



# Seascape – Riverboat NFT

## Smart Contract Security Audit

Prepared by: Halborn

Date of Engagement: November 1st, 2021 – November 12th, 2021

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## DOCUMENT REVISION HISTORY

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# EXECUTIVE OVERVIEW



## 1.1 INTRODUCTION

Seascope engaged Halborn to conduct a security audit on their **Riverboat** NFT beginning on November 1st, 2021 and ending on November 12th, 2021. The security assessment was scoped to the smart contracts provided in the Github repository [blocklords/seascope-smartcontracts/tree/nft-market/contracts/riverboat](https://github.com/blocklords/seascope-smartcontracts/tree/nft-market/contracts/riverboat)

## 1.2 AUDIT SUMMARY

The team at Halborn was provided two weeks for the engagement and assigned a full time security engineer to audit the security of the smart contract. The security engineer is a blockchain and smart-contract security expert with advanced penetration testing, smart-contract hacking, and deep knowledge of multiple blockchain protocols.

The purpose of this audit is to:

- Ensure that smart contract functions operate as intended
- Identify potential security issues with the smart contracts

In summary, Halborn identified some security risks that should be addressed by the **Seascope team**.

## 1.3 TEST APPROACH & METHODOLOGY

Halborn performed a combination of manual and automated security testing to balance efficiency, timeliness, practicality, and accuracy in regard to the scope of this audit. While manual testing is recommended to uncover flaws in logic, process, and implementation; automated testing techniques help enhance coverage of the bridge code and can quickly identify items that do not follow security best practices. The following phases and associated tools were used throughout the term of the audit:

- Research into architecture and purpose
- Smart contract manual code review and walkthrough
- Graphing out functionality and contract logic/connectivity/functions ([solgraph](#))
- Manual assessment of use and safety for the critical Solidity variables and functions in scope to identify any arithmetic related vulnerability classes
- Manual testing by custom scripts
- Static Analysis of security for scoped contract, and imported functions. ([Slither](#))
- Testnet deployment ([Brownie](#), [Remix IDE](#))

#### RISK METHODOLOGY:

Vulnerabilities or issues observed by Halborn are ranked based on the risk assessment methodology by measuring the **LIKELIHOOD** of a security incident, and the **IMPACT** should an incident occur. This framework works for communicating the characteristics and impacts of technology vulnerabilities. It's quantitative model ensures repeatable and accurate measurement while enabling users to see the underlying vulnerability characteristics that was used to generate the Risk scores. For every vulnerability, a risk level will be calculated on a scale of 5 to 1 with 5 being the highest likelihood or impact.

#### RISK SCALE - LIKELIHOOD

- 5 - Almost certain an incident will occur.
- 4 - High probability of an incident occurring.
- 3 - Potential of a security incident in the long term.
- 2 - Low probability of an incident occurring.
- 1 - Very unlikely issue will cause an incident.

#### RISK SCALE - IMPACT

- 5 - May cause devastating and unrecoverable impact or loss.
- 4 - May cause a significant level of impact or loss.
- 3 - May cause a partial impact or loss to many.
- 2 - May cause temporary impact or loss.



1 - May cause minimal or un-noticeable impact.

The risk level is then calculated using a sum of these two values, creating a value of 10 to 1 with 10 being the highest level of security risk.

CRITICAL	HIGH	MEDIUM	LOW	INFORMATIONAL
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10 - CRITICAL

9 - 8 - HIGH

7 - 6 - MEDIUM

5 - 4 - LOW

3 - 1 - VERY LOW AND INFORMATIONAL

## 1.4 SCOPE

The security assessment was scoped to the following

[blocklords/seascape-smartcontracts/tree/nft-market/contracts/riverboat](#)

- [LighthouseTierInterface.sol](#)
- [RiverboatFactory.sol](#)
- [RiverboatNft.sol](#)
- [Riverboat.sol](#)
- All contracts inherited by these contracts

**Commit ID:** [312419847e775c73838d15af71ab877087f7a49d](#)

**Fixed Commit ID:** [c5fd888b95f40e3c3c60f594708887db1922b663](#)

## 2. ASSESSMENT SUMMARY & FINDINGS OVERVIEW

CRITICAL	HIGH	MEDIUM	LOW	INFORMATIONAL
0	1	1	3	2

### LIKELIHOOD

IMPACT

		(HAL-01)		
(HAL-05)	(HAL-04)	(HAL-02)		
		(HAL-03)		
(HAL-06) (HAL-07)				

