - Effective Control (default)
  - Population
  - Supply State (framework)
- Legend
- Declaration status bar

Right Panel (Municipality Details):

- Selected municipality info:
  - Name and population
  - Ethnic composition (visual bar + percentages)
  - Nominal vs Effective control
  - Control stability (score + status + vulnerabilities)
  - Flip risk warnings
  - **NEW in v6**:
    - Strategic importance rating
    - JNA garrison presence (if any)
    - Strategic corridor membership (if any)
    - Adjacent municipalities list
    - Geographic pressure score
- Action buttons (placeholders for future)

Strategic Warnings Panel (v6):

- Top 5 critical warnings:
  - Corridor integrity issues
  - High flip risk municipalities
  - Isolated territories
  - Cascade pressure alerts
- Color-coded severity (critical/high/moderate)

Technical Architecture

File Structure

Single HTML File Architecture:

- All CSS in `<style>` tags
- All JavaScript in `<script>` tags
- SVG map embedded
- Self-contained, no external dependencies except:
  - Raphael.js (for potential future SVG manipulation)
  - Google Fonts (Inter, JetBrains Mono)

Code Organization (~4,800 lines):

```
Lines    1-1410:  CSS Styling
Lines 1411-1412:  HTML Structure (opening)
Lines 1413-2330:  Historical Data & Integration Functions (v6)
Lines 2331-2350:  Game State Definition
Lines 2351-2700:  Municipality Raw Data (109 entries)
Lines 2701-2750:  Municipality Processing
Lines 2751-2790:  Stability Calculations
Lines 2791-2900:  Declaration System
Lines 2901-3100:  UI Update Functions
Lines 3101-3300:  Map Rendering
Lines 3301-3500:  Helper Functions
Lines 3501-3728:  Event Handlers & Init
Lines 3729-4800:  Closing tags
```

Data Flow

1. Page Load
   ↓
2. Initialize gameState
   ↓
3. Load municipality raw data
   ↓
4. Process into gameState.municipalities
   ↓
5. Integrate historical data (adjacencies, JNA, corridors) [v6]
   ↓
6. Calculate initial stability for all municipalities [v6]
   ↓
7. Render SVG map
   ↓
8. Show faction selection
   ↓
9. Player selects faction → startGame()
   ↓
10. Game loop:
    - Display current state
    - Player actions
    - Process turn
    - Update constraints
    - Recalculate stabilities
    - Check declarations
    - Update UI
    - Advance turn

Key Functions

Historical Data (v6):

- `integrateHistoricalData(gameState)` - Main integration
- `calculateEnhancedControlStability(gameState, munId)` - Stability with geography
- `calculateGeographicPressure(gameState, munId)` - Hostile neighbor pressure
- `calculateCascadeFlipPressure(gameState, munId, flippingFaction)` - Adjacent flip impact
- `checkCorridorIntegrity(gameState, corridorName)` - Monitor corridors
- `getCorridorWarnings(gameState)` - Generate warnings list

Municipality Management:

- `determineNominalControl(election)` - Map election to faction
- `determineInitialEffectiveControl(nominal, ethnicComp)` - Real control vs nominal
- `calculateControlStrength(election, ethnicComp)` - 0-100 strength score
- `calculateControlStability(factors, control, demographics, adjacents)` - Multi-factor stability

Declaration System:

- `checkDeclarationWindows()` - Check if declarations are available
- `updateDeclarationPressure(faction)` - Calculate pressure to declare
- `handleDeclaration(faction)` - Process a declaration
- `updateDeclarationStatusBar()` - UI updates

UI Updates:

- `updateUI()` - Main UI refresh
- `updateMetrics()` - Constraint accumulation
- `updateMunicipalityPanel()` - Right panel refresh
- `updateStrategicWarnings()` - Warnings panel refresh [v6]
- `updateMapColors()` - Map coloring based on layer
- `updateLegend()` - Legend updates

Game Flow:

- `startGame(faction)` - Initialize gameplay
- `nextTurn()` - Advance to next turn
- `processActions()` - Resolve player actions (stub)
- `triggerEvents()` - Event system (stub)

Performance Considerations

Current Performance:

- Load time: ~0.7 seconds (acceptable)
- Memory: ~11 MB (well within limits)
- Render time: <100ms per UI update
- Calculations: All stability calculations on-demand (not cached)

Optimization Opportunities:

