



SMART CONTRACT AUDIT



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PREPARED FOR

SAT STAKING



INTRODUCTION

Auditing Firm	InterFi Network
Client Firm	Satoshis Vision
Methodology	Automated Analysis, Manual Code Review
Language	Solidity
Contract	0x7666CA32eF844Ff435506568f66D6de6792e8425
Blockchain	Ethereum Chain
Centralization	Active ownership
Commit	013bc7261e605dbd8a07910be2fc79793bd99707
Website	https://www.satoshisvision.cash/
Telegram	https://t.me/SatoshisVisionERC20/
Twitter	https://twitter.com/SatoshiVision75/
Medium	https://medium.com/@satoshisvision/
Report Date	March 14, 2023


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EXECUTIVE SUMMARY

InterFi has performed the automated and manual analysis of solidity codes. Solidity codes were reviewed for common contract vulnerabilities and centralized exploits. Here's a quick audit summary:

Status	Critical ●	Major ●	Medium ●	Minor ●	Unknown ●
Open	0	0	1	0	0
Acknowledged	0	0	1	1	1
Resolved	0	1	0	3	0

 Please note that smart contracts deployed on blockchains aren't resistant to exploits, vulnerabilities and/or hacks. Blockchain and cryptography assets utilize new and emerging technologies. These technologies present a high level of ongoing risks. For a detailed understanding of risk severity, source code vulnerability, and audit limitations, kindly review the audit report thoroughly.

 Please note that centralization privileges regardless of their inherited risk status – constitute an elevated impact on smart contract safety and security.



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SCOPE OF WORK

InterFi was consulted by SAT Staking to conduct the smart contract audit of their solidity source codes.

The audit scope of work is strictly limited to mentioned solidity file(s) only:

- SATStaking.sol

 If source codes are not deployed on the main net, they can be modified or altered before main-net deployment. Verify the contract's deployment status below:

Public Contract Link	
https://etherscan.io/address/0x7666ca32ef844ff435506568f66d6de6792e8425#code	
Contract Name	SATStaking
Compiler Version	0.8.18
License	MIT



AUDIT METHODOLOGY

Smart contract audits are conducted using a set of standards and procedures. Mutual collaboration is essential to performing an effective smart contract audit. Here's a brief overview of InterFi's auditing process and methodology:

CONNECT

- The onboarding team gathers source codes, and specifications to make sure we understand the size, and scope of the smart contract audit.

AUDIT

- Automated analysis is performed to identify common contract vulnerabilities. We may use the following third-party frameworks and dependencies to perform the automated analysis:
 - Remix IDE Developer Tool
 - Open Zeppelin Code Analyzer
 - SWC Vulnerabilities Registry
 - DEX Dependencies, e.g., Pancakeswap, Uniswap
- Simulations are performed to identify centralized exploits causing contract and/or trade locks.
- A manual line-by-line analysis is performed to identify contract issues and centralized privileges.

We may inspect below mentioned common contract vulnerabilities, and centralized exploits:

Centralized Exploits	<ul style="list-style-type: none">○ Token Supply Manipulation○ Access Control and Authorization○ Assets Manipulation○ Ownership Control○ Liquidity Access○ Stop and Pause Trading○ Ownable Library Verification
----------------------	---



Common Contract Vulnerabilities

- Integer Overflow
- Lack of Arbitrary limits
- Incorrect Inheritance Order
- Typographical Errors
- Requirement Violation
- Gas Optimization
- Coding Style Violations
- Re-entrancy
- Third-Party Dependencies
- Potential Sandwich Attacks
- Irrelevant Codes
- Divide before multiply
- Conformance to Solidity Naming Guides
- Compiler Specific Warnings
- Language Specific Warnings

REPORT

- The auditing team provides a preliminary report specifying all the checks which have been performed and the findings thereof.
- The client's development team reviews the report and makes amendments to solidity codes.
- The auditing team provides the final comprehensive report with open and unresolved issues.

PUBLISH

- The client may use the audit report internally or disclose it publicly.

 It is important to note that there is no pass or fail in the audit, it is recommended to view the audit as an unbiased assessment of the safety of solidity codes.



