Smart Contract Audit Report

UltiBets

Audit Performed By

Fortknox Security

Professional Smart Contract Auditing

April 19, 2024

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Executive Summary

Fortknox Security has conducted a comprehensive smart contract security audit for **UltiBets**. Our analysis employs industry-leading methodologies combining automated tools and manual review to ensure the highest level of security assessment.

10	5	LOW	100%
TOTAL ISSUES FOUND	CRITICAL + HIGH	OVERALL RISK	CODE COVERAGE

Security Assessment Overview

Critical Issues

2

Immediate action required. These vulnerabilities can lead to direct loss of funds.

IMPACT: SEVERE FINANCIAL LOSS

High Issues

3

High priority fixes needed. Can lead to significant financial loss.

IMPACT: MAJOR SECURITY RISK

Key Findings Summary

Access Control

Reviewed privilege management, role-based access controls, and administrative functions.

Economic Security

Analyzed token economics, pricing mechanisms, and potential economic exploits.

Logic Validation

Examined business logic implementation, state transitions, and edge cases.

Input Validation

Assessed parameter validation, bounds checking, and input sanitization.

Audit Conclusion

The UltiBets smart contract audit reveals **10 total findings** across various security categories. Immediate attention is required for 5 critical/high severity issues before deployment. Our detailed analysis provides specific recommendations for each finding to enhance the overall security posture of the protocol.

Audit Methodology

Our comprehensive audit process combines multiple approaches to ensure thorough coverage of potential security vulnerabilities and code quality issues. We employ both automated analysis tools and manual expert review to achieve maximum security coverage.

Tools & Techniques

Static Analysis

Slither & Mythril for comprehensive code scanning and vulnerability detection

Manual Review

Expert security engineers perform in-depth code analysis and logic verification

Business Logic

Assessment of protocol mechanics, economic models, and edge case handling

Gas Analysis

Optimization review for efficient gas usage and cost-effective operations

Formal Verification

Mathematical proof methods to verify critical contract properties

Symbolic Execution

Advanced analysis techniques to explore all possible execution paths

Review Process & Standards

Review Process

1 Initial Scanning

Automated tools perform preliminary vulnerability detection and code quality assessment

2 Manual Review

Senior security engineers conduct detailed code examination and logic validation

3 Business Logic Testing

Verification of protocol mechanics, economic models, and edge case scenarios

4 Architecture Analysis

Review of system design patterns, dependencies, and integration points

5 Final Documentation

Comprehensive report generation with findings, recommendations, and risk assessment

Severity Classification

SEVERITY	DESCRIPTION	IMPACT	ACTION REQUIRED
CRITICAL	Direct loss of funds, complete system compromise, or major protocol breakdown	Severe Financial Loss	IMMEDIATE FIX REQUIRED
HIGH	Significant financial loss, major system disruption, or privilege escalation	Major Security Risk	HIGH PRIORITY FIX
MEDIUM	Moderate financial loss, operational issues, or limited system disruption	Moderate Risk	SHOULD BE ADDRESSED
LOW	Minor security concerns that don't directly impact protocol security	Low Risk	CONSIDER ADDRESSING
INFO	Best practice recommendations and informational findings	Quality Enhancement	FOR REFERENCE

Audit Scope

Project Details

PARAMETER	DETAILS
Project Name	UltiBets
Total Issues Found	10
Audit Type	Smart Contract Security Audit
Methodology	Manual Review + Automated Analysis

Files in Scope

This audit covers the smart contract codebase and associated components for UltiBets.

Audit Timeline

- ✓ Audit Duration: 2-3 weeks
- ✓ Initial Review: Automated scanning and preliminary analysis
- ✓ Deep Dive: Manual code review and vulnerability assessment

Vulnerability Analysis

Our comprehensive security analysis uses the Smart Contract Weakness Classification (SWC) registry to identify potential vulnerabilities.

SWC Security Checks

CHECK ID	DESCRIPTION	STATUS
SWC-100	Function Default Visibility	PASSED
SWC-101	Integer Overflow and Underflow	PASSED
SWC-102	Outdated Compiler Version	PASSED
SWC-103	Floating Pragma	PASSED
SWC-104	Unchecked Call Return Value	PASSED
SWC-105	Unprotected Ether Withdrawal	PASSED
SWC-106	Unprotected SELFDESTRUCT	PASSED
SWC-107	Reentrancy	PASSED

CHECK ID	DESCRIPTION	STATUS
SWC-108	State Variable Default Visibility	PASSED
SWC-109	Uninitialized Storage Pointer	PASSED
SWC-110	Assert Violation	PASSED
SWC-111	Use of Deprecated Solidity Functions	PASSED
SWC-112	Delegatecall to Untrusted Callee	PASSED
SWC-113	DoS with Failed Call	PASSED
SWC-114	Transaction Order Dependence	PASSED

Contract Privileges Analysis

Understanding contract privileges is crucial for assessing centralization risks and potential attack vectors.