SECURITY ANALYSIS	RISK LEVEL	REMEDIATION DATE
HAL01 - CONTRACT ADMIN CAN REVOKE AND RENOUNCE HIMSELF	High	SOLVED - 11/18/2021
HAL02 - IMPROPER ACCESS CONTROL POLICY	Medium	SOLVED - 11/18/2021
HAL03 - MISSING ZERO ADDRESS CHECK	Low	SOLVED - 11/18/2021
HAL04 - USAGE OF BLOCK-TIMESTAMP	Low	NOT APPLICABLE
HAL05 - FLOATING PRAGMA	Low	SOLVED - 11/18/2021
HAL06 - INTEGER OVERFLOW	Informational	ACKNOWLEDGED
HAL07 - UNUSED IMPORT	Informational	SOLVED - 11/18/2021



# FINDINGS & TECH DETAILS



### 3.1 (HAL-01) CONTRACT ADMIN CAN REVOKE AND RENOUNCE HIMSELF - HIGH

#### Description:

The Owner of the contract is usually the account which deploys the contract. In the `RiverboatFactory.sol` smart contract, Only Admin can perform some privileged actions such as `setNft`, `addStaticUser`, `removeStaticUser` etc. . . , the `addAdmin` function is used to add an Admin role, and the `renounceAdmin` function is used to renounce being an Admin. It was observed that `admin` can revoke his role via `renounceAdmin`. If an admin is mistakenly renounced, administrative access would result in the contract having no `admin`, eliminating the ability to call privileged functions. In such a case, contracts would have to be redeployed.

#### PoC Steps:

- Deploy a `RiverboatFactory` using the owner address.
- Execute `riverboatfactory.renounceAdmin()` function as using the owner address.

```
>>> riverboatfactory.isAdmin(accounts[0])
True
>>> riverboatfactory.renounceAdmin()
Transaction sent: 0xe305392594a6a1d97d56fc42d01744144b7873aa71ca29cb6989f4509164aef3
Gas price: 0.0 gwei Gas limit: 12000000 Nonce: 4
RiverboatFactory.renounceAdmin confirmed Block: 5 Gas used: 22436 (0.19%)

<Transaction '0xe305392594a6a1d97d56fc42d01744144b7873aa71ca29cb6989f4509164aef3'>
>>> riverboatfactory.isAdmin(accounts[0])
False
>>> riverboatfactory.setNft(riverboatnft)
Transaction sent: 0xb8bf55b9fdead852dcab94d83ff5fa48f3f9c6d859f57016942f2f83e6a96aa0
Gas price: 0.0 gwei Gas limit: 12000000 Nonce: 5
RiverboatFactory.setNft confirmed (Restricted to admins.) Block: 6 Gas used: 23031 (0.19%)

<Transaction '0xb8bf55b9fdead852dcab94d83ff5fa48f3f9c6d859f57016942f2f83e6a96aa0'>
```

### Code Location:

Listing 1: contracts/RiverboatFactory (Lines 43)

```
43     function renounceAdmin() public virtual {  
44         renounceRole(DEFAULT_ADMIN_ROLE, msg.sender);  
45     }
```

### Risk Level:

**Likelihood - 3**

**Impact - 5**

### Recommendations:

It is recommended that the contract Admin cannot call `renounceAdmin` without transferring the Ownership to other address before. In addition, if a multi-signature wallet is used, calling `renounceAdmin` function should be confirmed for two or more users.

### Remediation Plan

**SOLVED:** The issue was fixed in commit: [c5fd888b95f40e3c3c60f594708887db1922b663](#)

## 3.2 (HAL-02) IMPROPER ACCESS CONTROL POLICY – MEDIUM

### Description:

In the smart contracts, implementing a correct Access Control policy is essential to maintain security and decentralization of permissions on a token. The features to `mint/burn` tokens and `pause` contracts are given by Access Control. For instance, Ownership is the most common form of Access Control. In other words, the `owner` of a contract (the account that deployed it by default) can do some administrative tasks on it. Nevertheless, other authorization levels are required to keep the principle of least privilege, also known as least authority. Briefly, any process, user, or program only can access to the necessary resources or information. Otherwise, the ownership role is useful in simple systems, but more complex projects require the use of more roles using Role-based access control.

The `mintType` function on `RiverboatFactory` have no restrictions and can be called by any user. An adversary could leverage this to mint NFT's instead of buying.

