STATEMENT OF WORK (SOW)

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F1 Race Prediction & Simulation Platform

Document Version: 1.0
Date: November 24, 2025
Prepared For: Antigravity Development Team
Project Owner: [Your Name/Company]
Document Status: Final

1. EXECUTIVE SUMMARY

1.1 Project Overview

This Statement of Work outlines the development of a comprehensive **Formula 1 Race Prediction & Simulation Platform**—an advanced machine learning-powered system that predicts race outcomes, optimizes pit stop strategies, simulates lap-by-lap race scenarios, and provides real-time analytics based on historical and live Formula 1 data.

1.2 Project Vision

To create an industry-leading F1 analytics platform that rivals the internal strategic tools used by professional F1 teams, offering predictive capabilities across race winners, grid positions, tyre strategies, weather impacts, and dynamic race simulations.

1.3 Target Outcomes

- **Race Winner Prediction:** 85%+ accuracy for race outcome predictions
- **Strategy Optimization:** Real-time pit stop and tyre strategy recommendations
- **Lap-by-Lap Simulation:** Complete race simulation with position changes
- **Weather Impact Analysis:** Dynamic predictions based on changing conditions
- **Historical Analysis:** Comprehensive database spanning 2014-2025 seasons

2. PROJECT SCOPE

2.1 In-Scope Features

Phase 1: Core Prediction Engine (MVP)

1. **Historical Data Integration**
    - Race results (2014-2025)
    - Qualifying session data
    - Practice session data (FP1, FP2, FP3)
    - Driver and constructor standings
    - Circuit characteristics and track data
2. **Basic Prediction Models**
    - Race winner prediction
    - Podium (Top 3) prediction
    - Grid position analysis
    - Weather condition impact (Dry vs Wet vs Mixed)
3. **Simple Strategy Recommendations**
    - 1-stop, 2-stop, 3-stop strategy suggestions
    - Basic tyre compound recommendations (Soft/Medium/Hard)
    - Pit stop window identification
4. **Data Visualization Dashboard**
    - Driver performance charts
    - Historical race analysis
    - Prediction confidence scores
    - Basic race statistics

Phase 2: Enhanced Analytics & Simulation

5. **Lap-by-Lap Race Simulation**
    - Complete race simulation from lights-out to checkered flag
    - Position tracking for all 20 drivers
    - Lap time predictions for each driver
    - Gap analysis and delta times
    - DRS zone optimization
6. **Advanced Tyre Strategy Module**
    - Tyre degradation modeling for each compound
    - Track temperature impact on tyre performance
    - Optimal pit stop timing (undercut/overcut scenarios)
    - Tyre allocation strategy
    - Compound performance across different circuits
7. **Qualifying Predictions**
    - Q1, Q2, Q3 advancement predictions
    - Pole position probability
    - Based on FP1, FP2, FP3 performance analysis
    - Track evolution modeling
8. **Dynamic Weather Integration**
    - Hour-by-hour weather forecasting
    - Rain probability and intensity predictions
    - Wet-to-dry track transition modeling
    - Intermediate/Wet tyre window optimization
    - Temperature and humidity impact analysis

Phase 3: Advanced Race Intelligence

9. **Safety Car & Race Incidents**
    - Safety Car (SC) deployment probability
    - Virtual Safety Car (VSC) scenarios
    - Strategic impact of SC on pit stops
    - Red flag scenario modeling
    - Free tyre change opportunities
10. **Car Performance & Reliability**
    - Power unit performance modeling
    - Aerodynamic efficiency by circuit type
    - Reliability predictions and DNF probability
    - Upgrade impact analysis
    - Team-specific performance trends
11. **Driver & Team Analysis**
    - Driver form and recent performance trends
    - Head-to-head teammate comparisons
    - Team strategy pattern recognition
    - Driver-circuit affinity analysis
    - Historical performance at specific tracks

12. **Multi-Variable Position Prediction**
    - Overtaking probability calculations
    - Traffic management and blue flag impact
    - Fuel load effect on lap times
    - Backmarker influence on race outcomes

