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INITIAL AUDIT

PSYOP

Audited on May 17th 2023

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SMART CONTRACT AUDIT SERVICES REPORT
PSYOP

Summary

This document was commissioned by PSYOP (https://twitter/psyopeth) for the express reason to audit the project's affiliated smart contracts.

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PSYOP is an ERC20 token that will be launched on the Ethereum Blockchain using the Uniswap router.

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Project Summary

Project Name	PSYOP
Intended Network	ETHEREUM
Language / Version	SOLIDITY Version >=0.8.0<0.9.0
Codebase Location	https://github.com/psyop/psyop-sc
Initial Commit Audited	f51e38ede8f0c90eaf16a5d4ef9b119d02b4669a
Final Commit Audited	22c5ef789f916c368b47ebc57d1faaf458a37323

Audit Summary

Requested Date	5/16/2023
Delivery Date	5/18/2023
Audit Methodology	Static Analysis, Manual Review

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Preliminary Audit Scope

The scope of this audit was limited to the smart contract(s) shown below.

Contract Name	Abbreviation	Checksum Value
Psyop.sol	PSY1	7bd79ad56c668b9e9989ee8e8ceb2f8cc30c9048d4ac8020449754be20c30996
Restrictable.sol	PSY2	3bbf81ffcabe586f8b29d4fc831812e099fffb053f49e6753be55167c402e1e0

The 'Checksum' value is a placeholder for the state of the contract at the time the snapshot was taken for the audit. HLW Group leverages sha256sum to calculate this value.

- Restrictable.sol is an abstract solidity contract that controls a _restricted boolean and has several helper methods and modifiers to check for the value and update it.
- Psyop.sol is an ERC20 token using OpenZeppelins Ownable module; it has blacklist, pause, anti bot and buy limit functionality.
- The contract has a max buy limit of 137,500,000 tokens in a single transaction.
- The contract has a total supply of 550,000,000,000 tokens.
- The contract will send initial minted tokens to 1 address supplied in the constructor.
- There is a whitelist for bypassing pause and anti bot functionality.
- The owner can add or remove addresses from the whitelist..
- The owner can pause and unpause the contract at any time.
- The owner can set the uniswap pool contract address.
- The owner can turn anti bot and buy limits off.
- If a user is blacklisted, they can no longer transfer tokens.

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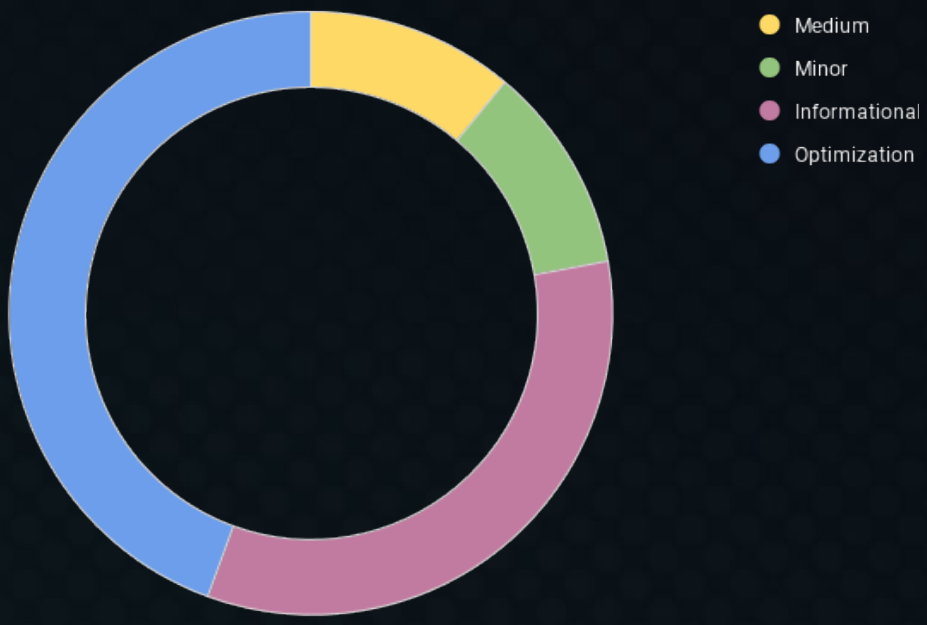
Preliminary Summary of Findings

HLW Group has detected the following issues during the smart contract audit process. PSYOP should address Critical and Major issues ASAP to prevent loss.