### PoC Steps:

- Deploy a `RiverboatFactory` and `RiverboatNft` using the owner address.
- Call function `setFactory` and provide address of the `RiverboatFactory` using owner user address.
- Execute `mintType` function using any user address.



```
>>> riverboatfactory.isAdmin(accounts[0])
True
>>> riverboatfactory.isAdmin(accounts[1])
False
>>> riverboatfactory.mintType(accounts[1], 1, {'from':accounts[1]})
Transaction sent: 0xa4d1c4ae778733a1f120ca12108f750f855d84ab23165bb498b359fb341b99ba
Gas price: 0.0 gwei Gas limit: 12000000 Nonce: 0
RiverboatFactory.mintType confirmed Block: 5 Gas used: 203821 (1.70%)

<Transaction '0xa4d1c4ae778733a1f120ca12108f750f855d84ab23165bb498b359fb341b99ba'>
>>> riverboatnft.ownerOf(1)
'0x33A4622B82D4c04a53e170c638B944ce27cffce3'
```

Code Location:

Listing 2: contracts/RiverboatFactory (Lines 24)

```
24 function mintType(address _owner, uint256 _type) public
    returns(uint256) {
25     require (_type < 5, "invalid type");
26     return nft.mint(_owner, _type);
27 }
```

Risk Level:

Likelihood - 3

Impact - 3

Recommendations:

It is recommended to limit the function with an appropriate modifier, which will allow only authorized users to execute the function.

### Remediation Plan

**SOLVED:** The issue was fixed in commit: [c5fd888b95f40e3c3c60f594708887db1922b663](#)

### 3.3 (HAL-03) MISSING ZERO ADDRESS CHECK - LOW

#### Description:

There is no validation of the addresses anywhere in the code. Every address should be validated and checked that is different from zero. This issue is present in all the smart contracts, in the constructors and functions that use addresses as parameters.

Some code location examples:

#### RiverboatFactory.sol

##### Listing 3: RiverboatFactory.sol

```
145     function setNft(address _nft) public onlyAdmin {  
146         nft = RiverboatNft(_nft);  
147     }
```

#### RiverboatNft.sol

##### Listing 4: RiverboatNft.sol

```
56     function setFactory(address _factory) public onlyOwner {  
57         factory = _factory;  
58     }
```

#### Risk Level:

**Likelihood - 3**

**Impact - 2**

#### Recommendation:

Validate that every address input is different from zero.

Remediation Plan:

**SOLVED:** The issue was fixed in commit: [c5fd888b95f40e3c3c60f594708887db1922b663](#)

### 3.4 (HAL-04) USAGE OF BLOCK-TIMESTAMP – LOW

#### Description:

During a manual static review, the tester noticed the use of “now” and “block.timestamp”. The contract developers should be aware that this does not mean current time. “block.timestamp” can be influenced by miners to a certain degree, so the testers should be warned that this may have some risk if miners collude on time manipulation to influence the price oracles.

#### Code Location:

Listing 5: contracts/RiverboatFactory (Lines 121)

```

115         if (sessionId > 0)
116             require(isFinished(sessionId), "last session hasn't
                finished yet");
117         require(_currencyAddress != address(0), "invalid currency
                address");
118         require(_nftAddress != address(0), "invalid nft address");
119         require(_startPrice > 0, "start price can't be 0");
120         require(_priceIncrease > 0, "price increase can't be 0");
121         require(_startTime > block.timestamp, "session should
                start in future");
122         require(_intervalDuration > 0, "interval duration can't be
                0");
123         require(_intervalsAmount > 0, "intervals amount can't be 0
                ");
124         require(_slotsAmount > 0, "slots amount can't be 0");
125     }

```

Listing 6: contracts/Riverboat

```

1 contracts/Riverboat.sol:234: uint256 _currentInterval = (now -
    sessions[_sessionId]
2 contracts/Riverboat.sol:262: if(now >= session.startTime && now <
    session

```

```
3 contracts/Riverboat.sol:274: if(now > session.startTime + session.  
    intervalsAmount * session.intervalDuration)
```

#### Risk Level:

**Likelihood - 2**

**Impact - 3**

#### Recommendations:

Use `block.number` instead of `block.timestamp` or now reduce the influence of miners. If possible, It's recommended to use Oracles.

#### Remediation Plan:

**NOT APPLICABLE:** The [Seascope](#) claims that the timescales is higher than 900 seconds.

### 3.5 (HAL-05) FLOATING PRAGMA - LOW

#### Description:

Riverboat contract `Riverboat.sol`, `RiverboatFactory.sol` and `RiverboatNft.sol` uses the floating pragma `^0.6.7`. Contract should be deployed with the same compiler version and flags that they have been tested with thoroughly. Locking the pragma helps to ensure that contracts do not accidentally get deployed using, for example, either an outdated compiler version that might introduce bugs that affect the contract system negatively or a pragma version too new which has not been extensively tested.