Phase 4: Real-Time & Advanced Features

13. **Live Race Integration** (if feasible)
    - Real-time position tracking
    - Live strategy updates and adjustments
    - Dynamic prediction recalculation during race
    - Gap analysis with live timing data
    - Incident impact assessment
14. **What-If Scenario Engine**
    - Alternative strategy simulation
    - "What if driver X pitted on lap Y?" analysis
    - Different weather scenario testing
    - Grid position change impact
    - Driver substitution modeling
15. **Post-Race Analysis**
    - Actual vs predicted comparison
    - Strategy effectiveness review
    - Model performance evaluation
    - Learning and model updates
    - Detailed race report generation
16. **Machine Learning Optimization**
    - Continuous model improvement
    - Feature importance analysis
    - Hyperparameter tuning
    - Ensemble model integration
    - Deep learning LSTM/RNN implementation

2.2 Out-of-Scope

The following items are **NOT** included in this project:

- Mobile application development (web-only initially)
- Team radio analysis (unless data becomes publicly available)
- Driver/team proprietary telemetry data
- Integration with betting platforms
- Commercial licensing or white-labeling
- Hardware or IoT device integration
- 3D race visualization or gaming elements

3. TECHNICAL SPECIFICATIONS

3.1 System Architecture

Frontend

- **Framework:** React 18+ with TypeScript
- **UI Library:** Material-UI (MUI) or Tailwind CSS
- **State Management:** Redux Toolkit or Zustand
- **Data Visualization:** D3.js, Chart.js, or Recharts
- **Real-time Updates:** WebSocket (Socket.io)

Backend

- **Language:** Python 3.10+
- **Framework:** FastAPI or Django REST Framework
- **Machine Learning:** scikit-learn, TensorFlow, PyTorch
- **Data Processing:** pandas, NumPy
- **Task Queue:** Celery with Redis
- **API Gateway:** NGINX or Kong

Database

- **Primary Database:** PostgreSQL 15+ (relational data)
- **Time-Series Data:** TimescaleDB (lap times, telemetry)
- **Cache Layer:** Redis
- **Search Engine:** Elasticsearch (optional for advanced search)

Data Sources & APIs

1. **OpenF1 API** - Real-time and historical F1 data
2. **Ergast F1 API (Jolpica Mirror)** - Historical race data, standings
3. **FastF1 Python Library** - Telemetry and timing data
4. **Weather APIs** - OpenWeatherMap or Weather.com API
5. **Web Scraping** (if necessary) - F1.com, FIA official documents

Machine Learning Stack

- **Frameworks:** scikit-learn, XGBoost, LightGBM
- **Deep Learning:** TensorFlow/Keras or PyTorch
- **Model Types:**
  - Random Forest (baseline)
  - Gradient Boosting (XGBoost, LightGBM)
  - Neural Networks (MLP)
  - LSTM/RNN (for sequence prediction)
  - Ensemble models (stacking/voting)

Deployment & Infrastructure

- **Cloud Provider:** AWS, Google Cloud, or Azure
- **Containerization:** Docker
- **Orchestration:** Kubernetes (optional for scale)
- **CI/CD:** GitHub Actions or GitLab CI/CD
- **Monitoring:** Prometheus + Grafana
- **Logging:** ELK Stack (Elasticsearch, Logstash, Kibana)

3.2 Data Requirements

Historical Data Collection

- Race results: 2014-2025 (12 seasons, ~280 races)
- Qualifying data: All sessions (Q1, Q2, Q3)
- Practice sessions: FP1, FP2, FP3 for all race weekends
- Sprint race data: 2021-2025
- Weather data: Historical weather for each race
- Tyre data: Compound choices, stint lengths, degradation
- Pit stop data: Timing, duration, strategy

Real-Time Data Sources

- Live timing during race weekends
- Weather updates (hourly forecasts)
- Session results as they happen
- Driver radio messages (if available)
- Track temperature and conditions