RISK CATEGORIES

Smart contracts are generally designed to hold, approve, and transfer tokens. This makes them very tempting attack targets. A successful external attack may allow the external attacker to directly exploit. A successful centralization-related exploit may allow the privileged role to directly exploit. All risks which are identified in the audit report are categorized here for the reader to review:

Risk Type	Definition
Critical 	These risks could be exploited easily and can lead to asset loss, data loss, asset, or data manipulation. They should be fixed right away.
Major 	These risks are hard to exploit but very important to fix, they carry an elevated risk of smart contract manipulation, which can lead to high-risk severity.
Medium 	These risks should be fixed, as they carry an inherent risk of future exploits, and hacks which may or may not impact the smart contract execution. Low-risk re-entrancy-related vulnerabilities should be fixed to deter exploits.
Minor 	These risks do not pose a considerable risk to the contract or those who interact with it. They are code-style violations and deviations from standard practices. They should be highlighted and fixed nonetheless.
Unknown 	These risks pose uncertain severity to the contract or those who interact with it. They should be fixed immediately to mitigate the risk uncertainty.

All statuses which are identified in the audit report are categorized here for the reader to review:

Status Type	Definition
Open	Risks are open.
Acknowledged	Risks are acknowledged, but not fixed.
Resolved	Risks are acknowledged and fixed.



CENTRALIZED PRIVILEGES

Centralization risk is the most common cause of cryptography asset loss. When a smart contract has a privileged role, the risk related to centralization is elevated.

There are some well-intended reasons have privileged roles, such as:

- Privileged roles can be granted the power to pause() the contract in case of an external attack.
- Privileged roles can use functions like, include(), and exclude() to add or remove wallets from fees, swap checks, and transaction limits. This is useful to run a presale and to list on an exchange.

Authorizing privileged roles to externally-owned-account (EOA) is dangerous. Lately, centralization-related losses are increasing in frequency and magnitude.

- The client can lower centralization-related risks by implementing below mentioned practices:
- Privileged role's private key must be carefully secured to avoid any potential hack.
- Privileged role should be shared by multi-signature (multi-sig) wallets.
- Authorized privilege can be locked in a contract, user voting, or community DAO can be introduced to unlock the privilege.
- Renouncing the contract ownership, and privileged roles.
- Remove functions with elevated centralization risk.

 Understand the project's initial asset distribution. Assets in the liquidity pair should be locked. Assets outside the liquidity pair should be locked with a release schedule.



AUTOMATED ANALYSIS

Symbol	Definition
	Function modifies state
	Function is payable
	Function is internal
	Function is private
	Function is important

```

| **IERC20** | Interface | |||
| L | totalSupply | External  | |NO  |
| L | balanceOf | External  | |NO  |
| L | transfer | External  |  |NO  |
| L | allowance | External  | |NO  |
| L | approve | External  |  |NO  |
| L | transferFrom | External  |  |NO  |
|||||
| **Address** | Library | |||
| L | functionCall | Internal  |  | |
| L | functionCall | Internal  |  | |
| L | functionCallWithValue | Internal  |  | |
| L | functionCallWithValue | Internal  |  | |
| L | functionStaticCall | Internal  | | |
| L | functionStaticCall | Internal  | | |
| L | functionDelegateCall | Internal  |  | |
| L | functionDelegateCall | Internal  |  | |
| L | verifyCallResult | Internal  | | |

```



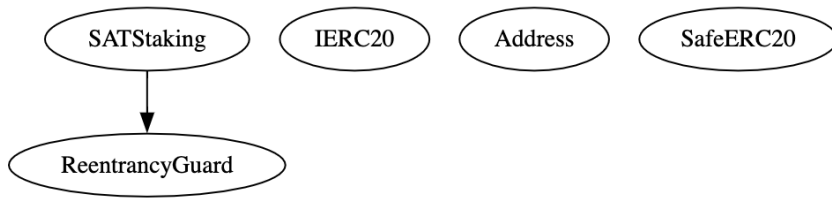
|||||

| ****SafeERC20**** | Library | |||| ^L | safeTransfer | Internal | 🔒 | 🔴 | || ^L | safeTransferFrom | Internal | 🔒 | 🔴 | || ^L | safeApprove | Internal | 🔒 | 🔴 | || ^L | safeIncreaseAllowance | Internal | 🔒 | 🔴 | || ^L | safeDecreaseAllowance | Internal | 🔒 | 🔴 | || ^L | _callOptionalReturn | Private | 🔑 | 🔴 | |