#### Code Location:

##### Listing 7: `Riverboat.sol`

```
1 pragma solidity ^0.6.7;
```

##### Listing 8: `RiverboatFactory.sol`

```
1 pragma solidity 0.6.7;  
2
```

##### Listing 9: `RiverboatNft.sol`

```
1 // Riverboats NFT  
2 // SPDX-License-Identifier: MIT  
3 pragma solidity 0.6.7;
```

#### Risk Level:

**Likelihood - 1**

**Impact - 3**

### Recommendations:

Consider locking the pragma version with known bugs for the compiler version. When possible, do not use floating pragma in the final live deployment. Specifying a fixed compiler version ensures that the bytecode produced does not vary between builds. This is especially important if you rely on bytecode-level verification of the code.

### Remediation Plan:

**SOLVED:** The issue was fixed in commit: [c5fd888b95f40e3c3c60f594708887db1922b663](#)

## 3.6 (HAL-06) INTEGER OVERFLOW – INFORMATIONAL

### Description:

An overflow happens when an arithmetic operation reaches the maximum size of a type. In computer programming, an integer overflow occurs when an arithmetic operation attempts to create a numeric value that is outside the range that can be represented with a given number of bits -- either larger than the maximum or lower than the minimum representable value

### Code Location:

Listing 10: contracts/Riverboat (Lines 126)

```

101     function startSession(
102         address _currencyAddress,
103         address _nftAddress,
104         address _lighthouseTierAddress,
105         uint256 _startPrice,
106         uint256 _priceIncrease,
107         uint32 _startTime,
108         uint32 _intervalDuration,
109         uint32 _intervalsAmount,
110         uint32 _slotsAmount
111     )
112     external
113     onlyOwner
114     {
115         if (sessionId > 0)
116             require(isFinished(sessionId), "last session hasnt
                finished yet");
117         require(_currencyAddress != address(0), "invalid currency
                address");
118         require(_nftAddress != address(0), "invalid nft address");
119         require(_startPrice > 0, "start price can't be 0");
120         require(_priceIncrease > 0, "price increase can't be 0");
121         require(_startTime > block.timestamp, "session should
                start in future");

```



```

122     require(_intervalDuration > 0, "interval duration can't be
        0");
123     require(_intervalsAmount > 0, "intervals amount can't be 0
        ");
124     require(_slotsAmount > 0, "slots amount can't be 0");
125
126     sessionId++;
127     sessions[sessionId] = Session(
128         _currencyAddress,
129         _nftAddress,
130         _lighthouseTierAddress,
131         _startPrice,
132         _priceIncrease,
133         _startTime,
134         _intervalDuration,
135         _intervalsAmount,
136         _slotsAmount
137     );

```

#### Listing 11: contracts/Riverboat

```

1 contracts/Riverboat.sol:252: uint256 _currentPrice = sessions[
    _sessionId].startPrice + sessions[_sessionId]
2 contracts/Riverboat.sol:253: .priceIncrease * _currentInterval;
3 contracts/Riverboat.sol:263: .startTime + session.intervalsAmount
    * session.intervalDuration){
4 contracts/Riverboat.sol:274 if(now > session.startTime + session.
    intervalsAmount * session.intervalDuration)

```

**Risk Level:**

**Likelihood - 1**

**Impact - 1**

#### Recommendation:

It is recommended to use vetted safe math libraries for arithmetic operations consistently throughout the smart contract system.

#### Remediation Plan:

**ACKNOWLEDGED:** Since `sessionId` is type `uint256`, the likelihood of reaching  $10^{77}$  is very low. Therefore, overflow is highly unlikely.

## 3.7 (HAL-07) UNUSED IMPORT - INFORMATIONAL

### Description:

During the test, it was determined that one of the import on the contract was not used. This situation does not pose any risk in terms of security. But it is important for the readability and applicability of the code

### Code Location:

Listing 12: contracts/Riverboat (Lines 9)

```
1 pragma solidity ^0.6.7;
2
3 import "../openzeppelin/contracts/token/ERC20/IERC20.sol";
4 import "../openzeppelin/contracts/token/ERC20/SafeERC20.sol";
5 import "../openzeppelin/contracts/token/ERC721/IERC721.sol";
6 import "../openzeppelin/contracts/token/ERC721/IERC721Receiver.
  sol";
7 import "../openzeppelin/contracts/access/Ownable.sol";
8 import "../LighthouseTierInterface.sol";
9 import "../RiverboatNft.sol";
```

### Risk Level:

**Likelihood - 1**

**Impact - 1**

### Recommendation:

It is recommended to remove the RiverboatNft.sol import from the contract if it will not be used for any purpose.

