Cyberscope

Audit Report

FOMO BULL CLUB

June 2024

Repository https://github.com/artiffine-vojtech/fmbc-contracts-tmp/tree/main

Commit 7c256eebe0b210cae8bbb2928e69a22ddb2cc1b4

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Review

Audit Updates

Initial Audit	05 Jun 2024
Corrected Phase 2	21 Jun 2024

Source Files

Filename	SHA256
packages/hardhat/contracts/launchpad/NFTChecker.sol	67ac55ffcf12a422d4b100304e6880ac5e975b33a33d6655c7adeeb288beef23
packages/hardhat/contracts/launchpad/MEMEVesting.sol	934d888aba18f096427749fcb93c8ffc2f8f0f19a1fccdef9af5f4d82caccfe9
packages/hardhat/contracts/launchpad/Launchpad.sol	c3bd08dc50bf85a5d28200c52afe384dc3ff0cdd161df709b10f0a7945f4fe9b
packages/hardhat/contracts/launchpad/IdentityVerifier.sol	19c2605b605b90b6c6ef35a7bcdde88486d8ff6f479a9a08e8416d7484b2824d
packages/hardhat/contracts/launchpad/ERC20MEME.sol	469bc78d95c1f7f332aac3e52a0d4b004eb0d3c038e27ff6f3bbc82189a16036
packages/hardhat/contracts/launchpad/providers/UniswapV2DexProvider.sol	4c696300585189e11b13af68b9c872e5eb6613ff3fdc776da24492ecbe304c85
packages/hardhat/contracts/launchpad/providers/BalancerDexProvider.sol	113e78e4842c7b38a11a3267c03f4fbf8124ad2c91218fd9e165b9fb1bbdb6da
packages/hardhat/contracts/launchpad/libraries/LaunchControl.sol	aac0d981295af32d1c36f00fd985df6225f65784fb4865f630613b8e28aa8806

packages/hardhat/contracts/launchpad/interfaces/ITokenProxy.sol	3804731b75022a37eb28fe23e45bac14baf3f9f46d0d9f9d5e55aa7a0fbeeaee
packages/hardhat/contracts/launchpad/interfaces/ITokenIncentivesController.sol	88c371d1bf00acc79399c797b424e2e45b4dab13d2a0d4c5db045aa2be0afad6
packages/hardhat/contracts/launchpad/interfaces/ITokenEmissionsController.sol	619d41e5bec5469083142c8794459a76cc1a94b926b2803f238aa5d4bee8cfb3
packages/hardhat/contracts/launchpad/interfaces/ITokenControllerCommons.sol	280b6cfbcdbc09aa59f5853780ab833e390ef519b4c2060be19b14e519a061aa
packages/hardhat/contracts/launchpad/interfaces/INFTChecker.sol	7c8ae2a37db26675d1cc5684913caa2fe47364ffcc8a4a8a07efe726476a36d8
packages/hardhat/contracts/launchpad/interfaces/IMEMEVesting.sol	1af16ad34a5baf7be2c55a488e1cb79a53494828dd79cfe85b8b5c649280b984
packages/hardhat/contracts/launchpad/interfaces/ILaunchpad.sol	da13bd167a1b35a739838e80d8607a8700be4e3d37ca1b880884a5dd0cb43e26
packages/hardhat/contracts/launchpad/interfaces/ILaunchCommon.sol	feb8d99cfbc0f76683541f673c262bcbfa81249ab1350304badec87c65689710
packages/hardhat/contracts/launchpad/interfaces/IIdentityVerifier.sol	64d88ffd5853cb84e72980ddcf864b7745b0a770f867a2aab828bd28a0e55374
packages/hardhat/contracts/launchpad/interfaces/IDexProvider.sol	a91ff9da4199556a6ae0ca8c02ff02bd759cda89cac142701810c0249acee344
packages/hardhat/contracts/launchpad/interfaces/IControllerFactory.sol	85347bfad15252253e58e37175e3f5e7c504441f3eabefef3f38160919e8a158
packages/hardhat/contracts/launchpad/interfaces/IBalanceController.sol	f1c7123fa650b08913f2e2e01d6bafce06e4dd4bd1af9187a7ea2249d9435ada
packages/hardhat/contracts/launchpad/interfaces/balancer/IWeightedPool.sol	afca14b72bfdbf8b8660ffc6c358d309da0674ada77eda9df29b04cc9ad13267