3.3 Machine Learning Models

Model 1: Race Winner Prediction

- **Type:** Multi-class classification
- **Algorithm:** Gradient Boosting + Neural Network ensemble
- **Features:** ~50 features including qualifying position, driver/team historical performance, circuit characteristics, weather conditions, recent form, car reliability metrics

Model 2: Lap Time Prediction

- **Type:** Time-series regression
- **Algorithm:** LSTM Neural Network
- **Features:** Previous lap times, tyre age and compound, fuel load, track position, weather conditions, track temperature

Model 3: Tyre Strategy Optimization

- **Type:** Reinforcement Learning or Optimization
- **Algorithm:** Q-Learning or Linear Programming
- **Features:** Tyre degradation curves, track characteristics, safety car probability, competitor strategies, weather forecast

Model 4: Position Change Predictor

- **Type:** Multi-output regression
- **Algorithm:** Random Forest + XGBoost
- **Features:** Starting grid position, car performance delta, overtaking difficulty by circuit, strategy differential, historical position change data

3.4 Performance Requirements

- **Prediction Latency:** < 2 seconds for race winner prediction
- **Simulation Speed:** Complete 60-lap race simulation in < 30 seconds
- **API Response Time:** < 500ms for standard queries
- **Concurrent Users:** Support 1,000+ simultaneous users
- **Data Update Frequency:** Real-time updates every 1-2 seconds during live races
- **Model Accuracy:**
  - Race winner: 85%+ top-1 accuracy
  - Podium: 75%+ top-3 accuracy
  - Lap time prediction: < 0.5s mean absolute error

3.5 Security Requirements

- HTTPS/TLS encryption for all data transmission
- API authentication using JWT tokens
- Rate limiting: 100 requests/minute per user
- Data encryption at rest (AES-256)
- Regular security audits and penetration testing
- GDPR compliance for user data
- Secure API key management

4. DELIVERABLES

4.1 Phase 1 Deliverables

#	Deliverable	Description
1.1	Data Pipeline	ETL pipeline for historical F1 data ingestion
1.2	Database Schema	Complete PostgreSQL schema with relationships
1.3	MVP Prediction Model	Basic race winner prediction model
1.4	Backend API	REST API with core endpoints
1.5	Dashboard UI	Basic React dashboard with predictions
1.6	Documentation	API documentation and setup guide

4.2 Phase 2 Deliverables

#	Deliverable	Description
2.1	Lap-by-Lap Simulator	Complete race simulation engine
2.2	Tyre Strategy Module	Advanced tyre degradation modeling

#	Deliverable	Description
2.3	Weather Integration	Dynamic weather impact system
2.4	Enhanced Dashboard	Advanced visualizations and charts
2.5	Qualifying Predictor	Q1/Q2/Q3 prediction models
2.6	Testing Suite	Unit tests, integration tests (80% coverage)

4.3 Phase 3 Deliverables

#	Deliverable	Description
3.1	Safety Car Module	SC/VSC/Red Flag scenario modeling
3.2	Reliability Predictor	DNF probability and car performance
3.3	Driver/Team Analytics	Comprehensive performance analysis
3.4	Position Predictor	Multi-variable position change model
3.5	Admin Panel	Backend management interface
3.6	Performance Optimization	System optimization and scaling

4.4 Phase 4 Deliverables

#	Deliverable	Description
4.1	Real-Time Integration	Live race data processing (if feasible)
4.2	What-If Engine	Scenario simulation system
4.3	Post-Race Analysis	Automated analysis and reporting
4.4	ML Model Optimization	Advanced ensemble models, tuning
4.5	User Documentation	Complete user guide and tutorials
4.6	Final Testing & QA	End-to-end testing, bug fixes

4.5 Documentation Deliverables

- Technical Architecture Document
- API Documentation (Swagger/OpenAPI)
- Database Schema and ERD
- Machine Learning Model Documentation
- User Manual and Tutorials
- Deployment Guide
- Maintenance and Operations Manual

