GUARDIAN AUDITS

SMART CONTRACT SECURITY AUDIT OF

Hamsters of Opera

Summary - Preliminary Report

Audit Firm - Guardian Audits

Client Firm - Hamsters of Opera

Final Report Date - Preliminary Report

Audit Summary

After a line by line manual analysis and automated review, Guardian Audits has concluded that:

- Hamsters of Opera's smart contracts have a MEDIUM RISK SEVERITY
- Hamsters of Opera's smart contracts have an **ACTIVE OWNERSHIP**
- Important operator privileges – `setTaxOffice`, `setTaxRate`, `setLockUp`, `setOperator`, `allocateSeignorage`, `hamsterWheelSetLockUp`, `setBondDepletionFloorPercent`, `setBootstrap`, `setDiscountPercent`, `setExtraFunds`, `setHamsterOracle`, `setHamsterPriceCeiling`, `setHamsterWheel`, `setMaxDebtRatioPercent`, `setMaxExpansionTiersEntry`, `setMaxPremiumRate`, `setMaxSupplyContractionPercent`, `setMaxSupplyExpansionPercents`, `setMintingFactorForPayingDebt`, `setPremiumPercent`, `setPremiumThreshold`, `setSupplyTiersEntry`.
- Hamsters of Opera's smart contract owner has multiple "write" privileges. Centralization risk correlated to the active ownership is **HIGH**

Notice that the examined smart contracts are not resistant to internal exploit. For a detailed understanding of risk severity, source code vulnerability, and potential attack vectors, refer to the complete audit report below.

🔗 Blockchain network: **Fantom Opera**

✅ Verify the authenticity of this report on Guardian's GitHub: https://github.com/guardianaudits

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Project Overview

Project Summary

Project Name	Hamsters Of Operator
Language	Solidity
Codebase	https://github.com/hamster-money/hamster-contracts
Commit	ee153c18241a0a8ff23d021e58cf318f5a849f3f

Audit Summary

Delivery Date	Preliminary Report
Audit Methodology	Static Analysis, Manual Review

Vulnerability Summary

Vulnerability Level	Total	Pending	Declined	Acknowledged	Partially Resolved	Resolved
Critical	0	0	0	0	0	0
High	0	0	0	0	0	0
Medium	3	3	0	0	0	0
Low	14	14	0	0	0	0

Audit Scope & Methodology

Scope

ID	File	SHA-1 Checksum
HAM	Hamster.sol	f0a453d6715354eb96a039212c1f24e656d4b806
SHARE	HShare.sol	6c560db0dd2f3dad1553852245bd4c632f4e5941
BOND	HBond.sol	a803852d69a6af4dbefb151f994857217ecba818
REWARD	HamsterRewardPool.sol	67ea84224f686182ee5f9a739a8ebbc913faa7a4
WHEEL	HamsterWheel.sol	b8f137ec23368b6cb82ba9f75ee3aa0458f18fad
TRS	Treasury.sol	9a196a6c3b6b5770d45bb8ecca32706cf7ef0abc
TAX	TaxOfficeV2.sol	534f49026453d5e44c3d368d4ab28a8733de3694
ZAP	HamsterZapper.sol	a269d20a7aa8e42766bb8c47d64a6f0212cacf5c

Methodology

The auditing process pays special attention to the following considerations:

