

Aurox LLC. Public Report

PROJECT: Aurox LLC.

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Aurox LLC. Protocol Review

# Executive Summary

## Scope of Engagement

Bramah Systems, LLC was engaged in February of 2021 to perform a comprehensive security review of the Aurox LLC. smart contracts (specific contracts denoted within the appendix). Our review was conducted over a period of three days by a member of the Bramah Systems, LLC. executive staff.

Bramah Systems completed the assessment using manual, static and dynamic analysis techniques.

## Timeline

Review Commencement: February 10th, 2021

Report Delivery: February 15th, 2021

## Engagement Goals

The primary scope of the engagement was to evaluate and establish the overall security of the Aurox LLC. protocol, with a specific focus on trading actions. In specific, the engagement sought to answer the following questions:

* Is it possible for an attacker to steal or freeze tokens?
* Does the Solidity code match the specification as provided?
* Is there a way to interfere with the contract mechanisms?
* Are the arithmetic calculations trustworthy?

## Contract Specification

Contract specification was provided in the form of code comments and functional unit tests, along with a verbose specification document which provided justification for infrastructure decisions and structural fundamentals.

## Overall Assessment

Bramah Systems was engaged to evaluate and identify any potential security concerns within the codebase of the Aurox LLC. Protocol. During the course of our engagement, Bramah Systems found few instances wherein the team deviated materially from established best practices and procedures of secure software development within DLT, as our report details.

The team otherwise used **thoroughly** reviewed and vetted components and provided details as to the token structure, economics, and intent, which helped Bramah highlight any potential concerns with their approach.

Disclaimer  
As of the date of publication, the information provided in this report reflects the presently held, commercially reasonable understanding of Bramah Systems, LLC.’s knowledge of security patterns as they relate to the Aurox LLC. Protocol, with the understanding that distributed ledger technologies (“DLT”) remain under frequent and continual development, and resultantly carry with them unknown technical risks and flaws. The scope of the review provided herein is limited solely to items denoted within “Scope of Engagement” and contained within “Directory Structure”. The report does NOT cover, review, or opine upon security considerations unique to the Solidity compiler, tools used in the development of the protocol, or distributed ledger technologies themselves, or to any other matters not specifically covered in this report.   
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# General Recommendations

Best Practices & Solidity Development Guidelines

## Multiple return values could be replaced with a struct

In areas in which there are multiple values being returned at once (returnStakeState), a struct could be utilized to

**Resolution**: This function behaves this way because it modifies the structs fields to include a “currentStakeValue” value. This is the stakes value at the current time including interest, which can’t be stored in the struct. It also doesn’t return values in the struct that aren’t relevant to the client.

## TODO remain in code

The following item exists within the StakingMaster.sol code, indicating that functionality remains to be developed.

**// TODO import the interfaces instead to reduce the amount of code**

**Resolution**: Line removed

## Provide explanation for magic number in code comment

The following magic number exists within **StakingMaster.sol**

**uint256 private secondsPerMonth = 2628334;**

As months differ in length and therefore do not have a set number of seconds, the variable appears to be the average seconds per month -- however, it does not appear to be correct. The average month is 30.42 days. A day is 24 hours, so the average month is 730.08 hours ( 30.42 days \* 24 hours ). 730.08 hours is equal to 43,804.8 minutes ( 730.08 hours \* 60 minutes ), or 2,628,288 seconds ( 43 , 804.8 minutes \* 60 seconds ).

**Resolution:** The above calculation is more correct than my initial value, but it is still slightly off.

According to the following link: <https://www.rapidtables.com/calc/time/seconds-in-year.html> the number of seconds in a Gregorian calendar year is 31556952.

This equates to roughly 365.2425 days, the reason for this extra .2425 is to account for leap years. Based on this calculation the correct amount of seconds per month is 2,629,746.

The secondsPerMonth value in the contract has been updated to reflect that.

## Unused local variable

Unused local variable **currentEpoch** exists within the **claimRewards** function of **Provider.sol.** As the unused variable does appear to serve a necessary function in a later function call, this variable should be properly initialized and utilized.