4.6 Code & Repository

- GitHub repository with complete source code
- Comprehensive README.md
- Docker configuration files
- CI/CD pipeline configuration

- Database migration scripts
- Sample data and test fixtures

5. PROJECT TIMELINE

5.1 Overall Timeline

Total Duration: 32 weeks (~8 months)
Start Date: [TBD - Insert Start Date]
Expected Completion: [TBD - Insert End Date]

5.2 Phase-Based Timeline

Phase	Duration	Status	Key Deliverables
Phase 1: MVP Development	8 weeks	Planning	Data pipeline, prediction model, basic dashboard
Phase 2: Enhanced Analytics	8 weeks	Planned	Simulation engine, strategy module, weather integration
Phase 3: Advanced Intelligence	8 weeks	Planned	Safety car scenarios, reliability analysis, admin panel
Phase 4: Real-Time & Finalization	8 weeks	Planned	Live integration, what-if engine, model optimization

5.3 Milestone Schedule

Milestone 1: MVP Launch (End of Phase 1)

- Basic race winner prediction functional
- Historical data integrated
- Dashboard operational
- API endpoints working

Milestone 2: Feature Complete (End of Phase 2)

- Lap-by-lap simulation working
- Tyre strategy recommendations
- Weather impact modeling
- Qualifying predictions

Milestone 3: Advanced Features (End of Phase 3)

- Safety car scenarios
- Reliability predictions
- Driver/team analytics
- Admin management panel

Milestone 4: Production Launch (End of Phase 4)

- Real-time integration (if feasible)
- What-if scenario engine
- Post-race analysis
- All models optimized

5.4 Key Dependencies

- API access from OpenF1, Ergast/Jolpica
- Weather API subscription
- Cloud infrastructure setup
- Historical data availability (2014-2025)
- Testing with real race data during F1 season

6. ROLES & RESPONSIBILITIES

6.1 Client Team (Your Side)

Project Owner/Sponsor

- Final decision-making authority
- Requirement clarification
- UAT (User Acceptance Testing)
- Budget approval

Domain Expert (F1 Subject Matter Expert)

- Validate prediction accuracy
- Provide F1 racing insights
- Review strategy recommendations
- Test scenarios validation

Quality Assurance Lead

- Define acceptance criteria
- Conduct UAT
- Report bugs and issues
- Sign-off on deliverables

6.2 Development Team (Antigravity)

Project Manager

- Overall project coordination
- Timeline management
- Risk management
- Stakeholder communication
- Status reports

Solution Architect

- System architecture design
- Technology stack decisions
- Integration strategy
- Performance optimization
- Security best practices

Backend Development Team (2-3 developers)

- Python/FastAPI development
- Database design and optimization
- API development

- Data pipeline implementation
- Background job processing

Machine Learning Engineers (2 engineers)

- Model development and training
- Feature engineering
- Model optimization and tuning
- Performance evaluation
- ML pipeline automation

Frontend Development Team (2 developers)

- React application development
- UI/UX implementation
- Data visualization
- Responsive design
- User interaction flows

Data Engineer

- ETL pipeline development
- Data collection automation
- Database optimization
- Data quality assurance
- Real-time data processing

DevOps Engineer

- Infrastructure setup (AWS/GCP/Azure)
- CI/CD pipeline
- Container orchestration
- Monitoring and logging
- Deployment automation

QA Engineer

- Test plan development
- Automated testing
- Performance testing
- Bug tracking and verification
- Regression testing

UI/UX Designer

- Dashboard design
- User experience flows
- Visual design system
- Responsive layouts
- Interaction prototypes

6.3 Communication Plan

- **Status Meetings:** Weekly (day and time TBD)
- **Sprint Reviews:** Bi-weekly
- **Daily Standups:** Monday-Friday (development team)
- **Status Reports:** Weekly summary via email
- **Communication Channels:**
  - Slack/Discord for daily communication
  - Jira for project tracking
  - Confluence for documentation
  - GitHub for code review
  - Zoom/Google Meet for meetings