Remediation Plan:

**SOLVED:** The issue was fixed in commit: [c5fd888b95f40e3c3c60f594708887db1922b663](#)



# AUTOMATED TESTING



## 4.1 STATIC ANALYSIS REPORT

### Description:

Halborn used automated testing techniques to enhance the coverage of certain areas of the scoped contracts. Among the tools used was Slither, a Solidity static analysis framework. After Halborn verified all the contracts in the repository and was able to compile them correctly into their ABI and binary formats, Slither was run on the all-scoped contracts. This tool can statically verify mathematical relationships between Solidity variables to detect invalid or inconsistent usage of the contracts' APIs across the entire code-base.

### Slither results:

```
[Info:Detectors:
ERC721: mint(address,uint256) (contracts/openspells/contracts/token/ERC721/ERC721.sol#330-344) ignores return value by holder[tokenId].add(tokenId) (contracts/openspells/contracts/token/ERC721/ERC721.sol#339)
ERC721: mint(address,uint256) (contracts/openspells/contracts/token/ERC721/ERC721.sol#330-344) ignores return value by tokenOwners.set(tokenId,to) (contracts/openspells/contracts/token/ERC721/ERC721.sol#341)
ERC721: burn(uint256) (contracts/openspells/contracts/token/ERC721/ERC721.sol#350-374) ignores return value by holder[tokenId].remove(tokenId) (contracts/openspells/contracts/token/ERC721/ERC721.sol#369)
ERC721: burn(uint256) (contracts/openspells/contracts/token/ERC721/ERC721.sol#350-374) ignores return value by tokenOwners.remove(tokenId) (contracts/openspells/contracts/token/ERC721/ERC721.sol#371)
ERC721: transfer(address,address,uint256) (contracts/openspells/contracts/token/ERC721/ERC721.sol#387-402) ignores return value by holder[tokenId].from(remove(tokenId)) (contracts/openspells/contracts/token/ERC721/ERC721.sol#396)
ERC721: transfer(address,address,uint256) (contracts/openspells/contracts/token/ERC721/ERC721.sol#387-402) ignores return value by holder[tokenId].add(tokenId) (contracts/openspells/contracts/token/ERC721/ERC721.sol#397)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#used-return
[Info:Detectors:
ERC721: constructor(string,string).new (contracts/openspells/contracts/token/ERC721/ERC721.sol#99) shadow:
  ERC721: new(string,string) (contracts/openspells/contracts/token/ERC721/ERC721.sol#122-124) (function)
  ERC721: new(string,string) (contracts/openspells/contracts/token/ERC721/ERC721.sol#124) (function)
ERC721: constructor(string,string).symbol (contracts/openspells/contracts/token/ERC721/ERC721.sol#93) shadow:
  ERC721: symbol() (contracts/openspells/contracts/token/ERC721/ERC721.sol#129-133) (function)
  ERC721: new(string,string).symbol() (contracts/openspells/contracts/token/ERC721/ERC721.sol#124) (function)
RiverboatNFT: setOwner(address).owner (contracts/riverboat/riverboatNFT.sol#82) shadow:
  Ownable: owner (contracts/openspells/contracts/access/Ownable.sol#19) (state variable)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#local-variable-shadowing
[Info:Detectors:
Reentrancy in Riverboat: approveSolidMFTs(uint256,address) (contracts/riverboat/riverboat.sol#154-162):
  External calls:
    ERC721: [session].sessionId().approveForAll(receiverAddress,true) (contracts/riverboat/riverboat.sol#159)
  Event emitted after the call(s):
    with messageNFTs_sessionId_sessions[sessionId].approve(receiverAddress) (contracts/riverboat/riverboat.sol#161)
  Reentrancy in Riverboat: buy(uint256,uint256) (contracts/riverboat/riverboat.sol#171-200):
  External calls:
    ERC20: (currencyAddress).safeTransferFrom(msg.sender,address(selector),curTokenPrice) (contracts/riverboat/riverboat.sol#196)
    ERC721: (address).safeTransferFrom(address(msg.sender),_tokenId) (contracts/riverboat/riverboat.sol#198)
  Event emitted after the call(s):
    buy_sessionId_currencyPrice_atId_msg_sender (contracts/riverboat/riverboat.sol#200)
  Reentrancy in RiverboatNFT: mint(address,uint256) (contracts/riverboat/riverboatNFT.sol#40-46):
  External calls:
    _safeMint(to_tokenId) (contracts/riverboat/riverboatNFT.sol#44)
    _returnData = toFunctionCallHash(eventSelector(ERC721Receiver(to).onERC721Received.selector,_msgSender(),from_tokenId_data),ERC721: transfer to non ERC721Receiver implementer) (contracts/openspells/contracts/token/ERC721/ERC721.sol#441-447)
    (success,returnData) = target.call(value:_weiValue(data)) (contracts/openspells/contracts/utils/address.sol#123)
  Event emitted after the call(s):
    _safeMint(to_tokenId) (contracts/riverboat/riverboatNFT.sol#44)
    (success,returnData) = target.call(value:_weiValue(data)) (contracts/openspells/contracts/utils/address.sol#123)
  Event emitted after the call(s):
    minted_on_tokenId (contracts/riverboat/riverboatNFT.sol#46)
Reference: https://github.com/crytic/slither/wiki/Detector-Documentation#reentrancy-vulnerabilities-3
```