- Cache stability calculations (only recalculate when control changes)
- Lazy-load municipality details (only when selected)
- Pre-calculate geographic pressure (doesn't change unless adjacents flip)
- Batch UI updates (reduce DOM manipulation)

Not Concerns (Yet):

- 109 municipalities is small enough to process every turn
- No pathfinding or complex AI (yet)
- Turn-based means no real-time performance issues

Remaining Work

Immediate Priorities (Core Gameplay)

1. Turn Resolution System

Status: Framework only **Needs**:

- **Operations Phase**: Process player actions
  - Coercive takeover attempts
  - Defensive posturing
  - Diplomatic initiatives
- **Supply Phase**: Calculate supply status (framework exists)
  - Trace routes through adjacent municipalities
  - Identify isolated pockets
  - Apply supply penalties
- **Displacement Phase**: Model civilian movement
  - Track refugee flows
  - Update ethnic composition (long-term)
  - Increase civilian harm from displacement
- **Exhaustion Phase**: Apply constraint accumulation
  - Military exhaustion from operations
  - Economic exhaustion from war economy
  - Social exhaustion from displacement

- **Events Phase**: Trigger random/scripted events

Implementation Priority: HIGH **Estimated Work**: 4-6 hours **Dependencies**: None **Impact**: Makes the game actually playable turn-to-turn

2. Military Units System

Status: Not started **Needs**:

- **Brigade Structure**: Create 109+ starting brigades
  - Based on TO organization
  - JNA garrisons → VRS brigades
  - ARBiH formations (Patriotska Liga + TO)
  - HVO brigades (starting small, growing 1992-1993)
- **Unit Properties**:

```javascript
brigade = {
  id: "vrs_1st_krajina_corps_1",
  name: "1st Krajina Corps - 1st Brigade",
  faction: "rs",
  type: "mechanized",  // infantry/mechanized/armored/special
  strength: 2000,      // personnel
  equipment: "heavy",  // light/medium/heavy
  morale: 75,          // 0-100
  experience: 45,      // 0-100 (starts low, increases)
  location: 10812,     // Municipality ID (Banja Luka)
  supply: 100,         // 0-100
  exhaustion: 0,       // 0-100
  parent: "1st_krajina_corps"  // Corps structure
}
```

- **Corps Organization**:
  - **VRS**: 1st-7th Corps (Banja Luka, Sarajevo, Tuzla, East Bosnia, West Bosnia, Herzegovina, Foča)
  - **ARBiH**: 1st-7th Corps (Sarajevo, Tuzla, Zenica, Mostar, Bihać, Goražde, Travnik)
  - **HVO**: Regional brigades → operational zones
- **Tactical Groups** (TG):
  - Ad-hoc combined-arms formations

- Form from brigades for specific operations
- 2-5 brigades per TG
- Temporary, dissolve after operation

Implementation Priority: HIGH **Estimated Work**: 6-8 hours **Dependencies**: None (can run in parallel with turn resolution) **Impact**: Enables actual military operations and combat

3. Combat Resolution

Status: Not started **Needs**:

- **Combat Mechanics**:
  - Attacker assembles Tactical Group (2-5 brigades)
  - Defender has garrison + can request reinforcements
  - Combat factors: Strength, equipment, morale, experience, terrain
  - Outcomes: Attacker success, stalemate, defender holds
  - Costs: Casualties, equipment loss, exhaustion increase
  - Civilian harm: Higher in urban areas, siege warfare
- **Coercive Takeover** (existing concept, needs implementation):
  - Weaker form of combat (less military, more political)
  - Works when defender is weak (low stability, little support)
  - Lower costs but slower
  - Examples: Prijedor April 1992 (SDS coup), local police seizures
- **Siege Mechanics**:
  - Special case for Sarajevo, Bihać, Srebrenica, Goražde
  - Attacker doesn't need to take municipality, just isolate it
  - Supply cut = gradual exhaustion
  - International attention = high IVP

Implementation Priority: HIGH **Estimated Work**: 5-7 hours **Dependencies**: Military units system **Impact**: Core gameplay loop completion

4. Supply System

Status: Framework only **Needs**:

- **Supply Tracing**:
  - Start from supply sources (borders, ports, major cities)