7. ASSUMPTIONS & CONSTRAINTS

7.1 Assumptions

1. **Data Availability**
   - OpenF1 API and Ergast API will remain accessible throughout the project
   - Historical data from 2014-2025 is complete and accurate
   - Weather data APIs provide sufficient historical coverage
2. **Technical Infrastructure**
   - Cloud infrastructure (AWS/GCP/Azure) will be available
   - Development team has access to necessary tools and licenses
   - GPU resources available for ML model training
3. **Project Resources**
   - Development team of 8-10 people available
   - Client availability for weekly reviews and feedback
   - Budget sufficient to cover cloud costs, API subscriptions, tools
4. **Legal & Compliance**
   - Use of publicly available F1 data is legally compliant
   - No proprietary or confidential F1 team data required
   - GDPR compliance achievable with standard practices
5. **F1 Season**
   - F1 racing calendar continues as scheduled
   - No major regulation changes affecting data structure
   - API providers maintain data consistency

7.2 Constraints

1. **Data Limitations**
   - Real-time telemetry data may not be publicly available
   - Team radio transcripts may be limited
   - Internal team strategy documents not accessible
   - Some historical data may have gaps
2. **Technical Constraints**
   - Prediction accuracy depends on data quality

- Real-time predictions limited by API update frequency
- Weather forecasting accuracy affects predictions
- Model training requires computational resources

3. **Timeline Constraints**
   - 32-week timeline is fixed
   - F1 season breaks may affect testing
   - Holiday periods may slow development
4. **Budget Constraints**
   - Cloud infrastructure costs within budget
   - API subscription fees impact total cost
   - ML training costs must be managed
   - Third-party tool licenses within budget
5. **Regulatory & Legal**
   - Cannot use proprietary F1 team data
   - Must comply with API terms of service
   - Cannot integrate with betting platforms
   - Data privacy regulations must be followed

8. ACCEPTANCE CRITERIA

8.1 Functional Acceptance Criteria

Phase 1 (MVP)

✓ System predicts race winner with 70%+ accuracy (baseline)
✓ Historical data from 2014-2025 imported
✓ Dashboard displays predictions for upcoming race
✓ API responds within 2 seconds
✓ Weather impact (dry/wet) in predictions
✓ Basic tyre strategy (1-stop, 2-stop, 3-stop) suggested

Phase 2 (Enhanced Analytics)

✓ Lap-by-lap simulation completes 60-lap race in < 30 seconds
✓ Qualifying predictions achieve 65%+ accuracy
✓ Tyre degradation model realistic
✓ Weather integration dynamic
✓ Position changes tracked for all drivers
✓ Dashboard with interactive visualizations

Phase 3 (Advanced Intelligence)

✓ Safety car scenarios modeled
✓ DNF probability calculated
✓ Driver/team performance analytics
✓ Position predictor considers overtaking
✓ Admin panel for data management
✓ System optimized for 1,000+ users

Phase 4 (Real-Time & Finalization)

✓ Real-time data integration functional
✓ What-if scenario engine operational
✓ Post-race analysis automated
✓ ML models achieve 85%+ accuracy
✓ Complete documentation delivered
✓ 80%+ code coverage achieved

8.2 Non-Functional Acceptance Criteria

Performance

- API response time < 500ms (95th percentile)
- Page load time < 3 seconds
- Database queries < 100ms
- System handles 1,000 concurrent users

Reliability

- System uptime: 99.5%
- Daily automated backups
- Graceful error handling
- Data integrity protection

Security

- HTTPS/TLS encryption
- JWT authentication
- Rate limiting enabled
- No SQL injection or XSS vulnerabilities
- Regular security audits

Usability

- Intuitive dashboard
- Mobile-responsive design
- Clear error messages
- WCAG 2.1 AA accessibility

Maintainability

- Code follows style standards
- Comprehensive documentation
- Modular architecture
- Version control best practices