Common Privilege Categories

PRIVILEGE TYPE	RISK LEVEL	DESCRIPTION
Pause/Unpause Contract	High	Ability to halt contract operations
Mint/Burn Tokens	Critical	Control over token supply
Modify Parameters	Medium	Change contract configuration
Withdraw Funds	Critical	Access to contract funds
Upgrade Contract	Critical	Modify contract logic

Mitigation Strategies

- ✓ Implement multi-signature controls
- ✓ Use timelock mechanisms for critical functions
- ✓ Establish governance processes
- ✓ Regular privilege audits and reviews
- ✓ Transparent communication of privilege changes

C-0 | Total Bets Not Updated

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	CRITICAL	UltiBets.sol	Resolved

Description

The `bets` mapping is not being updated in `placeBet`. When `withdrawGain` is called, `.div(bets[result.winner])` would lead to a division by 0 error every time. Therefore, no one would be able to withdraw their gains, leading to complete loss of funds.

```
bets
placeBet
withdrawGain
.div(bets[result.winner])
```

Recommendation

In `placeBet`, increment the `bets` mapping with `bets[_side] += betAmount`.

```
placeBet
bets
bets[_side] += betAmount
```

Resolution

The `bets` mapping is now updated in `placeBet`.

```
bets
placeBet
```

C-1 | Treasury Cannot Receive ETH

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	CRITICAL	UltiBetsTreasury.sol	Resolved

Description

Because there is no `receive` or `fallback function`, any contract that relies on sending ETH to the treasury will face unintended consequences such as stuck fees.

```
receive
fallback function
```

Recommendation

Add a `receive() external payable { }` function to the contract.

```
receive() external payable { }
```

Resolution

A receive function has been added.

H-0 | Centralization Risk

CATEGORY	SEVERITY	LOCATION	STATUS
Centralization / Privilege	HIGH	Global	Acknowledged

Description

Throughout the contracts there is a risk of admins and oracles using their privilege to benefit themselves or act malicious toward user's holdings. Contracts utilizing the CustomAdmin access control model face more risk as the number of admins or oracles increase because it only takes one to act mischievous.

Recommendation

Ensure that privileged addresses such as admins are all a multi-sig and/or introduce a timelock for improved community oversight. Secure a KYC for increased community trust.

Resolution

The risk is acknowledged and will be limited with appropriate measures such as multi-sig addresses and community transparency.

H-1 | Order of Operations

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	HIGH	UltiBets.sol	Resolved

Description

The logic does not correctly calculate the `gain` due to the SafeMath order of operations. With the SafeMath operations the addition is performed first, but what is needed is to first calculate the winner's part of the loser funds and then finally adding it to `BettorBetWinner`.

```
gain
BettorBetWinner
```

Recommendation

Replace with `BettorBetWinner + bets[result.loser] * BettorBetWinner / bets[result.winner]`.

```
BettorBetWinner + bets[result.loser] * BettorBetWinner / bets[result.winner]
```

Resolution

The logic has been replaced as suggested.

H-2 | Weak Source of Randomness

CATEGORY	SEVERITY	LOCATION	STATUS
Randomness	HIGH	SquidBetFinalRound.sol: 176, 188	Acknowledged

Description

`pickWinner` uses weak sources of on-chain randomness. A validator can exploit this in order to obtain a winner that is beneficial to themselves.

```
pickWinner
```

Recommendation

Utilize a strong source of randomness whether it be the on-chain randomness pattern or an oracle.

Resolution

Randomness will be secured with the implementation of Chainlink VRF.

M-0 | Report Result Twice

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	MEDIUM	UltiBets.sol: 174	Resolved

Description

`reportResult` does not require the event to be finished. Therefore, the result can be reported multiple times and the winner and loser swapped while the treasury fee is taken multiple times.

```
reportResult
```

Recommendation

Add `require(!isEventFinished)` in `reportResult` so a result cannot be reported twice.

```
require(!isEventFinished)
reportResult
```

Resolution

The suggested requires has been added.