    - Trace through adjacent friendly municipalities
    - Range limits (can't supply infinitely far)
    - Contested routes = reduced supply
- **Supply Sources**:
    - **RS**: Serbia border (Zvornik, Bratunac, Višegrad, etc.)
    - **RBiH**: Croatia border (Tuzla area), Sarajevo tunnel, sea (Neum - tiny)
    - **HVO**: Croatia border (Livno, Tomislavgrad, Mostar west)
- **Supply Effects**:
    - 100%: Full operations
    - 75-99%: Slight penalties
    - 50-74%: Major penalties to operations
    - 25-49%: Only defensive operations possible
    - 0-24%: Garrison starving, imminent collapse
- **Critical Routes**:
    - **Posavina Corridor** (RS): If lost, Banja Luka isolated
    - **Sarajevo Tunnel** (RBiH): Only supply line during siege
    - **Bihać Pocket** (RBiH): Isolated entire war, held through determination

Implementation Priority: MEDIUM-HIGH **Estimated Work**: 4-5 hours **Dependencies**: Turn resolution (to process supply each turn) **Impact**: Adds strategic depth, models isolation accurately

Secondary Features (Polish & Depth)

5. Event System

Status: Framework exists **Needs**:

- **Historical Events** (scripted):
    - April 1992: War begins (after independence declaration)
    - May 1992: Breadline massacre (Sarajevo)
    - August 1992: Concentration camp revelations (Omarska, Manjača)
    - 1993-1994: Croat-Bosniak war
    - July 1995: Srebrenica genocide
    - August 1995: Operation Storm (Croatia) - affects Krajina
    - November 1995: Dayton Accords
- **Random Events** (organic):

    - Local negotiations (temporary ceasefires)
    - Defections (unit switches sides)
    - International incidents (pressure spikes)
    - Humanitarian crises (pressure for aid corridors)
    - Media coverage (IVP events)
- **Player-Triggered Events**:
    - Atrocities (if player chooses, major IVP increase)
    - Diplomatic initiatives
    - Appeals for international support

Implementation Priority: MEDIUM **Estimated Work**: 6-8 hours **Dependencies**: Turn resolution **Impact**: Historical flavor, dynamic pressure

6. Diplomacy & International System

Status: IVP constraint exists, no mechanics **Needs**:

- **International Actors**:
    - UN: Peacekeepers, no-fly zones, safe zones
    - NATO: Air strikes (1994-1995), intervention threat
    - EU: Recognition politics, diplomatic pressure
    - USA: Engagement increases over time, Dayton broker
    - Russia: Serbia support, Security Council vetoes
    - Neighboring states: Croatia, Serbia (support for respective sides)
- **Diplomatic Actions** (player options):
    - Appeal for intervention
    - Negotiate ceasefires
    - Request peacekeepers
    - Seek recognition
    - Coordinate with allies
- **International Responses** (driven by IVP):
    - Low IVP: Minimal engagement
    - Medium IVP: Arms embargoes, sanctions
    - High IVP: No-fly zones, safe zones
    - Critical IVP: NATO strikes, forced negotiations

Implementation Priority: MEDIUM **Estimated Work**: 5-6 hours **Dependencies**: Event system **Impact**: Models external constraints that shaped the war

7. Economy & Resources

Status: Not implemented **Needs**:

- **Economic Model** (simple):
  - Population = economic capacity
  - War = economic degradation
  - Lost territory = lost economy
  - Exhaustion partially driven by economic collapse
- **Resource Types**:
  - Manpower (population)
  - Industrial capacity (Tuzla, Zenica, Sarajevo = key)
  - External support (Serbia → RS, Croatia → HVO/RBiH)
  - Black market (everyone)
- **Economic Effects**:
  - Low economy = slower unit recruitment
  - Economic collapse = exhaustion increases faster
  - Population loss = long-term capacity reduction

Implementation Priority: LOW **Estimated Work**: 4-5 hours **Dependencies**: None **Impact**: Additional strategic layer, but not critical

8. AI System

Status: Not implemented **Needs**:

- **AI Behaviors** (for non-player factions):
  - Strategic priorities (defend key areas, contest corridors)
  - Opportunistic attacks (when player weak)
  - Defensive reactions (reinforce threatened areas)
  - Constraint awareness (if exhausted, avoid offensives)
- **Difficulty Levels**:
  - Easy: AI makes mistakes, poor coordination
  - Normal: Competent defense, occasional offensives
  - Hard: Historical accuracy, aggressive when able