8.3 Testing Requirements

- Unit test coverage: 80%+ backend, 70%+ frontend
- Integration tests for all API endpoints
- End-to-end tests for critical flows
- Performance testing under load
- Security penetration testing

- Cross-browser testing

8.4 User Acceptance Testing (UAT)

- Client conducts UAT for each phase
- Minimum 2-week UAT period
- Critical bugs resolved before acceptance
- Written sign-off required
- Coverage of all core user journeys

9. BUDGET & PAYMENT TERMS

9.1 Cost Breakdown

Development Costs

Phase	Duration	Cost (INR)	Cost (USD)*
Phase 1: MVP	8 weeks	₹12,00,000	$14,400
Phase 2: Enhanced	8 weeks	₹15,00,000	$18,000
Phase 3: Advanced	8 weeks	₹18,00,000	$21,600
Phase 4: Finalization	8 weeks	₹15,00,000	$18,000
Total Development	**32 weeks**	**₹60,00,000**	**$72,000**

*USD conversion at ₹83/$1 (approximate)

Infrastructure & Tools (Estimated Annual)

Item	Annual Cost (INR)	Annual Cost (USD)
Cloud Infrastructure (AWS/GCP)	₹3,60,000	$4,320
Weather API Subscription	₹60,000	$720
Database Hosting	₹1,20,000	$1,440
Monitoring Tools	₹48,000	$576
GPU Compute (ML Training)	₹2,40,000	$2,880
Total Infrastructure	**₹8,28,000**	**$9,936**

Additional Costs

Item	Cost (INR)	Cost (USD)
Project Management	₹6,00,000	$7,200
UI/UX Design	₹3,00,000	$3,600
Testing & QA	₹4,00,000	$4,800
Documentation	₹1,50,000	$1,800
Total Additional	**₹14,50,000**	**$17,400**

GRAND TOTAL

- **Development + Additional:** ₹74,50,000 ($89,400)
- **Infrastructure (First Year):** ₹8,28,000 ($9,936)
- **Total Project Cost:** ₹82,78,000 ($99,336)

9.2 Payment Schedule

Milestone-Based Payments

Milestone	Deliverable	Payment %	Amount (INR)	Trigger
Project Kickoff	Contract Signed	20%	₹14,90,000	Upon signing SOW
Milestone 1	MVP Launch	20%	₹14,90,000	Phase 1 UAT approval
Milestone 2	Feature Complete	20%	₹14,90,000	Phase 2 UAT approval
Milestone 3	Advanced Features	20%	₹14,90,000	Phase 3 UAT approval
Final Delivery	Production Launch	20%	₹14,90,000	Final UAT & go-live
Total		**100%**	**₹74,50,000**	

Infrastructure Payments

- Infrastructure costs billed monthly
- Estimated ₹69,000/month ($830/month)
- First 3 months prepaid: ₹2,07,000 ($2,490)

9.3 Payment Terms

- Payments due within 15 days of invoice
- Wire transfer or online payment accepted
- Late payments incur 2% interest per month
- Infrastructure costs separate from development
- All prices in INR (Indian Rupees)
- Taxes as applicable (GST 18% in India)

9.4 Change Request Pricing

- Minor changes (< 8 hours): No charge
- Medium changes (8-40 hours): ₹3,000/hour ($36/hour)
- Major changes (> 40 hours): SOW amendment required

10. RISK MANAGEMENT

10.1 Identified Risks

High Priority Risks

Risk 1: Data Availability Issues

- **Description:** API becomes unavailable or structure changes
- **Impact:** High
- **Probability:** Medium

- **Mitigation:** Multiple data source fallbacks, local caching, web scraping backup
- **Contingency:** Use FastF1 library, manual data collection

Risk 2: Prediction Accuracy Below Target

- **Description:** ML models fail to achieve 85% accuracy
- **Impact:** High
- **Probability:** Medium
- **Mitigation:** Iterative model development, feature engineering, ensemble approach
- **Contingency:** Lower target, focus on other insights