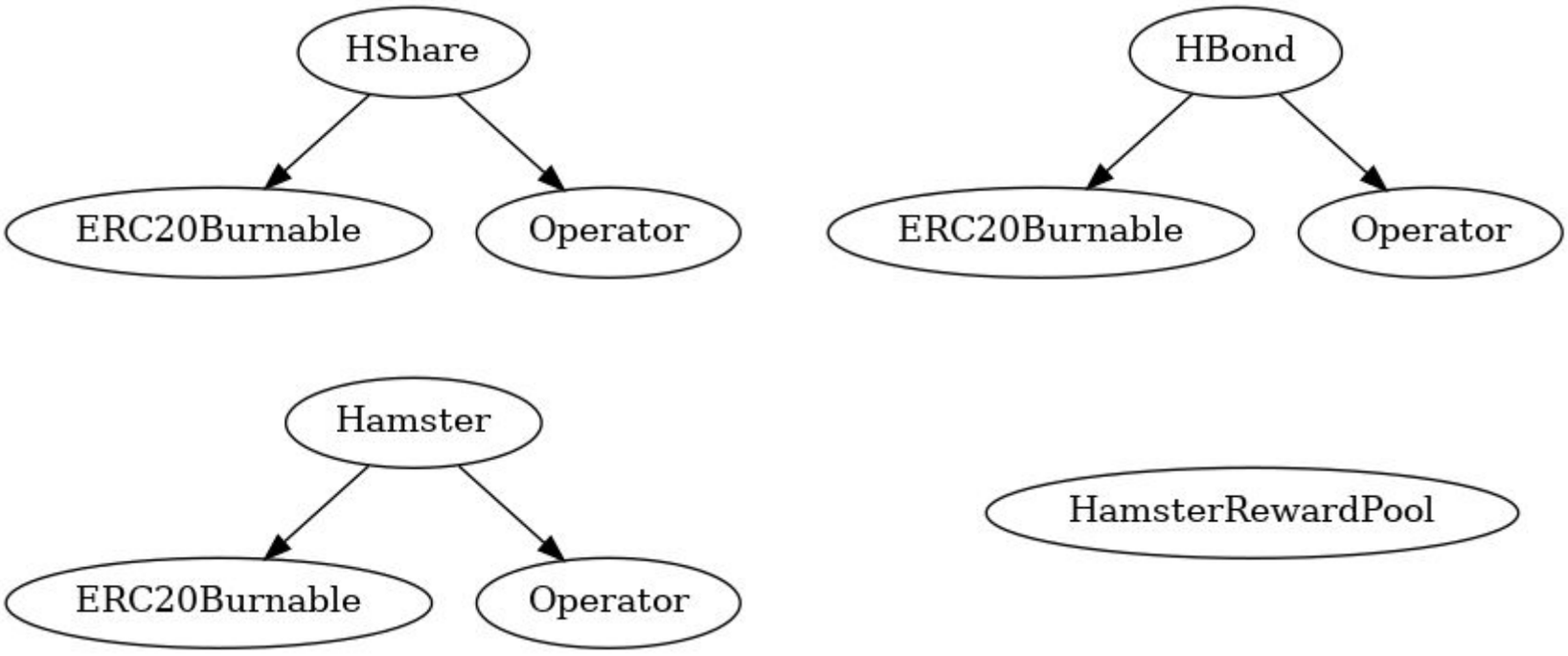
- Testing the smart contracts against both common and uncommon attack vectors.
- Assessing the codebase to ensure compliance with current best practices and industry standards.
- Ensuring contract logic meets the specifications and intentions of the client.
- Cross referencing contract structure and implementation against similar smart contracts produced by industry leaders.
- Thorough line-by-line manual review of the entire codebase by industry experts.