packages/hardhat/contracts/launchpad/interfaces/balancer/IVault.sol	11fdd2136ffb09f45ac0955aadee5bf8eff1e0724989ccefd2da65680ba3e955
packages/hardhat/contracts/launchpad/interfaces/balancer/IBalancerFactory.sol	fc1ba1b6a6a340597e5c9df152ec3d2b715a2ce12ef9956938fab124c5a23398
packages/hardhat/contracts/launchpad/controllers/TokenProxy.sol	3aeec74656e3c54671d665f50078229c2e91b0ef0a38944a030c1777f75217d3
packages/hardhat/contracts/launchpad/controllers/TokenIncentivesController.sol	0a151edbbcd14450f0b7dbf9917b1c195e05acfee89fc084ac4daab7a89da1d7
packages/hardhat/contracts/launchpad/controllers/TokenEmissionsController.sol	870d417b7ec0b74314c6f96ef2b9ab6990b1e4ee0857a3f32009f4005d257137
packages/hardhat/contracts/launchpad/controllers/ControllerFactory.sol	89f8f13c8a67cffadb3530106336d641a50dcd2ea221d828644210513113aa2d

Overview

FOMO BULL CLUB is a decentralized launchpad and liquidity hub designed to facilitate the seamless launch and support of new cryptocurrency tokens. The protocol's primary functionalities encompass three core components: the launchpad, staking, and vesting.

Launchpad

The launchpad is responsible for the initial deployment of new tokens. Users can pledge liquidity or their staked NFTs to participate in the launch. Upon meeting predefined conditions, a new token is created, liquidity is added to a decentralized exchange (DEX), staking contracts are established, and the vesting for Key Opinion Leaders (KOL) allocations commences.

Staking

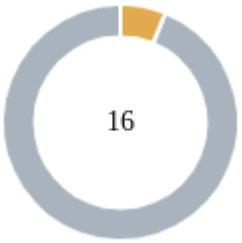
The staking contract offers a lock period feature, where rewards are scaled based on the duration of the lock. Additionally, users can stake their NFTs to receive boosted rewards. These rewards can be distributed in various tokens, and the system allows the administrator to add more reward options at any time.

Vesting

Vesting is managed through a contract that locks tokens for a specified duration, ensuring a controlled and gradual release.

FOMO BULL CLUB aims to provide a robust and flexible environment for launching new tokens, incentivizing participation through staking, and ensuring orderly token distribution through vesting.

Findings Breakdown



Critical	0
Medium	1
Minor / Informative	15

Severity	Unresolved	Acknowledged	Resolved	Other
Critical	0	0	0	0
Medium	1	0	0	0
Minor / Informative	13	0	0	2

Diagnostics

Critical Medium Minor / Informative

Severity	Code	Description	Status
Medium	PPI	Potential Precision Issue	Unresolved
Minor / Informative	APW	Admin Privileged Withdrawals	Unresolved
Minor / Informative	CCR	Contract Centralization Risk	Unresolved
Minor / Informative	DPI	Decimals Precision Inconsistency	Unresolved
Minor / Informative	DAU	Direct Address Usage	SemiResolved
Minor / Informative	MEM	Misleading Error Messages	Unresolved
Minor / Informative	MEE	Missing Events Emission	SemiResolved
Minor / Informative	MSC	Missing Sanity Check	Unresolved
Minor / Informative	PEVE	Potential Early Vesting Exit	Unresolved
Minor / Informative	PRAV	Potential Replay Attack Vector	Unresolved
Minor / Informative	RSML	Redundant SafeMath Library	Unresolved
Minor / Informative	USEA	Unrestricted Start Emissions Access	Unresolved
Minor / Informative	L04	Conformance to Solidity Naming Conventions	Unresolved
Minor / Informative	L07	Missing Events Arithmetic	Unresolved

●	L13	Divide before Multiply Operation	Unresolved
●	L16	Validate Variable Setters	Unresolved

PPI - Potential Precision Issue

Criticality	Medium
Location	packages/hardhat/contracts/launchpad/MEMEVesting.sol#L95
Status	Unresolved

Description

The `availableToClaim` function in the contract calculates the amount of tokens unlocked for a given account based on a predefined precision and unlock rate. However, due to precision limitations, there are cases where the `amountUnlocked` can be slightly larger than the originally vested amount. This discrepancy can cause subsequent claims to fail due to an insufficient balance.