Risk 3: Timeline Delays

- **Description:** Development falls behind schedule
- **Impact:** Medium
- **Probability:** High
- **Mitigation:** Buffer time, agile methodology, early identification of blockers
- **Contingency:** Descope features, extend timeline

Medium Priority Risks

Risk 4: Team Resource Constraints

- **Description:** Key team members unavailable
- **Impact:** Medium
- **Probability:** Medium
- **Mitigation:** Cross-training, documentation, backup resources
- **Contingency:** Bring in contractors, redistribute workload

Risk 5: Infrastructure Costs Overrun

- **Description:** Cloud and API costs exceed budget
- **Impact:** Medium
- **Probability:** Medium
- **Mitigation:** Cost monitoring, query optimization, efficient ML training
- **Contingency:** Budget reallocation, code optimization

Risk 6: Third-Party API Changes

- **Description:** APIs change structure or access terms
- **Impact:** Medium
- **Probability:** Low
- **Mitigation:** Version pinning, abstraction layer, API monitoring
- **Contingency:** Adapt quickly, use alternatives

Low Priority Risks

Risk 7: F1 Regulation Changes

- **Description:** Major F1 rule changes
- **Impact:** Low
- **Probability:** Low
- **Mitigation:** Follow F1 news, flexible architecture
- **Contingency:** Update models with new features

Risk 8: Security Breach

- **Description:** System compromise or data leak
- **Impact:** High (if occurs)
- **Probability:** Very Low
- **Mitigation:** Security best practices, audits, encryption
- **Contingency:** Incident response plan

10.2 Risk Monitoring

- Weekly risk review in status meetings
- Risk register maintained
- Escalation: PM → Architect → Project Owner

11. CHANGE MANAGEMENT

11.1 Change Request Process

1. Written request submission via project management tool
2. Impact assessment (5 business days)
3. Client approval/rejection
4. Implementation and tracking

11.2 Change Categories

Minor Changes (< 8 hours)

- Bug fixes, UI tweaks, copy updates
- No cost, no timeline impact

Medium Changes (8-40 hours)

- New features within scope
- ₹3,000/hour, 1-2 week impact

Major Changes (> 40 hours)

- Out-of-scope features
- SOW amendment required

11.3 Change Control Board

- **Members:** Project Owner, PM, Solution Architect
- **Decision Making:** Consensus required

12. QUALITY ASSURANCE

12.1 QA Standards

Code Quality

- Peer code reviews
- Automated linting (ESLint, Pylint)
- Consistent formatting (Prettier, Black)
- Cyclomatic complexity < 10

- Function documentation required

Testing Standards

- 80%+ backend, 70%+ frontend coverage
- Integration tests for all endpoints
- E2E tests for critical paths
- Performance and security testing
- Cross-browser compatibility

Defect Management

- Jira tracking
- Severity levels with SLAs
- Critical: 4-hour fix
- High: 24-hour fix
- Medium: 1-week fix
- Low: Next sprint

12.2 QA Process

1. Unit testing during development
2. Code review and merge
3. Integration testing
4. System testing by QA
5. UAT by client
6. Regression testing
7. Production deployment

12.3 Quality Metrics

- Test coverage percentage
- Bug density
- Resolution time
- Regression bugs
- Performance metrics
- User satisfaction

13. MAINTENANCE & SUPPORT

13.1 Warranty Period

- **Duration:** 90 days post-launch
- **Coverage:** Bug fixes, performance issues, data consistency

13.2 Post-Launch Support Options

Option 1: Basic Support

- **Cost:** ₹2,50,000/year
- **Includes:** Bug fixes, email support, monthly reports, security patches

Option 2: Standard Support

- **Cost:** ₹5,00,000/year
- **Includes:** All Basic + priority fixes, phone support, quarterly retraining, feature enhancements (40 hrs/year)

Option 3: Premium Support

- **Cost:** ₹10,00,000/year
- **Includes:** All Standard + 24/7 support, dedicated engineer, monthly retraining, feature enhancements (80 hrs/year)