Audit Scope & Methodology

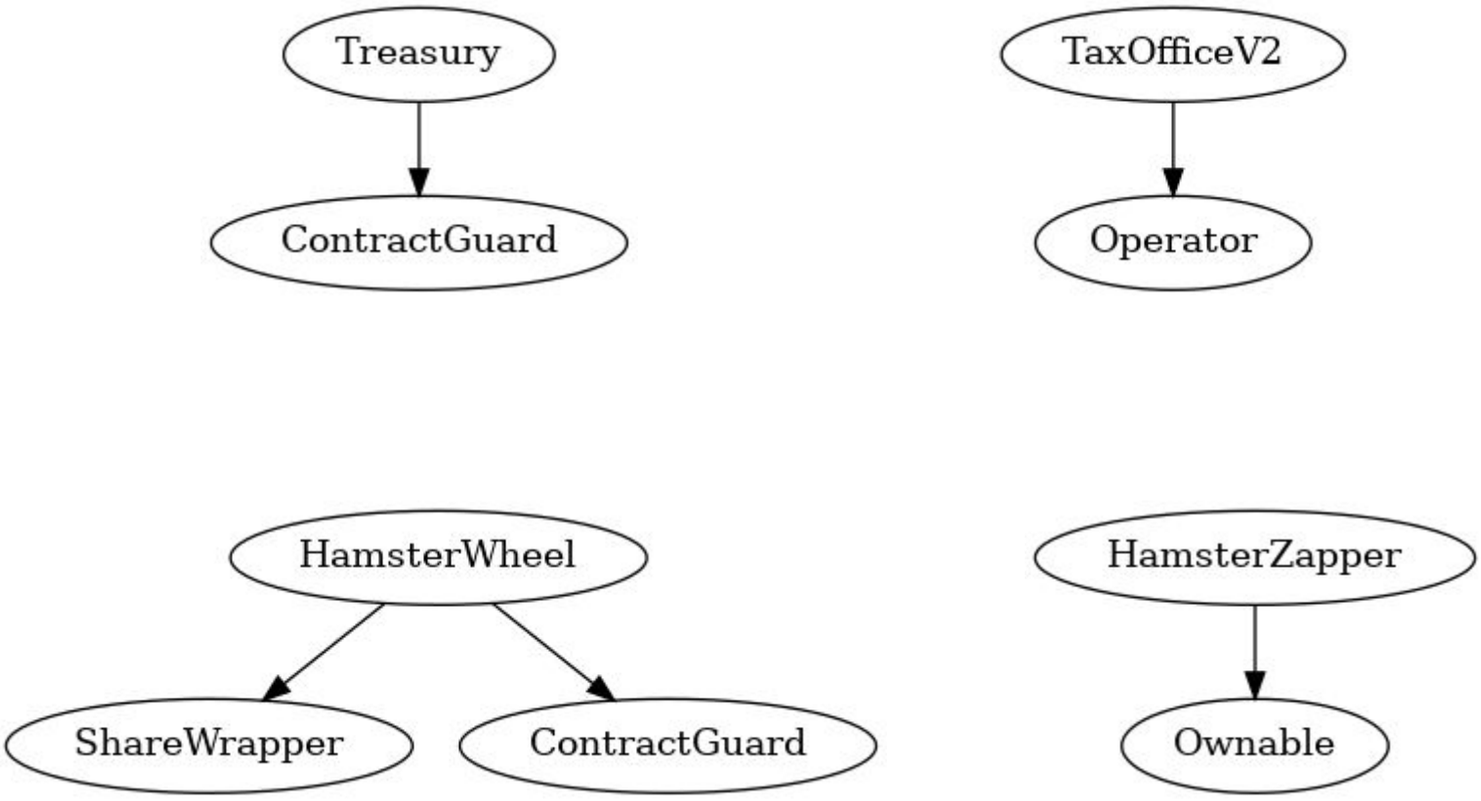
Vulnerability Classifications

Vulnerability Level	Classification
🔴 Critical	Easily exploitable by anyone, causing loss/manipulation of assets or data.
🟠 High	Arduously exploitable by a subset of addresses, causing loss/manipulation of assets or data.
🟡 Medium	Inherent risk of future exploits that may or may not impact the smart contract execution.
🟢 Low	Minor deviation from best practices.