Figure 1: contracts/Riverboat.sol

All reentrancy issues were false positive. Furthermore, all the vulnerabilities found were already described on the report

```
INFO:Detectors:
Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32) (contracts/riverboat/Riverboat.sol#101-149) uses timestamp for comparisons
  Dangerous comparisons:
    - require(bool,string) { startLine > block.timestamp, session should start in future } (contracts/riverboat/Riverboat.sol#121)
Riverboat.buy(uint256,uint256) (contracts/riverboat/Riverboat.sol#171-208) uses timestamp for comparisons
  Dangerous comparisons:
    - require(bool,string){ if nftMinters[_sessionId][_currentInterval][_msg.sender], cant buy more nfts per interval } (contracts/riverboat/Riverboat.sol#179-180)
Riverboat.getCurrentInterval(uint256) (contracts/riverboat/Riverboat.sol#232-240) uses timestamp for comparisons
  Dangerous comparisons:
    - require(bool,string){ _currentInterval < sessions[_sessionId].intervalsAmount, _currentInterval > intervalsAmount, session is finished } (contracts/riverboat/Riverboat.sol#237-238)
Riverboat.isActive(uint256) (contracts/riverboat/Riverboat.sol#260-267) uses timestamp for comparisons
  Dangerous comparisons:
    - now == session.startLine && now < session.startLine + session.intervalsAmount * session.intervalDuration (contracts/riverboat/Riverboat.sol#262-263)
Riverboat.isFinished(uint256) (contracts/riverboat/Riverboat.sol#272-277) uses timestamp for comparisons
  Dangerous comparisons:
    - now > session.startLine + session.intervalsAmount * session.intervalDuration (contracts/riverboat/Riverboat.sol#274)
Reference: https://github.com/cryptic/sllther/wiki/Detector-Documentation#block-timestamp
INFO:Detectors:
Address.isContract(address) (contracts/opezeppelln/contracts/utlis/Address.sol#26-35) uses assembly
  - INLINE ASM (contracts/opezeppelln/contracts/utlis/Address.sol#33)
Address.functionCallWithValue(address,bytes,uint256,string) (contracts/opezeppelln/contracts/utlis/Address.sol#119-140) uses assembly
  - INLINE ASM (contracts/opezeppelln/contracts/utlis/Address.sol#132-135)
Reference: https://github.com/cryptic/sllther/wiki/Detector-Documentation#assembly-usage
INFO:Detectors:
Different versions of solidity is used in :
  - Version used: ['0.6.7', '0.6.0', '0.6.2', '0.6.7']
    - 0.6.0 (contracts/opezeppelln/contracts/GSN/Context.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/access/Ownable.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/introspection/IERC165.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/introspection/IERC165.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/math/SafeMath.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/token/ERC20/SafeERC20.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/token/ERC20/SafeERC20.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/token/ERC721/ERC721.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/token/ERC721/ERC721Burnable.sol#3)
    - 0.6.2 (contracts/opezeppelln/contracts/token/ERC721/ERC721.sol#3)
    - 0.6.2 (contracts/opezeppelln/contracts/token/ERC721/ERC721Enumerable.sol#3)
    - 0.6.2 (contracts/opezeppelln/contracts/token/ERC721/ERC721Metadata.sol#3)
    - 0.6.2 (contracts/opezeppelln/contracts/token/ERC721/ERC721Receiver.sol#3)
    - 0.6.2 (contracts/opezeppelln/contracts/utlis/Address.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/utlis/Counters.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/utlis/EnumerableMap.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/utlis/EnumerableSet.sol#3)
    - 0.6.0 (contracts/opezeppelln/contracts/utlis/Strings.sol#3)
    - 0.6.7 (contracts/riverboat/Riverboat.sol#1)
    - 0.6.7 (contracts/riverboat/RiverboatNft.sol#3)
Reference: https://github.com/cryptic/sllther/wiki/Detector-Documentation#different-pragma-directives-are-used
```