    - Very Hard: Optimal play, ruthless
- **Historical Constraints**:
    - AI should respect historical patterns
    - RS doesn't abandon Posavina Corridor
    - Bihać 5th Corps holds pocket (stubbornly)
    - Sarajevo never falls (even when could have)

Implementation Priority: LOW (multiplayer more important) **Estimated Work**: 10-15 hours **Dependencies**: All core systems **Impact**: Single-player experience

Enhancements (Future)

9. Enhanced UI/UX

Needs:

- **Better Visualizations**:
    - Supply route tracing (lines on map)
    - JNA garrison icons (military symbols)
    - Corridor status overlays
    - Animated control changes
    - Battle markers
- **Improved Panels**:
    - Tabbed interface for detailed data
    - Unit list with filters
    - Historical timeline
    - Statistics dashboard
    - Comparison tools
- **Quality of Life**:
    - Save/load system
    - Undo turn
    - Fast forward
    - Speed controls
    - Tooltips everywhere

Implementation Priority: LOW **Estimated Work**: 8-12 hours **Dependencies**: None **Impact**: User experience, accessibility

10. Campaign Mode

Needs:

- **Scenario System**:
  - Start from different dates (Sept 1991, April 1992, 1993, 1994, 1995)
  - What-if scenarios (What if Posavina fell? What if NATO earlier?)
  - Faction-specific campaigns (RS defense, RBiH survival, HVO expansion)
- **Victory Conditions** (optional, against the game's philosophy):
  - Survival-focused: "Hold key territories until Dayton"
  - Maximalist: "Control X% of territory by end"
  - Minimalist: "Maintain existence as state"
- **Historical Benchmarks**:
  - Compare player outcome to historical reality
  - "RS controls 10% less territory than historical"
  - "War ended 6 months earlier due to exhaustion"

Implementation Priority: VERY LOW **Estimated Work**: 6-10 hours **Dependencies**: All core systems complete **Impact**: Replayability, educational value

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Next Steps

Phase 6: Make It Playable (Now - Next 2-3 weeks)

Goal: Complete the core gameplay loop so turns are interactive and meaningful

Immediate Tasks (Priority Order):

1. **Turn Resolution System** (Week 1)
   - [ ] Create turn phase structure
   - [ ] Implement operations phase (process actions)
   - [ ] Implement supply phase (trace routes)
   - [ ] Implement displacement phase (refugee simulation)
   - [ ] Implement exhaustion phase (constraint accumulation)
   - [ ] Add resolution summary UI

2. **Military Units System** (Week 1-2)
   - [ ] Create brigade data structure
   - [ ] Define starting units (109+ brigades)
   - [ ] Implement Corps organization
   - [ ] Add unit display panel
   - [ ] Create unit selection/management UI
   - [ ] Link units to municipalities
3. **Combat Resolution** (Week 2)
   - [ ] Design combat algorithm
   - [ ] Implement Tactical Group formation
   - [ ] Create combat resolution function
   - [ ] Add combat results processing
   - [ ] Implement coercive takeover variant
   - [ ] Create combat report UI
4. **Supply System** (Week 2-3)
   - [ ] Define supply sources (borders, cities)
   - [ ] Implement supply tracing algorithm
   - [ ] Add supply status to municipalities
   - [ ] Calculate supply effects on units
   - [ ] Create supply overlay map mode
   - [ ] Add isolated pocket warnings
5. **Testing & Balancing** (Week 3)
   - [ ] Playtest full turn cycle
   - [ ] Balance constraint accumulation rates
   - [ ] Tune combat outcomes
   - [ ] Verify historical accuracy
   - [ ] Fix bugs and edge cases

Success Criteria:

- Can play from Sept 1991 to Dayton (Nov 1995)
- Can conduct military operations
- Can flip municipalities through combat
- Supply system creates strategic constraints
- Constraints force eventual settlement
- No game-breaking bugs

Phase 7: Events & Polish (Weeks 4-6)

Goal: Add historical events, diplomacy, and UI polish

Tasks:

1. **Event System**
   - [ ] Implement historical event triggers
   - [ ] Create random event generator
   - [ ] Add event notification UI
   - [ ] Test event impact on gameplay
2. **Diplomacy**
   - [ ] Define international actors
   - [ ] Implement diplomatic actions
   - [ ] Create international response system
   - [ ] Add diplomacy UI panel
3. **UI Polish**
   - [ ] Improve map visuals
   - [ ] Add animations
   - [ ] Enhance panel layouts
   - [ ] Add tooltips everywhere
   - [ ] Improve mobile responsiveness
4. **Documentation**
   - [ ] In-game tutorial
   - [ ] Historical context panels
   - [ ] Strategy guide
   - [ ] Update this master document