Vulnerability Summary

Level	Total	Pending	Declined	Ack'd	Mitigated	Part Res	Resolved
Critical	0	0	0	0	0	0	0
Major	0	0	0	0	0	0	0
Medium	1	0	0	0	0	0	1
Minor	1	0	0	1	0	0	0
Optimization	4	0	0	0	0	0	4
Informational	3	0	0	2	0	0	1

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Preliminary Detailed Explanations and Potential Remedies

PSY1-01

Level	Category	Location	Status
Medium	Logic	Psyop.sol:95-97 Psyop.sol:130-177	Resolved

Description

Transfers will always revert if deadBlock is set to a block in the future, and can be set to an arbitrary value by the owner.

The owner has the ability to set the deadBlock field providing the _currentBlock and _numberOfDeadBlocks as input, instead of relying on block.number and a fixed number of blocks to last for.

```
function setDeadBlock(uint256 _currentBlock, uint256 _numberOfDeadblocks) public onlyOwner {
  deadBlock = _currentBlock + _numberOfDeadblocks; // setting up our own customer number instead of it being fixed.
}
```

If the deadBlock is accidentally or maliciously set too high, all trading will be disabled for non whitelisted users until block.number is higher than deadBlock

```
if (_isBuyTokenTransfer(sender, recipient)) {
  if (shouldBlacklist && _checkIfBot(recipient) && !isBlacklist(recipient)) {
    _setAddressToBlackList(recipient, true);
  }
  if (restricted() && amount > MAX_BUY) {
    revert LimitExceeded();
  }
  _lastBlockTransfer[recipient] = block.number; // could cost more gas to purchase...
}

if (_isSellTokenTransfer(recipient, amount) && block.number <= _lastBlockTransfer[recipient]) {
  revert NotAllowed();
}
```

During a buy, a _checkIfBot function is called and if the user is not whitelisted and if *either* they are a contract *or* they trade before deadBlock., the address is subsequently added to the blacklist mapping.

```
function _checkIfBot(address _address) internal view returns (bool) {
  return (block.number < deadBlock || _isContract(_address)) && !isWhitelist(_address);
}
```

Further on after bot checks are done, the _isAllowedToTransfer function is checked. This checks if either the sender or receiver are blacklisted and will revert the transaction.

```
function _isAllowedToTransfer(address sender, address recipient) internal view returns (bool) {
  return (recipient == address(0) || (!isBlacklist(recipient) && !isBlacklist(sender)));
}
```

This also means that writing to storage just to revert does nothing as no data is stored on chain in a revert, and is an unnecessary gas cost.

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Recommendation

- Replace _setAddressToBlackList(recipient, true) with a revert.
- Set a fixed number of blocks to use for _setDeadBlock() and use block.number as your starting block

  This will revert the transaction earlier instead, avoids storage reads and writes and allows you to remove a blacklist check.

PSY1-02

Level	Category	Location	Status
Optimization	Syntax	Psyop.sol:139	Resolved

Description

isBlacklist is a public function. In Solidity, it is cheaper to access a storage slot directly instead of redirecting via public methods.

```
function _isAllowedToTransfer(address sender, address recipient) internal view returns (bool) {
  return (recipient == address(0) || (!isBlacklist(recipient) && !isBlacklist(sender)));
}
```

Recommendation

- Replace isBlacklist(recipient) with blackList[recipient].
- Replace isBlacklist(sender) with blackList[sender].

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PSY1-03

Level	Category	Location	Status
Optimization	Syntax	Psyop.sol:135	Resolved

Description

isWhitelist is a public function that reads from the whitelist storage. In Solidity, it is cheaper to access a storage slot directly instead of redirecting via public methods.

```
function _checkIfBot(address _address) internal view returns (bool) {
  return (block.number < deadBlock || _isContract(_address)) && !isWhitelist(_address);
}
```

Recommendation

- Replace isWhitelist(_address) with whiteList[_address].

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PSY1-04

Level	Category	Location	Status
Optimization	Logic/Syntax	Psyop.sol:172	Resolved

Description

Whitelisting sender address 0 here is extraneous because the only minting is done during deployment of the contract when paused is false.

```
if (paused() && (!isWhitelist(sender) || !isWhitelist(recipient) || sender != address(0))) {
  revert ContractPaused();
}
```

Recommendation

- Remove reference to sender != address(0).

PSY1-05

Level	Category	Location	Status
Informational	Constant	Psyop.sol:29	Acknowledged

Description

MAX_BUY is currently set to 137,500,000 tokens. This value will be unchangeable after deployment.

```
uint256 public constant MAX_BUY = 137_500_000 ether;
```

Recommendation

- We suggest replacing the constant with a setter so that the maximum buy can be changed in the future if desired.

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PSY1-06

Level	Category	Location	Status
Minor	Logic	Psyop.sol:135 Psyop.sol:172	Acknowledged

Description

The whitelist field is used for multiple purposes. It allows the user to bypass both the pause functionality and the bot check functionality.
This could lead to unintended addresses being able to trade when the contract is paused.

```
function _checkIfBot(address _address) internal view returns (bool) {
  return (block.number < deadBlock || _isContract(_address)) && !isWhitelist(_address);
}
```

```
if (paused() && (!isWhitelist(sender) || !isWhitelist(recipient) || sender != address(0))) {
  revert ContractPaused();
}
```

Recommendation

- Use (2) separate whitelist storage fields to separate logic.