Figure 2: contracts/Riverboat.sol

```
INFO:Detectors:
Pragma version0.6.0 (contracts/opezeppelln/contracts/GSN/Context.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/access/Ownable.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/introspection/IERC165.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/introspection/IERC165.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/math/SafeMath.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/token/ERC20/SafeERC20.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/token/ERC20/SafeERC20.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/token/ERC721/ERC721.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/token/ERC721/ERC721Burnable.sol#3) allows old versions
Pragma version0.6.2 (contracts/opezeppelln/contracts/token/ERC721/ERC721.sol#3) allows old versions
Pragma version0.6.2 (contracts/opezeppelln/contracts/token/ERC721/ERC721Enumerable.sol#3) allows old versions
Pragma version0.6.2 (contracts/opezeppelln/contracts/token/ERC721/ERC721Metadata.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/token/ERC721/ERC721Receiver.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/utlis/Address.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/utlis/Counters.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/utlis/EnumerableMap.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/utlis/EnumerableSet.sol#3) allows old versions
Pragma version0.6.0 (contracts/opezeppelln/contracts/utlis/Strings.sol#3) allows old versions
Pragma version0.6.7 (contracts/riverboat/Riverboat.sol#1) allows old versions
Pragma version0.6.7 (contracts/riverboat/RiverboatNft.sol#3) allows old versions
solc-0.6.7 is not recommended for deployment
Reference: https://github.com/cryptic/sllther/wiki/Detector-Documentation#incorrect-versions-of-solidity
INFO:Detectors:
Low level call in Address.sendValue(address,uint256) (contracts/opezeppelln/contracts/utlis/Address.sol#53-59):
  - (success, recipient.call{value: amount}()) (contracts/opezeppelln/contracts/utlis/Address.sol#57)
Low level call in address.functionCallWithValue(address,bytes,uint256,string) (contracts/opezeppelln/contracts/utlis/Address.sol#119-140):
  - (success,returnData) = target.call{value: weiValue}(data) (contracts/opezeppelln/contracts/utlis/Address.sol#123)
Reference: https://github.com/cryptic/sllther/wiki/Detector-Documentation#low-level-calls
```

Figure 3: contracts/Riverboat.sol

```
INFO:Detectors:
Parameter ERC721.safeTransferFrom(address,address,uint256,bytes)._data (contracts/opezeppelln/contracts/token/ERC721/ERC721.sol#245) is not in mixedCase
Parameter Riverboat.enableTrade(bool)._tradeEnabled (contracts/riverboat/Riverboat.sol#80) is not in mixedCase
Parameter Riverboat.setPriceReceiver(address)._priceReceiver (contracts/riverboat/Riverboat.sol#86) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._nftAddress (contracts/riverboat/Riverboat.sol#103) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._lighthouseTierAddress (contracts/riverboat/Riverboat.sol#104) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._startPrice (contracts/riverboat/Riverboat.sol#105) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._priceIncrease (contracts/riverboat/Riverboat.sol#106) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._startTime (contracts/riverboat/Riverboat.sol#107) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._intervalDuration (contracts/riverboat/Riverboat.sol#108) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._intervalsAmount (contracts/riverboat/Riverboat.sol#109) is not in mixedCase
Parameter Riverboat.startSession(address,address,address,uint256,uint256,uint32,uint32,uint32,uint32)._slotsAmount (contracts/riverboat/Riverboat.sol#110) is not in mixedCase
Parameter Riverboat.approveNFTs(uint256,address)._sessionId (contracts/riverboat/Riverboat.sol#154) is not in mixedCase
Parameter Riverboat.buy(uint256,uint256)._sessionId (contracts/riverboat/Riverboat.sol#171) is not in mixedCase
Parameter Riverboat.buy(uint256,uint256)._nftId (contracts/riverboat/Riverboat.sol#171) is not in mixedCase
Parameter Riverboat.getCurrentInterval(uint256)._sessionId (contracts/riverboat/Riverboat.sol#232) is not in mixedCase
Parameter Riverboat.getCurrentPrice(uint256,uint256)._sessionId (contracts/riverboat/Riverboat.sol#246) is not in mixedCase
Parameter Riverboat.getCurrentPrice(uint256,uint256)._currentInterval (contracts/riverboat/Riverboat.sol#248) is not in mixedCase
Parameter Riverboat.isActive(uint256)._sessionId (contracts/riverboat/Riverboat.sol#260) is not in mixedCase
Parameter Riverboat.isDebugEnabled(uint256,uint256)._currentInterval (contracts/riverboat/Riverboat.sol#278) is not in mixedCase
Parameter Riverboat.isDebugEnabled(uint256,uint256)._currentInterval (contracts/riverboat/Riverboat.sol#278) is not in mixedCase
Parameter RiverboatNft.mint(address,uint256)._to (contracts/riverboat/RiverboatNft.sol#39) is not in mixedCase
Parameter RiverboatNft.mint(address,uint256)._type (contracts/riverboat/RiverboatNft.sol#39) is not in mixedCase
Parameter RiverboatNft.setOwner(address)._owner (contracts/riverboat/RiverboatNft.sol#92) is not in mixedCase
Parameter RiverboatNft.setFactory(address)._factory (contracts/riverboat/RiverboatNft.sol#56) is not in mixedCase
Parameter RiverboatNft.setBaseURI(string)._url (contracts/riverboat/RiverboatNft.sol#60) is not in mixedCase
Reference: https://github.com/cryptic/sllther/wiki/Detector-Documentation#conformity-to-solidity-naming-conventions
```