Phase 8: Advanced Features (Weeks 7-12)

Goal: AI, economy, campaign mode, multiplayer

Tasks (flexible priority):

1. **AI System**
   - [ ] Basic AI decision-making
   - [ ] Difficulty levels
   - [ ] Historical behavior patterns
   - [ ] Testing and tuning
2. **Economy**

- [ ] Economic model
- [ ] Resource tracking
- [ ] Economic effects on gameplay
- [ ] Economic collapse mechanics

3. **Campaign Mode**
   - [ ] Scenario system
   - [ ] Historical benchmarks
   - [ ] Victory conditions (optional)
   - [ ] What-if scenarios
4. **Multiplayer** (if desired)
   - [ ] Hot-seat implementation
   - [ ] Online play infrastructure
   - [ ] Synchronized state management
   - [ ] Multiplayer lobby/matchmaking

Long-Term Roadmap

Version 1.0 - "Playable War" (Target: 3 months)

- ✅ All core systems complete
- ✅ Full turn cycle working
- ✅ Combat, supply, units operational
- ✅ Events and diplomacy implemented
- ✅ UI polished and intuitive
- ✅ Tested and balanced
- ✅ Documentation complete

Version 1.5 - "Historical Depth" (Target: 6 months)

- ✅ AI opponents
- ✅ Campaign scenarios
- ✅ Advanced economic model
- ✅ Extended timeline (1990-1996)
- ✅ Post-war consequences
- ✅ Educational content integrated

Version 2.0 - "Beyond Bosnia" (Target: 12 months)

- ❓ Croatia (1991-1995)
- ❓ Slovenia (1991 - 10 day war)
- ❓ Kosovo (1998-1999)
- ❓ Entire Yugoslav Wars (1991-2001)
- ❓ Unified campaign mode across all conflicts

Version 3.0 - "Platform" (Target: 18+ months)

- ❓ Web-based multiplayer
- ❓ Mod support (custom scenarios)
- ❓ Community content
- ❓ Educational partnerships (universities, museums)
- ❓ Mobile app versions
- ❓ Professional historical consultants

Design Principles (Ongoing)

Historical Accuracy

- Every data point sourced from historical records
- Consultant review for sensitive content
- Primary sources preferred over secondary
- Acknowledge uncertainties and debates

Ethical Design

- Never gamify human suffering
- No points for atrocities
- Civilian harm tracked but never displayed as score
- Respectful representation of all sides
- Educational framing always present

Strategic Depth

- Constraints create meaningful choices

- No easy victories
- Trade-offs in every decision
- Long-term consequences
- Exhaustion and pressure model reality

Accessibility

- Intuitive UI
- Clear feedback
- Helpful tutorials
- Multiple difficulty levels (when AI exists)
- Comprehensive documentation

Educational Value

- Historical context integrated
- Primary source references
- Encourage critical thinking
- Acknowledge complexity
- Humanize the conflict

Project Statistics (Current)

Code Metrics:

- Total Lines: ~4,800
- CSS: ~1,400 lines
- JavaScript: ~3,200 lines
- HTML: ~200 lines
- File Size: 200KB

Data Coverage:

- Municipalities: 109 (100%)
- Adjacencies: 109 mapped (100%)
- JNA Garrisons: 24 major (80% estimated)

- Strategic Corridors: 8 (complete)
- Ethnic Data: 109 (100%, 1991 census)
- Election Data: 109 (100%, 1990 elections)

Systems Completion:

- Municipality System: 100%
- Control Stability: 90% (could expand)
- Flip Mechanics: 60% (framework complete, needs combat)
- Declaration System: 100%
- Constraint System: 80% (tracking works, effects need implementation)
- Turn System: 60% (structure works, resolution incomplete)
- Historical Data: 100% (for current scope)
- Map & UI: 85% (functional, could be prettier)
- Combat: 0%
- Units: 0%
- Supply: 20% (framework only)
- Events: 10% (framework only)
- Diplomacy: 20% (IVP exists, no mechanics)
- AI: 0%
- Economy: 0%

Overall Completion: ~40-45%

Playability: ~60%

- Can navigate turns
- Can make declaration decisions
- Can view strategic intelligence
- Cannot conduct combat operations yet
- Cannot manage units yet
- Cannot affect supply yet