Inheritance Graph - Protocol Tokens And Pool



Inheritance Graph - Protocol Core And Zapper



Findings & Resolutions

ID	Title	Category	Severity	Status
HAM-1	Uncapped Tax	Centralization / Privilege	Medium	Unresolved
HAM-2	Unchecked Return Value	Control Flow	Low	Unresolved
SHARE-1	Block Timestamp	Tx Manipulation	Low	Unresolved
SHARE-2	Immutability Modifiers	Mutability	Low	Unresolved
REWARD-1	Block Timestamp	Tx Manipulation	Low	Unresolved
REWARD-2	Memory Usage	Optimization	Low	Unresolved
REWARD-3	Immutability Modifiers	Mutability	Low	Unresolved
REWARD-4	`poolInfo` Denial of Service	Denial of Service	Low	Unresolved
WHEEL-1	Arbitrary Lockup	Centralization / Privilege	Low	Unresolved
WHEEL-2	Missing Events	Events	Low	Unresolved
TRS-1	Immutability Modifiers	Mutability	Low	Unresolved
TRS-2	Centralization Risk	Centralization / Privilege	Medium	Unresolved
TAX-1	Immutability Modifiers	Mutability	Low	Unresolved

Findings & Resolutions

ID	Title	Category	Severity	Status
TAX-2	Tax Inclusion Manipulation	Centralization / Privilege	Low	Unresolved
TAX-3	Unchecked Return Value	Control Flow	Low	Unresolved
TAX-4	Centralization Risk	Centralization / Privilege	Medium	Unresolved
TAX-5	Missing Events	Events	Low	Unresolved

HAM-1 | Uncapped Tax

Category	Severity	Location	Status
Centralization / Privilege	Medium	Hamster.sol:159	Unresolved

Description

The `setTaxRate` function allows for a tax as high as 99.99% to be imposed, which can lead to near total loss of funds for users.

Recommendation

Require a more strict cap on the `taxRate` and/or timelock the `setTaxRate` function.

Resolution

HAM-2 | Unchecked Return Value

Category	Severity	Location	Status
Control Flow	● Low	Hamster.sol:122	Unresolved

Description

The `governanceRecoverUnsupported` function uses `transfer` which provides a return value that should be checked. Not all ERC20 implementations revert in case of failure, so it is important to have some logic in the event these executions fail.

Recommendation

Check the return value, or opt for a `safeTransfer` alternative.

Resolution

SHARE-1 | Block Timestamp

Category	Severity	Location	Status
Tx Manipulation	● Low	HShare.sol: 25, 32, 68, 73	Unresolved

Description

Possibly dangerous reliance on `block.timestamp`. `block.timestamp` can be manipulated by validators.

Recommendation

Rely on `block.number` instead, or ensure resilience to `block.timestamp` manipulation.

Resolution

SHARE-2 | Immutability Modifiers

Category	Severity	Location	Status
Mutability	● Low	HShare.sol	Unresolved

Description

The `communityFundAllocation`, `devFundAllocation`, `vestingDuration`, `startTime`, `endTime`, `communityFundRewardRate`, and `devFundRewardRate` variables are only set in the constructor, and should therefore be declared `immutable`.

Recommendation

Declare them as `immutable`.

Resolution

REWARD-1 | Block Timestamp

Category	Severity	Location	Status
Tx Manipulation	Low	HamsterRewardPool.sol: 39, 40, 95, 123, 132, 133, 136, 184, 236, 241, 249, 253	Unresolved

Description

Possibly dangerous reliance on `block.timestamp`. `block.timestamp` can be manipulated by validators.

Recommendation

Rely on `block.number` instead, or ensure resilience to `block.timestamp` manipulation.

Resolution

REWARD-2 | Memory Usage

Category	Severity	Location	Status
Optimization	Low	HamsterRewardPool.sol: 35, 151, 170, 188, 210	Unresolved

Description

The `pool` variable is often declared `storage` when it is not modified.

Recommendation

Declare it as `memory` to save on gas.

Resolution

REWARD-3 | Immutability Modifiers

Category	Severity	Location	Status
Mutability	Low	HamsterRewardPool.sol	Unresolved

Description

The `hamster` and `poolStartTime` variables are only set in the constructor, and should therefore be declared `immutable`.