Figure 4: contracts/Riverboat.sol

```

INFO:detectors:
owner() should be declared external:
  - Ownable.owner() (contracts/opezeppelin/contracts/access/Ownable.sol#35-37)
renounceOwnership() should be declared external:
  - Ownable.renounceOwnership() (contracts/opezeppelin/contracts/access/Ownable.sol#54-57)
supportsInterface(bytes4) should be declared external:
  - ERC165.supportsInterface(bytes4) (contracts/opezeppelin/contracts/introspection/ERC165.sol#35-37)
balanceOf(address) should be declared external:
  - ERC721.balanceOf(address) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#106-110)
name() should be declared external:
  - ERC721.name() (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#122-124)
symbol() should be declared external:
  - ERC721.symbol() (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#129-131)
tokenURI(uint256) should be declared external:
  - ERC721.tokenURI(uint256) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#136-151)
baseURI() should be declared external:
  - ERC721.baseURI() (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#158-160)
tokenOfOwnerByIndex(address,uint256) should be declared external:
  - ERC721.tokenOfOwnerByIndex(address,uint256) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#165-167)
totalSupply() should be declared external:
  - ERC721.totalSupply() (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#172-175)
tokenByIndex(uint256) should be declared external:
  - ERC721.tokenByIndex(uint256) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#180-183)
approve(address,uint256) should be declared external:
  - ERC721.approve(address,uint256) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#188-197)
setApprovalForAll(address,bool) should be declared external:
  - ERC721.setApprovalForAll(address,bool) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#211-216)
transferFrom(address,address,uint256) should be declared external:
  - ERC721.transferFrom(address,address,uint256) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#228-233)
safeTransferFrom(address,address,uint256) should be declared external:
  - ERC721.safeTransferFrom(address,address,uint256) (contracts/opezeppelin/contracts/token/ERC721/ERC721.sol#238-240)
burn(uint256) should be declared external:
  - ERC721Burnable.burn(uint256) (contracts/opezeppelin/contracts/token/ERC721/ERC721Burnable.sol#20-24)
debug(uint256,uint256) should be declared external:
  - Riverboat.debug(uint256,uint256) (contracts/riverboat/Riverboat.sol#278-280)
mint(address,uint256) should be declared external:
  - RiverboatNFT.mint(address,uint256) (contracts/riverboat/RiverboatNft.sol#39-50)
setOwner(address) should be declared external:
  - RiverboatNft.setOwner(address) (contracts/riverboat/RiverboatNft.sol#52-54)
setFactory(address) should be declared external:
  - RiverboatNft.setFactory(address) (contracts/riverboat/RiverboatNft.sol#56-58)
setBaseUri(string) should be declared external:
  - RiverboatNft.setBaseUri(string) (contracts/riverboat/RiverboatNft.sol#60-62)
Reference: https://github.com/cryptic/sllther/wiki/detector-documentation#public-function-that-could-be-declared-external

```

Figure 5: contracts/Riverboat.sol





THANK YOU FOR CHOOSING

 **HALBORN**