**Resolution**: Line removed

## Function state can be pure

The function **\_returnEpochAmountIncludingShare** can have a “pure” state rather than a “view” state as the function performs no actions which impact state.

**Resolution**: Changed to pure

## Variable shadowing in function returnAllClaimableRewardAmounts

The function **returnAllClaimableRewardAmounts** has two variables, **rewardTotal** and **lastLiquidityAddedEpochReference** that shadow inherited state variables. These variables should be renamed where possible to prevent improper usage.

**Resolution**: As the shadowed variables exist inside a mapping -> structs, I don’t believe this requires changing as their accessing must always be through their mapping and the local variables will then never be shadowed.

## Commented out code in function claimRewards

The function **claimRewards** has the following line of commented-out code, which should be removed as it serves no purpose.

**// require(allClaimableAmounts > 0, "No rewards to claim for the user");**

**Resolution**: Line removed

# 

# Specific Recommendations

Unique to the Aurox LLC. Protocol

## Highly permissive owner account and centralization of power

The deploying account possesses a number of highly actions (namely, initiating ). This deploying account should (where possible) minimize usage of the associated key (e.g. performing transactions, using as a regular user account) and perform other operational security best practices. Potentially, this could involve transferring ownership to a MultiSignature governance.

**Resolution**: To resolve this it is optimal to create a Multi-Signature wallet and once all contracts are deployed to transfer the owner of those contracts to the Multi-Signature wallet.

The Aurox Token, Staking Master and Provider are all Ownable inherited contracts, this is an accepted standard that allows the ownership of those contracts to be transferred at any time. Once deployment is complete it is recommended to transfer the ownership to the Multi-Signature wallet. This is achieved through a function call on each of the contracts, we can advise on how to do this later.

For more information on Multi-Signature wallet creation refer to: <https://gnosis-safe.io/>.

## Contract relies upon external contract not controlled by team

The contract relies upon an ERC-1167 cloning factory, referenced in the code as an external call-out to a contract (**VestingFactoy.sol**, Lines 36-51). This address references a deployed version of the [clone-factoy](https://github.com/optionality/clone-factory) contracts, which notably currently have a build failure and have not been updated in 2 years, and most importantly - are not controlled by the team.

**Resolution**: The suggestion assumes that the Vesting Factory contract utilises a Third-Party deployment of the clone-factory contracts, this is incorrect as the deployment process deploys an instance of this factory and that is used within the contracts. In terms of 2 years being out of date, the contract has been tested for its reliability and it behaves as expected.

## Design principles rely upon a “closed” system

By design, many principles within the protocol rely upon having a closed system design, wherein various functionality exists within a “wrapper” in lieu of the native functionality supported by the ERC20 token.

While this is an intentional design choice and used to facilitate proper execution of the contracts, users should be aware that these functions may perform differently than their ERC20 counterparts (e.g. the performance of interactions within token vesting). It is suggested that due to this, **ReentrancyGuard** or a similar framework be used.

**Resolution**: Added **ReentrancyGuard** to all applicable functions

## Focus on “seconds” should be avoided

The contracts make extensive use of seconds (the atomic unit of time) and **block.timestamp**. Bramah suggests refocusing to larger time increments, as Solidity has multiple known caveats with time sensitive actions (largely relating to the passage of time and how miners may report it).

**Resolution**: As we are dealing with large time increments (weeks/months) they will be unaffected by inaccurate reporting of time by miners. Miners only have the ability to affect time dependent events by 15 seconds, so it’s accepted that time dependence events are accepted if they can vary by 15 seconds and still maintain integrity.

## Test coverage in most areas is poor

The test coverage in certain areas of the protocol (namely the token) is quite poor and should be made further exhaustive to better reflect the teams intent for each function.