The issue arises due to the precision factor. The computed value for `amountUnlocked` might end up slightly higher than the total vested amount (`vestingPosition.amount`). This happens because of the precision loss in the integer division and multiplication operations. The specific precision calculation for `PRECISION/UNLOCKED_MONTHLY` is `6.00240096` , which should be 6 instead.

When `amountUnlocked` exceeds the `vestingPosition.amount` , subsequent claims will attempt to withdraw more tokens than are actually vested. This will lead to a failure in the token transfer due to an insufficient balance.

```
uint256 constant UNLOCKED_MONTHLY = 1666;
...
uint256 constant PRECISION = 10000;
...
function availableToClaim(address _account, uint256 _positionIndex,
uint256 _timestamp) public view returns (uint256) {
    if (_timestamp < tgeTimestamp) return 0;
    VestingPosition storage vestingPosition =
vestingPositions[_account][_positionIndex];
    if (vestingPosition.cancelled) return 0;
    uint256 timeSinceStart = _timestamp -
vestingPosition.startTimestamp;
    uint256 numberOfUnlocks = timeSinceStart / 30 days;
    uint256 amountUnlocked = numberOfUnlocks >= NO_MONTHLY_UNLOCKS
        ? vestingPosition.amount
        : (vestingPosition.amount * (UNLOCKED_AT_TGE + (numberOfUnlocks
* UNLOCKED_MONTHLY))) / PRECISION;
    uint256 amountToClaim = amountUnlocked -
vestingPosition.amountClaimed;
    return amountToClaim;
}
```

Recommendation

To mitigate this issue, the team is advised to ensure that `amountUnlocked` never exceeds the initially vested amount. This can be achieved by adding a boundary check.

This boundary check ensures that the `amountUnlocked` will not exceed the original vesting amount, thus preventing the subsequent claims from failing due to insufficient balance.

APW - Admin Privileged Withdrawals

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/controllers/TokenEmissionsController.sol#L111 packages/hardhat/contracts/launchpad/controllers/TokenIncentivesController.sol#L73
Status	Unresolved

Description

The `withdraw` function in the staking contract allows the `withdrawingAdmin` to withdraw staked tokens on behalf of any staker after the expiration of the locking period. This functionality can be exploited if the `withdrawingAdmin` account is compromised or misused.

```
function withdraw(uint _amount, address _onBehalfOf) external {
    require(msg.sender == _onBehalfOf || msg.sender == withdrawingAdmin,
'Not withdrawing admin');
    require(userLockTime[_onBehalfOf] <= block.timestamp, 'Locked');
    Balances storage bal = balances[_onBehalfOf];
    require(_amount <= bal.staked, 'Amount greater than staked');
    _updateReward(_onBehalfOf, rewardTokens);
    if (msg.sender == _onBehalfOf) {
        _getReward(rewardTokens);
    }
    uint scaled = _amount.mul(bal.lockBoost).div(10);
    if (bal.boosted) {
        uint multiplier = _getMultiplier(bal.nftId);
        scaled = scaled.mul(multiplier).div(10);
    }
    if (_amount == bal.staked) {
        scaled = bal.scaled;
        bal.lockBoost = 0;
    }
    bal.staked = bal.staked.sub(_amount);
    bal.lockScaled = bal.staked.mul(bal.lockBoost).div(10);
    bal.scaled = bal.scaled.sub(scaled);
    totalScaled = totalScaled.sub(scaled);
    stakingToken.safeTransfer(msg.sender, _amount);
    emit Withdrawn(_onBehalfOf, _amount, scaled);
}
```

Recommendation

To mitigate this issue, the privilege of the withdrawingAdmin should be restricted to prevent unauthorized withdrawals. Consider implementing a multisignature (multisig) mechanism where multiple trusted parties must approve an action. Additionally, role-based access control could be used to segregate duties and limit the scope of administrative actions.