Recommendation

Declare them as `immutable`.

Resolution

REWARD-4 | poolInfo Denial of Service

Category	Severity	Location	Status
Denial of Service	Low	HamsterRewardPool.sol	Unresolved

Description

The `operator` can use `add` to extend the `poolInfo` list. If `poolInfo` becomes significantly long it can cause high gas consumption for the `governanceRecoverUnsupported`, `massUpdatePools`, `checkPoolDuplicate`, `add`, and `set` functions.

If the gas consumption were to exceed the transaction limit as a result, these functions would be rendered useless.

Recommendation

Timelock the `add` function or limit the maximum size of `poolInfo`.

Resolution

WHEEL-1 | Arbitrary Lockup

Category	Severity	Location	Status
Centralization / Privilege	● Low	HamsterWheel.sol: 124	Unresolved

Description

Using `setLockup`, the `operator` can arbitrarily set the `withdrawLockupEpochs` and `rewardLockupEpochs` as high as 56 epochs retroactively after an address has locked.

Recommendation

Timelock the `setLockup` sufficiently such that all current locks can become unlocked before the new lockup is applied, or refactor the logic such that the new lockup only applies to new lockers.

Resolution

WHEEL-2 | Missing Events

Category	Severity	Location	Status
Events	Low	HamsterWheel.sol	Unresolved

Description

The `setOperator` and `setLockup` functions change state that affects stakeholders so they should emit corresponding events.

Recommendation

Add event emissions to `setOperator` and `setLockup`.

Resolution

TRS-1 | Immutability Modifiers

Category	Severity	Location	Status
Mutability	● Low	Treasury.sol	Unresolved

Description

The `hamster` and `poolStartTime` variables are only set in the constructor, and should therefore be declared `immutable`.

Recommendation

Declare them as `immutable`.

Resolution

TRS-2 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	Medium	Treasury.sol	Unresolved

Description

The `operator` address is not a multi-sig and has potentially dangerous permissions for `hamsterWheelSetOperator`, `hamsterWheelAllocateSeigniorage`, `hamsterWheelSetLockUp`, `setBondDepletionFloorPercent`, `setBootstrap`, `setDiscountPercent`, `setExtraFunds`, `setHamsterOracle`, `setHamsterPriceCeiling`, `setHamsterWheel`, `setMaxDebtRatioPercent`, `setMaxExpansionTiersEntry`, `setMaxPremiumRate`, `setMaxSupplyContractionPercent`, `setMaxSupplyExpansionPercents`, `setMintingFactorForPayingDebt`, `setPremiumPercent`, `setPremiumThreshold`, `setSupplyTiersEntry`

Recommendation

Make the `operator` a multi-sig and/or introduce a timelock for the community to monitor events.

Resolution

TAX-1 | Immutability Modifiers

Category	Severity	Location	Status
Mutability	Low	TaxOfficeV2.sol: 124	Unresolved

Description

The `hamster` and `router` variables are only set in the constructor, and should therefore be declared `immutable` for gas optimization.

Recommendation

Declare them as `immutable`.

Resolution

TAX-2 | Tax Inclusion Manipulation

Category	Severity	Location	Status
Centralization / Privilege	● Low	TaxOfficeV2.sol	Unresolved

Description

If `setTaxExclusionForAddress` was called by the `operator` and set to true for an address, that address can call `taxFreeTransferFrom` with an excluded sender. Afterwards, the sender would be included in the tax.

Recommendation

Introduce a timelock such that the community can monitor what the `operator` sets.

Resolution

TAX-3 | Unchecked Return Value

Category	Severity	Location	Status
Control Flow	Low	TaxOfficeV2.sol: 84, 102	Unresolved

Description

The `addLiquidityTaxFree` function uses `transfer` which provides a return value that should be checked. Not all ERC20 implementations revert in case of failure, it is important to have some logic in the event these executions fail.