Key Documents

Created During Development:

1. **A_War_Without_Victory_Core_Rulebook_v1_3.docx**
    - Game rules and mechanics specification
    - Control system design
    - Constraint system design
    - Victory/settlement conditions
2. **A_War_Without_Victory_Systems_And_Mechanics_Manual_v1_1.docx**
    - Detailed mechanics documentation
    - Formula specifications
    - Implementation notes
3. **UI_Design_Research_And_Recommendations.md**
    - UI/UX design principles
    - Layout recommendations
    - Accessibility considerations
4. **Control_Formula_Demonstration_v2.md**
    - Stability calculation examples
    - Step-by-step demonstrations
    - Edge case handling
5. **Control_Stability_And_Flip_System_Documentation.md**
    - Comprehensive stability system docs
    - Flip mechanics specification
    - Historical examples
6. **Declaration_System_Hybrid_Implementation.md**
    - Declaration timing mechanics
    - Pressure calculations
    - Historical accuracy notes
7. **Declaration_System_Implementation_Summary.md**
    - Implementation guide
    - Code examples
    - Testing procedures
8. **INTEGRATION_GUIDE.md**
    - Historical data integration steps
    - Function reference

- Usage examples

9. **QUICK_REFERENCE.md**
    - Developer cheat sheet
    - Key municipality IDs
    - Function quick reference
10. **GEOGRAPHIC_REFERENCE.md**
    - Strategic context
    - Regional breakdowns
    - Corridor analysis
11. **historical_data.js**
    - Municipality adjacencies
    - JNA garrisons
    - Strategic corridors
    - Importance ratings
12. **historical_data_integration.js**
    - Integration functions
    - Query functions
    - Calculation functions
13. **INTEGRATION_VERIFICATION.md**
    - Testing guide
    - Verification steps
    - Troubleshooting
14. **BUG_FIXES_ROUND2.md**
    - Bug fixes log
    - Syntax errors resolved
    - Scope issues fixed
15. **EMOJIS_REMOVED.md**
    - Emoji removal log
    - Character encoding fixes
    - Symbol guide
16. **THIS DOCUMENT** (Master Project Documentation)
    - Complete project overview

- Development history
- Remaining work
- Roadmap

Acknowledgments & Sources

Historical Sources

- 1991 Yugoslav Census Data
- 1990 BiH Municipal Election Results
- ICTY (International Criminal Tribunal for the former Yugoslavia) documents
- UN reports and resolutions
- Academic histories of the conflict
- JNA deployment records (declassified sources)
- Contemporaneous news reports

Technical Inspiration

- Paradox Interactive grand strategy games (Europa Universalis, Hearts of Iron)
- GMT Games (For the People, Paths of Glory - constraint-driven design)
- Matrix Games (Gary Grigsby series - detail orientation)
- Francis Tresham design philosophy (1829, Civilization - historical systems)

Design Philosophy

- Brenda Romero's Train (ethical game design)
- Molleindustria's work (games as critical reflection)
- That Dragon, Cancer (respectful treatment of tragedy)
- Papers, Please (constraint-driven moral choices)

Contact & Contribution

Project Status: Active Development
License: TBD (likely open source with ethical use restrictions)
Looking For: Historical consultants, playtesters, developers, translators

Ethical Commitments:

- This game will never celebrate violence
- It will never minimize suffering
- It will always respect the victims
- It will seek to educate, not entertain through tragedy
- It will acknowledge all perspectives while maintaining historical accuracy

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Conclusion

"A War Without Victory" is not just a game - it's an attempt to model one of the late 20th century's most complex and tragic conflicts with the respect and nuance it deserves.

We are 40-45% complete with:

- ✅ Solid historical foundation
- ✅ Robust data integration
- ✅ Core systems designed and partially implemented
- ✅ Clear vision and ethical framework
- ✅ Comprehensive documentation

The next phase is making it playable:

- Add combat resolution
- Implement military units
- Complete turn resolution
- Integrate supply system
- Test and balance

The goal is to create something that:

- Educates about the conflict
- Models the constraints that shaped it
- Respects those who suffered
- Challenges players to think critically
- Never provides easy answers

There are no victory conditions. Only survival, settlement, and understanding.

Document Version: 1.0
Last Updated: January 17, 2026
Status: Active Development - v6 Complete, v7 (Playability) In Progress