CCR - Contract Centralization Risk

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/Launchpad.sol#L335,358,367,375,383,391,399,406,413,420 packages/hardhat/contracts/launchpad/NFTChecker.sol#L50,61 packages/hardhat/contracts/launchpad/MEMEVesting.sol#L140 packages/hardhat/contracts/launchpad/IdentityVerifier.sol#L29 packages/hardhat/contracts/launchpad/controllers/TokenProxy.sol#L44 packages/hardhat/contracts/launchpad/controllers/TokenIncentivesController.sol#L179,187,197 packages/hardhat/contracts/launchpad/controllers/TokenEmissionsController.sol#L223,232
Status	Unresolved

Description

The contract's functionality and behavior are heavily dependent on external parameters or configurations. While external configuration can offer flexibility, it also poses several centralization risks that warrant attention. Centralization risks arising from the dependence on external configuration include Single Point of Control, Vulnerability to Attacks, Operational Delays, Trust Dependencies, and Decentralization Erosion.

```
function setKolAddresses(address[] memory _kolAddresses, bool[] memory
_isKol) function setSoftCapAndFees(uint256 _softCap, uint256 _launchFee)
external onlyOwner
function setPledgeLimits(uint256 _min, uint256 _max) external onlyOwner
function setPledgeLimitsForKOLs(uint256 _min, uint256 _max) external
onlyOwner
function setSteakPlatformFee(uint256 _fee) external onlyOwner
function setMemePlatformFee(uint256 _fee) external onlyOwner
function setControllerFactory(address _controllerFactory) external
onlyOwner
function setSteakIC(address _steakIC) external onlyOwner
function setFomoIC(address _fomoIC) external onlyOwner
function addDexProvider(address _dexProvider) external onlyOwner
...
function addIncentivesController(address _controller) external onlyAdmin
function removeIncentivesController(uint index) external onlyOwner
...
function cancelVesting(address _account) external onlyOwner
...
function setSigner(address signer) public onlyAdmin
...
function setController(address _controller) external onlyOwner
...
function addReward(address _rewardToken) external onlyAdmin
function setWithdrawingAdmin(address _withdrawingAdmin) external
onlyOwner
function notifyReward(address[] calldata _rewardTokens, uint[] calldata
_amounts, uint _rewardsDuration) external onlyAdmin
...
function addReward(address _rewardToken) external onlyOwner
function notifyReward(address[] calldata _rewardTokens, uint[] calldata
_amounts, uint _rewardsDuration) external onlyAdmin
```

Recommendation

To address this finding and mitigate centralization risks, it is recommended to evaluate the feasibility of migrating critical configurations and functionality into the contract's codebase itself. This approach would reduce external dependencies and enhance the contract's self-sufficiency. It is essential to carefully weigh the trade-offs between external configuration flexibility and the risks associated with centralization.

DPI - Decimals Precision Inconsistency

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/Launchpad.sol#L326
Status	Unresolved

Description

The contract `Launchpad.sol` includes a calculation for determining the token allocation (`tokenAlloc`) of a user based on several parameters. However, the calculation uses a hardcoded decimal value (`1e18`) instead of dynamically retrieving the token's decimals. This practice can lead to incorrect token allocation calculations if the token in use does not adhere to the 18 decimal standard.

```
uint256 tokenAlloc = ((launchConfig.values[3] * 1e18 *
launchConfig.allocations[4] * userPledge.lp) /
    launchConfig.values[9]) / DEN;
```

Recommendation

Instead of using a hardcoded value, the contract should retrieve the token's decimals dynamically. This can be achieved by calling the `decimals()` function of the token contract. This change ensures that the calculation adapts to the actual decimals of the token, thereby maintaining accuracy in the token allocation.