Recommendation

Check the return value, or opt for a `safeTransfer` alternative.

Resolution

TAX-4 | Centralization Risk

Category	Severity	Location	Status
Centralization / Privilege	Medium	TaxOfficeV2.sol	Unresolved

Description

The `operator` address is not a multi-sig and has potentially dangerous permissions for `disableAutoCalculateTax`, `enableAutoCalculateTax`, `excludeAddressFromTax`, `includeAddressInTax`, `setBurnThreshold`, `setTaxCollectorAddress`, `setTaxExclusionForAddress`, `setTaxRate`, `setTaxTiersRate`, `setTaxTiersTwap`, `setTaxableHamsterOracle`, `transferTaxOffice`

Most notably `transferTaxOffice` sets the `taxOffice` for the `hamster` contract, potentially compromising the `hamster` `taxOffice` permissioned functions as well.

Recommendation

Make the `operator` a multi-sig and/or introduce a timelock for the community to monitor events.

Resolution

TAX-5 | Missing Events

Category	Severity	Location	Status
Events	● Low	TaxOfficeV2.sol	Unresolved

Description

The `disableAutoCalculateTax`, `enableAutoCalculateTax`, `excludeAddressFromTax`, `includeAddressInTax`, `setBurnThreshold`, `setTaxCollectorAddress`, `setTaxExclusionForAddress`, `setTaxRate`, `setTaxTiersRate`, `setTaxTiersTwap`, `setTaxableHamsterOracle`, `transferTaxOffice` functions change state that affects stakeholders so they should emit corresponding events.

Recommendation

Add event emissions to these functions.

Resolution

Auditor’s Verdict

After a line by line manual analysis and automated review, Guardian Audits has concluded that:

- Hamsters of Opera’s smart contracts have a MEDIUM RISK SEVERITY
- Hamsters of Opera’s smart contracts have an **ACTIVE OWNERSHIP**
- Important operator privileges – `setTaxOffice`, `setTaxRate`, `setLockUp`, `setOperator`, `allocateSeignorage`, `hamsterWheelSetLockUp`, `setBondDepletionFloorPercent`, `setBootstrap`, `setDiscountPercent`, `setExtraFunds`, `setHamsterOracle`, `setHamsterPriceCeiling`, `setHamsterWheel`, `setMaxDebtRatioPercent`, `setMaxExpansionTiersEntry`, `setMaxPremiumRate`, `setMaxSupplyContractionPercent`, `setMaxSupplyExpansionPercents`, `setMintingFactorForPayingDebt`, `setPremiumPercent`, `setPremiumThreshold`, `setSupplyTiersEntry`.
- Hamsters of Opera’s smart contract owner has multiple “write” privileges. Centralization risk correlated to the active ownership is **HIGH**

Disclaimer

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This report should not be used in any way to make decisions around investment or involvement with any particular project. This report in no way provides investment advice, nor should be leveraged as investment advice of any sort. This report represents an extensive assessing process intending to help our customers increase the quality of their code while reducing the high level of risk presented by cryptographic tokens and blockchain technology.

Blockchain technology and cryptographic assets present a high level of ongoing risk. Guardian’s position is that each company and individual are responsible for their own due diligence and continuous security. Guardian’s goal is to help reduce the attack vectors and the high level of variance associated with utilizing new and consistently changing technologies, and in no way claims any guarantee of security or functionality of the technology we agree to analyze.

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Notice that smart contracts deployed on the blockchain are not resistant from internal/external exploit. Notice that active smart contract owner privileges constitute an elevated impact to any smart contract’s safety and security. Therefore, Guardian does not guarantee the explicit security of the audited smart contract, regardless of the verdict.

About Guardian Audits

Founded in 2022 by DeFi experts, Guardian Audits is a leading audit firm in the DeFi smart contract space. With every audit report, Guardian Audits upholds best-in-class security while achieving our mission to relentlessly secure DeFi.

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