PSY1-07

Level	Category	Location	Status
Informational	Logic	Psyop.sol:155-157	Acknowledged

Description

The amount variable can never go below zero as it is an unsigned integer (uint256). There is no effect on allowing transfers with 0 amounts so no need to restrict it.

```
function _beforeTokenTransfer(address sender, address recipient, uint256 amount) internal override {
  if (amount <= 0) {
    revert LessThanZero();
  }
```

Recommendation

- Remove unnecessary code. Alternatively, only check for amount == 0, if 0 reverts are desired.

PSY1-08

Level	Category	Location	Status
Informational	Logic	Psyop.sol:96	Resolved

Description

Internal method usage can be simplified to storage access for simplicity if all they do is write variables.

```
function _setAddressToBlackList(address _address, bool _allow) private {
  blackList[_address] = _allow;
}
```

```
function setAddressToBlackList(address _address, bool _allow) public onlyOwner {
  _setAddressToBlackList(_address, _allow);
}
```

Recommendation

- Use blacklist[_address] = true instead.

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PSY2-01

Level	Category	Location	Status
Optimization	Logic	Restrictable.sol file	Resolved

Description

The Restrictable.sol class is used for nothing more than a boolean check in this contract, extra code is unnecessary.

```
/**
 * @dev Returns true if the contract is restricted, and false otherwise.
 */
function restricted() public view virtual returns (bool) {
    return _restricted;
}
```

```
if (restricted() && amount > MAX_BUY) {
  revert LimitExceeded();
}
```

```
function restrict() public onlyOwner {
  _restrict();
}

function unrestrict() public onlyOwner {
  _unrestrict();
}
```

Recommendation

- The Restrictable.sol can be replaced with simpler boolean logic inside the main token contract.

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Final Audit Scope

Contract Name	Abbreviation	Checksum Value
Psyop.sol	PSYF1	055becf2dda0471e93ece30e7e4195eb6a3401e89583533b899b652e30c50ba4

The 'Checksum' value is a placeholder for the state of the contract at the time the snapshot was taken for the audit. HLW Group leverages sha256sum to calculate this value.

- Psyop.sol is an ERC20 token using OpenZeppelins Ownable module; it has pause, anti bot and buy limit functionality.
- The contract has a max buy limit of 137,500,000 tokens in a single transaction.
- The contract has a total supply of 550,000,000,000 tokens.
- The contract will split initial minted tokens up to 2 addresses:
  - 522,500,000,000 to the address supplied in the constructor
  - 27,500,000,000 to the deployer address
- There is a whitelist for bypassing pause and anti bot functionality.
- The owner can add or remove addresses from the whitelist.
- The contract has an unleashPsyop function that can only be called by the owner.
  - When this is called, all pause, anti bot and buy limit functionality is disabled forever and ownership is renounced.
- The owner can pause and unpause the contract at any time.
  - When unpaused, there is a (3) block countdown in which every buy will revert.
- The owner can set the Uniswap pool contract address.
- The owner can turn anti-bot and buy limits off.
- The contract implements _lastBlockTransfer storage to keep track of when an address last bought or sold.
  - This limits trades to only allow for 1 buy or 1 sell per transaction per address.

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Final Summary of Findings

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Critical	0	0	0	0	0	0	0
Major	0	0	0	0	0	0	0
Medium	0	0	0	0	0	0	0
Minor	1	0	0	1	0	0	0
Optimization	0	0	0	0	0	0	0
Informational	0	0	0	0	0	0	0

Final Detailed Explanations and Potential Remedies

PSYF1-01

Level	Category	Location	Status
Minor	Logic	Psyop.sol:145 Psyop.sol:166	Acknowledged

Description

The whitelist field is used for multiple purposes. It allows the user to bypass both the pause functionality and the bot check functionality.
This could lead to unintended addresses being able to trade when the contract is paused.

```
/**
 * Checks if address has inhuman reflexes or if it's a contract
 * @param _address Address in question
 */
function _checkIfBot(address _address) internal view returns (bool) {
  return (block.number < DEADBLOCK_COUNT + deadblockStart || _isContract(_address)) && !whitelist[_address];
}
```

```
if (paused() && !whitelist[sender]) { revert ContractPaused(); }
```

Recommendation

- Use (2) separate whitelist storage fields to separate logic.

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- Provide accurate reviews.
- Provide insights on how to remedy any findings.
- Provide flexible options for low-cap project owners.

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