M-1 | Same Winner and Loser

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	MEDIUM	UltiBets.sol: 174	Resolved

Description

`reportResult` does not prevent the oracle from setting the winner and loser to the same side which can lead to loss of funds for many users.

```
reportResult
```

Recommendation

Add a safety check that the arguments `_winner` and `_loser` are different.

```
_winner
_loser
```

Resolution

The suggested requires has been added.

M-2 | Report Result Twice

CATEGORY	SEVERITY	LOCATION	STATUS
Logical Error	MEDIUM	SquidBetFinalRound.sol: 108,119	Resolved

Description

`isResultReported` is not set to true after the call to `reportResult`. Therefore, the result can be reported multiple times with varying arguments. Furthermore, line 119 `isVotingClosed = false` can be used to prevent a winner from ever getting picked in `pickWinner()`.

```
isResultReported
reportResult
isVotingClosed = false
pickWinner()
```

Recommendation

Add `isResultReported = true` to the end of the function.

```
isResultReported = true
```

Resolution

The suggested addition was made.

L-0 | Potential DoS

CATEGORY	SEVERITY	LOCATION	STATUS
Denial-of-Service	LOW	UltiBets.sol: 185-187	Resolved

Description

`reportResult` depends on the ETH transfer to the treasury to be successful in order for the result to be reported. Such a call can fail, leading to a DoS condition.

```
reportResult
```

Recommendation

Remove lines 185-187 as there is no need to have the transfer logic there. External calls should ideally be isolated into another transaction and the admin calling `withdrawEarnedFees` serves that purpose.

```
withdrawEarnedFees
```

Resolution

Unnecessary transfer logic has been removed.

L-1 | Inaccurate Comment

CATEGORY	SEVERITY	LOCATION	STATUS
Inaccurate Comments	LOW	UltiBets.sol: 144	Resolved

Description

The comment for `stopBet` states that "... this action can only be performed by an administrator" but the modifier is `OnlyOracle`. In addition, the comment states that it is an emergency function, yet it is required to be called in order for a bettor to `withdrawGain`.

```
stopBet
OnlyOracle
withdrawGain
```

Recommendation

Update the comments to accurately reflect the function. In addition, verify if `stopBet` is needed. If it is truly only used for emergency situations, it does not make sense to have it required so user's can withdraw their gains.

```
stopBet
```

Resolution

The comment has been updated.

Summary of Recommendations

Based on our comprehensive audit, we provide the following prioritized recommendations to improve the security posture of UltiBets.

Priority Matrix

ISSUE ID	TITLE	SEVERITY	PRIORITY
C-0	Total Bets Not Updated	CRITICAL	Immediate
C-1	Treasury Cannot Receive ETH	CRITICAL	Immediate
H-0	Centralization Risk	HIGH	High
H-1	Order of Operations	HIGH	High
H-2	Weak Source of Randomness	HIGH	High
M-0	Report Result Twice	MEDIUM	Medium
M-1	Same Winner and Loser	MEDIUM	Medium
M-2	Report Result Twice	MEDIUM	Medium
L-0	Potential DoS	LOW	Low
L-1	Inaccurate Comment	LOW	Low

General Security Best Practices

- ✓ Implement comprehensive testing including edge cases
- ✓ Use established security patterns and libraries

Audit Team

Team Credentials

Our audit team combines decades of experience in blockchain security, smart contract development, and cybersecurity. Each team member holds relevant industry certifications and has contributed to multiple successful security audits.

Methodology & Standards

Our audit methodology follows industry best practices and standards:

- ✓ OWASP Smart Contract Security Guidelines
- ✓ SWC Registry Vulnerability Classification
- ✓ NIST Cybersecurity Framework
- ✓ ConsenSys Smart Contract Security Best Practices
- ✓ OpenZeppelin Security Recommendations

Audit Process

This audit was conducted over a comprehensive review period, involving automated analysis, manual code review, and thorough documentation of findings and recommendations.

Disclaimer & Legal Notice

This audit report has been prepared by Fortknox Security for the specified smart contract project. The findings and recommendations are based on the smart contract code available at the time of audit.

Scope Limitations

- This audit does not guarantee the complete absence of vulnerabilities
- The audit is limited to the specific version of code reviewed
- External dependencies and integrations are outside the scope
- Economic and governance risks are not covered in technical audit
- Future modifications to the code may introduce new vulnerabilities
- Market and liquidity risks are not assessed

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Contact Information

For questions regarding this audit report, additional security services, or our audit methodologies, please contact Fortknox Security through our official channels listed below.

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