13.3 Service Level Agreements (SLAs)

Issue Severity	Response Time	Resolution Target
Critical	1 hour	4 hours
High	4 hours	24 hours
Medium	24 hours	5 business days
Low	48 hours	15 business days

13.4 Model Maintenance

- Continuous learning with new data
- Performance monitoring
- Feature updates for new regulations
- Post-race data integration
- API monitoring

14. INTELLECTUAL PROPERTY & LEGAL

14.1 Ownership Rights

- Client owns all developed code
- Client owns all documentation
- Client owns all trained models and data
- Client owns collected database
- IP transfers upon final payment

14.2 License Terms

- Open-source licenses respected
- API data per provider terms
- Client unlimited usage rights

14.3 Confidentiality

- Mutual NDA
- 5-year confidentiality period
- Exceptions for public information, legal requirements

14.4 Warranties & Disclaimers

- System performs as specified
- Predictions are estimates, not guarantees
- Data accuracy depends on sources
- Liability capped at project cost

14.5 Compliance

- GDPR compliance
- Clear TOS for users
- No trademark infringement (disclaimer)
- No betting platform integration

15. SUCCESS CRITERIA

15.1 Project Success Metrics

Technical Success

✓ All 4 phases completed on schedule
✓ Race winner accuracy: 85%+
✓ Podium accuracy: 75%+
✓ Uptime: 99.5%+
✓ Response time: < 500ms (95th percentile)
✓ Test coverage: 80%+ backend, 70%+ frontend
✓ Zero critical vulnerabilities
✓ Complete documentation

Business Success

✓ Client UAT approval
✓ Budget variance < 10%
✓ Timeline variance < 5%
✓ User satisfaction: 8/10+
✓ Support 1,000+ users
✓ Zero data loss

User Success

✓ Dashboard loads < 3 seconds
✓ Intuitive interface
✓ Mobile-responsive
✓ Accurate predictions

15.2 Final Acceptance

- All phases UAT approved
- Production deployment successful
- Documentation delivered
- Source code transferred
- 90-day warranty begins
- Final payment processed
- Project closed

16. APPENDICES

Appendix A: Glossary of Terms

Term	Definition
DRS	Drag Reduction System - Rear wing for overtaking
Undercut	Pit stop strategy to gain position
Overcut	Stay out longer before pitting
VSC	Virtual Safety Car - Speed reduction
DNF	Did Not Finish - Retirement
Stint	One tyre set run
Compound	Tyre type (Soft, Medium, Hard, Intermediate, Wet)
FP1/2/3	Free Practice sessions
Q1/2/3	Qualifying knockout sessions

Appendix B: Reference Documents

- OpenF1 API Documentation
- Ergast F1 API Documentation
- FastF1 Python Library
- FIA F1 Technical Regulations 2025
- F1 Sporting Regulations 2025

Appendix C: Data Sources

- OpenF1 API
- Ergast API (Jolpica Mirror)
- FastF1
- OpenWeatherMap API
- F1.com
- FIA Documents

Appendix D: Technology Stack Summary

Layer	Technology
Frontend	React 18+, TypeScript, Material-UI/Tailwind
Backend	Python 3.10+, FastAPI/Django REST
Database	PostgreSQL 15+, TimescaleDB, Redis
ML/AI	scikit-learn, TensorFlow, PyTorch, XGBoost
DevOps	Docker, Kubernetes, GitHub Actions
Cloud	AWS/GCP/Azure
Monitoring	Prometheus, Grafana, ELK Stack

17. APPROVAL & SIGN-OFF

Client Approval

I have reviewed this Statement of Work and agree to the scope, deliverables, timeline, budget, and terms outlined herein.

Client Signature: _____
Name: [Your Name]
Title: Project Owner
Date: _____

Development Partner Approval

We accept this Statement of Work and commit to delivering the project as specified.

Developer Signature: _____
Name: [Antigravity Representative]
Title: [Title]
Date: _____

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