|||||

| ****SATStaking**** | Implementation | ReentrancyGuard |||| ^L | <Constructor> | Public | ! | 🔴 | NO ! || ^L | currentDay | Public | ! | | NO ! || ^L | timeStamp | External | ! | | NO ! || ^L | contractBalance | Public | ! | | NO ! || ^L | deleteFromMapping | Private | 🔑 | 🔴 | || ^L | stakeSatoshisVision | External | ! | 🔴 | nonReentrant || ^L | matureUnstake | External | ! | 🔴 | nonReentrant || ^L | unstake | External | ! | 🔴 | nonReentrant || ^L | _calculatePayout | Internal | 🔒 | | || ^L | _calculateEarlyPayout | Internal | 🔒 | 🔴 | || ^L | _calculateLatePayout | Internal | 🔒 | | || ^L | _calculateLatePenalty | Internal | 🔒 | | || ^L | individualStakesLength | External | ! | | NO ! || ^L | enterLobby | External | ! | 🗳️ | NO ! || ^L | exitLobby | External | ! | 🔴 | NO ! || ^L | lobbyDelete | Private | 🔑 | 🔴 | || ^L | lobbyMemberDaysLength | External | ! | 🗳️ | NO ! || ^L | sweep | External | ! | 🗳️ | NO ! |TERFI
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INHERITANCE GRAPH



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MANUAL REVIEW

Identifier	Definition	Severity
SAT-01	Unknown external addresses and contracts	Medium 

An externally owned account (EOA) has no code, and one can send messages from an externally owned account by creating and signing a transaction.

```
address private Reserve = 0xD14e0D9DB23A7925c6C19C28D9A616d873357CBD;  
address public OriginAddr = 0xaDEF1dd539a70D59477f9CF18354F9c264fFf40f;  
address payable public FlushAddr = payable(0xaDEF1dd539a70D59477f9CF18354F9c264fFf40f);
```


```
IERC20 public SatoshisVision = IERC20(0x6C22910c6F75F828B305e57c6a54855D8adeAbf8);
```

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RECOMMENDATION

Private keys of externally owned accounts must be secured carefully.



Identifier	Definition	Severity
SAT-02	Hardcoded values in the contract	Minor 

Mentioned values are hardcoded in the contract without much explanation:

LaunchTime

MaxStakeDuration

EndOfLobby

OriginScale

FlushScale

PenaltyScale

DurationScale

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RECOMMENDATION

Add comments to explain why specific values were chosen. Some functions can be set onlyOwner to change their values in the future.

RESOLUTION

\$SATS team has added explanations for better readability.



Identifier	Definition	Severity
LOG-03	Re-entrancy	Major 🟡

Below mentioned functions are used with re-entrancy guard.

```
stakeSatoshisVision  
matureUnstake  
unstake
```

Below mentioned functions should be verified for Checks Effects Interactions:

```
exitLobby
```

RECOMMENDATION

Use Checks Effects Interactions pattern when handing over the flow to an external entity and/or guard functions against re-entrancy attacks. Re-entrancy guard is used to prevent re-entrant calls. Learn more: <https://consensys.github.io/smart-contract-best-practices/attacks/reentrancy/>

RESOLUTION

\$SATS team has added re-entrancy guard to exitLobby()




Identifier	Definition	Severity
LOG-03-01	Re-entrancy update	Medium 🟡

However, re-entrancy guard function `_reentrancyGuardEntered()` is not implemented. The purpose of `_reentrancyGuardEntered()` function is to provide a way for derived contracts to check if the re-entrancy guard is currently active. This can be useful in situations where a derived contract needs to know if it is safe to perform certain operations that may be vulnerable to re-entrancy attacks. Specifically, in `exitLobby()` inside the while loop, the function calculates the rewards for each contribution made by the user to the lobby. The calculation appears to be correct, but the if statement that checks if a referral address is set and if the rewards are greater than 5 and if the contract balance is greater than the rewards may be problematic. It could lead to a re-entrancy attack if the `safeTransfer` function call inside the if statement triggers an external contract call that re-enters this function. The if statement could be removed entirely or the `safeTransfer` function call could be moved outside the loop and aggregated across all contributions made by the user to the lobby.