**75%** Statements 336/448

**58.08%** Branches 115/198

**61.46%** Functions 59/96

**74.78%** Lines 338/452

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| File | Statements |  | Branches |  | Functions |  | Lines |  |
| Provider/ | 90.96% | 161/177 | 85.53% | 65/76 | 91.3% | 21/23 | 90.91% | 160/176 |
| StakingMaster/ | 73.64% | 95/129 | 47.14% | 33/70 | 70.59% | 12/17 | 73.48% | 97/132 |
| Token/ | 44.23% | 23/52 | 20% | 4/20 | 33.33% | 6/18 | 44.23% | 23/52 |
| Uniswap/ | 100% | 0/0 | 100% | 0/0 | 100% | 0/0 | 100% | 0/0 |
| Vesting/ | 63.27% | 31/49 | 40% | 8/20 | 52.63% | 10/19 | 62.75% | 32/51 |
| lib/ | 63.41% | 26/41 | 41.67% | 5/12 | 52.63% | 10/19 | 63.41% | 26/41 |

**Resolution:** Due to the large amount of tests the Test coverage runner is unable to run for the entire duration of all the tests, to ensure that this runner succeeds you must run the coverage for each contract independently. The total test coverage for each contract is then:

Provider**: 95.51%**

Staking Master**: 97.12%**

Staking Master**: 93.89%**

# Toolset Warnings

Unique to the Aurox LLC. Protocol

## Overview

In addition to our manual review, our process involves utilizing static analysis and formal methods in order to perform additional verification of the presence of security vulnerabilities (or lack thereof). An additional part of this review phase consists of reviewing any automated unit testing frameworks that exist.

The following sections detail warnings generated by the automated tools and confirmation of false positives where applicable.

## Compilation Warnings

No warnings were present at time of compilation.

## Test Coverage

The contract repository possesses extensive unit test coverage throughout. This testing provides a variety of unit tests which encompass the various operational stages of the contract.

## Static Analysis Coverage

The contract repository underwent heavy scrutiny with multiple static analysis agents, including:

* [Securify](https://github.com/eth-sri/securify)
* [MAIAN](https://github.com/MAIAN-tool/MAIAN)
* [Mythril](https://github.com/ConsenSys/mythril)
* [Oyente](https://github.com/melonproject/oyente)
* [Slither](https://github.com/crytic/slither)

In each case, the team had either mitigated relevant concerns raised by each of these tools or provided adequate justification for the risk (such as adhering to the ERC-20 standard), or a concern stemming from the discovered risk was elevated to a larger issue and is referenced above.

# Directory Structure

At time of review, the directory structure of the Aurox LLC. smart contracts repository appeared as it does below. Our review, at request of Aurox LLC., covers the Solidity code (\*.sol) as of commit-hash **e5dc484** of the Aurox LLC. repository.

.

├── Migrations.sol

├── Provider

│ ├── IProvider.sol

│ ├── Provider.sol

│ └── artifacts

│ ├── Provider.json

│ └── Provider\_metadata.json

├── StakingMaster

│ ├── IStakingMaster.sol

│ ├── StakingMaster.sol

│ └── artifacts

│ ├── AuroxToken.json

│ ├── AuroxToken\_metadata.json

│ ├── StakingMaster.json

│ └── StakingMaster\_metadata.json

├── TestHelpers

│ ├── ERC20.sol

│ └── ERC20Mintable.sol

├── Token

│ ├── AuroxToken.sol

│ ├── IAuroxToken.sol

│ ├── TokenVesting.sol

│ └── artifacts

│ ├── AuroxToken.json

│ ├── AuroxToken\_metadata.json

│ ├── TokenVesting.json

│ └── TokenVesting\_metadata.json

├── Uniswap

│ ├── IUniswapV2Factory.sol

│ └── IUniswapV2Router02.sol

├── Vesting

│ ├── TokenVesting.sol

│ ├── VestingFactory.sol

│ └── artifacts

│ ├── VestingFactory.json

│ └── VestingFactory\_metadata.json

└── artifacts

├── AuroxToken.json

├── AuroxToken\_metadata.json

├── AuroxVesting.json

├── AuroxVesting\_metadata.json

├── VestingVault.json

└── VestingVault\_metadata.json

11 directories, 32 files