RECOMMENDATION

Check while loop in `exitLobby()` and add `_reentrancyGuardEntered()` function re-entrancy guard library.



Identifier	Definition	Severity
COD-01	Use of assert	Minor 

Mentioned functions use assert instead of require:

matureUnstake

unstake

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RECOMMENDATION

Use assert instead of require wherever necessary.

RESOLUTION

\$SATS team has removed assert.



Identifier	Definition	Severity
COD-02	Timestamp manipulation via <code>block.timestamp</code>	Minor 

Be aware that the timestamp of the block can be manipulated by a miner. When the contract uses the timestamp to seed a random number, the miner can actually post a timestamp within 15 seconds of the block being validated, effectively allowing the miner to precompute an option more favorable to their chances.

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RECOMMENDATION

To maintain block integrity, follow 15 seconds rule, and scale time dependent events accordingly.

RESOLUTION

According to \$SATS team:

"Timestamp is not a concern as we are not working with random numbers. The contract views the current timestamp just to have an estimate of what day it is. Furthermore `block.timestamp` does not affect the contract because it isn't part of the main components of the contract"



Identifier	Definition	Severity
COD-04	Missing or inaccurate error messages	

Below mentioned functions have missing or inaccurate error messages:

matureUnstake

unstake

enterLobby

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RECOMMENDATION

Provide accurate information strings for require related errors.

RESOLUTION

\$SATS team has added information strings for require related errors.



Identifier	Definition	Severity
COD-08	Lack of fallback function	Minor ●

Fallback functions are usually executed in one of the following cases: If a function identifier doesn't match any of the available functions in a smart contract. If there was no data supplied along with the function call.

RECOMMENDATION

Use fallback function with empty data, and mark it external, and payable.

ACKNOWLEDGEMENT

According to \$SATS team:

“Contract isn’t intended to receive eth in that way so we will not be needing a fallback function”



Identifier	Definition	Severity
COD-09	Lack of contract balance withdraw	

Smart contract may collect tokens, and ethers from external addresses. Some swap, and liquidity-add events may accumulate residual ethers, and tokens.

RECOMMENDATION

Add `withdraw()` function to take out tokens and ethers from the contract.

RESOLUTION

\$SATS team has added sweep function to take out tokens and ethers from the contract. However, this function is not provided any access restriction.



Identifier	Definition	Severity
COD-10	Third Party Dependencies	Unknown 🟤

Smart contract is interacting with third party protocols e.g., Market Makers, SATS contract, Decentralized Applications, Open Zeppelin tools. The scope of the audit treats third party entities as black boxes and assumes their functional correctness. However, in the real world, third parties can be compromised, and exploited. Moreover, upgrades in third parties can create severe impacts, e.g., increased transactional fees, deprecation of previous routers, etc.

RECOMMENDATION

Inspect third party dependencies regularly, and mitigate severe impacts whenever necessary.

ACKNOWLEDGEMENT

\$SATS team will inspect third party dependencies periodically.



DISCLAIMERS

InterFi Network provides the easy-to-understand audit of solidity source codes (commonly known as smart contracts).

The smart contract for this particular audit was analyzed for common contract vulnerabilities, and centralization exploits. This audit report makes no statements or warranties on the security of the code. This audit report does not provide any warranty or guarantee regarding the absolute bug-free nature of the smart contract analyzed, nor do they provide any indication of the client's business, business model or legal compliance. This audit report does not extend to the compiler layer, any other areas beyond the programming language, or other programming aspects that could present security risks. Cryptographic tokens are emergent technologies, they carry high levels of technical risks and uncertainty. You agree that your access and/or use, including but not limited to any services, reports, and materials, will be at your sole risk on an as-is, where-is, and as-available basis. This audit report could include false positives, false negatives, and other unpredictable results.

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ABOUT INTERFI NETWORK

InterFi Network provides intelligent blockchain solutions. We provide solidity development, testing, and auditing services. We have developed 150+ solidity codes, audited 1000+ smart contracts, and analyzed 500,000+ code lines. We have worked on major public blockchains e.g., Ethereum, Binance, Cronos, Doge, Polygon, Avalanche, Metis, Fantom, Bitcoin Cash, Velas, Oasis, etc.

InterFi Network is built by engineers, developers, UI experts, and blockchain enthusiasts. Our team currently consists of 4 core members, and 6+ casual contributors.

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