DAU - Direct Address Usage

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/libraries/LaunchControl.sol#L192,231,235 packages/hardhat/contracts/launchpad/controllers/ControllerFactory.sol#L31,38
Status	SemiResolved

Description

In the contract, the address `0x000000000000000000000000000000000000dEaD` is used directly in multiple functions. This address is often referred to as the "dead address".

```
IERC20(_vars.fomo).safeTransfer(0x000000000000000000000000000000000000dEaD, fomoToBurn);
...
// Transfer LP tokens to dead address
IERC20(_addrs.usdcLP).safeTransfer(
    0x000000000000000000000000000000000000dEaD,
    IERC20(_addrs.usdcLP).balanceOf(address(this))
);
IERC20(_addrs.fomoLP).safeTransfer(
    0x000000000000000000000000000000000000dEaD,
    IERC20(_addrs.fomoLP).balanceOf(address(this))
);
...
TokenEmissionsController usdcLPController = new TokenEmissionsController(
    IERC20(_usdcLP),
    INFTWithLevel(_memberNFT),
    _token,
    0x000000000000000000000000000000000000dEaD
);
...
TokenEmissionsController fomoLPController = new TokenEmissionsController(
    IERC20(_fomoLP), INFTWithLevel(_memberNFT), _token, 0x000000000000000000000000000000000000dEaD
);
```

Recommendation

To enhance code readability and maintainability, it is recommended to define the dead address as a constant variable. This approach centralizes the address definition, making it easier to manage and reducing the likelihood of errors.

Team Update

The team adjusted the `LaunchControl.sol` contract.

MEM - Misleading Error Messages

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/Launchpad.sol#L358,374,382,411 packages/hardhat/contracts/launchpad/controllers/TokenIncentivesController.sol#L257 packages/hardhat/contracts/launchpad/controllers/TokenEmissionsController.sol#L300
Status	Unresolved

Description

The contract is using misleading error messages. These error messages do not accurately reflect the problem, making it difficult to identify and fix the issue. As a result, the users will not be able to find the root cause of the error.

```
require(_launchFee < USDC_SOFT_CAP)
require(_fee <= 2000)
require(_dexProvider != address(0))
require(rewardData[_rewardToken].lastUpdateTime == 0)
```

Recommendation

The team is suggested to provide a descriptive message to the errors. This message can be used to provide additional context about the error that occurred or to explain why the contract execution was halted. This can be useful for debugging and for providing more information to users that interact with the contract.

MEE - Missing Events Emission

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/IdentityVerifier.sol#L29 packages/hardhat/contracts/launchpad/NFTChecker.sol#L50,61 packages/hardhat/contracts/launchpad/controllers/TokenProxy.sol#L43 packages/hardhat/contracts/launchpad/Launchpad.sol#L389,396,403,410
Status	SemiResolved

Description

The contract performs actions and state mutations from external methods that do not result in the emission of events. Emitting events for significant actions is important as it allows external parties, such as wallets or dApps, to track and monitor the activity on the contract. Without these events, it may be difficult for external parties to accurately determine the current state of the contract.

```
function setSigner(address signer) public onlyAdmin
...
function addIncentivesController(address _controller) external onlyAdmin
function removeIncentivesController(uint index) external onlyOwner
...
function setController(address _controller) external onlyOwner
...
function setControllerFactory(address _controllerFactory) external
onlyOwner
function setSteakIC(address _steakIC) external onlyOwner
function setFomoIC(address _fomoIC) external onlyOwner
function addDexProvider(address _dexProvider) external onlyOwner
```

Recommendation

It is recommended to include events in the code that are triggered each time a significant action is taking place within the contract. These events should include relevant details such as the user's address and the nature of the action taken. By doing so, the contract will be more transparent and easily auditable by external parties. It will also help prevent potential issues or disputes that may arise in the future.

Team Update

The team adjusted the `Launchpad.sol` contract.

MSC - Missing Sanity Check

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/IdentityVerifier.sol#L29 packages/hardhat/contracts/launchpad/providers/UniswapV2DexProvider.sol#L21 packages/hardhat/contracts/launchpad/Launchpad.sol#L76,389
Status	Unresolved

Description

The contract does not properly check for the validity of the initialized address in the constructor. If the addresses are not initialized correctly, the contract will not function as intended.

```
constructor(address signer)
function setSigner(address signer) public onlyAdmin
...
constructor(address _router, address _factory)
...
constructor(
    address _fomoUsdcLp,
    address _steakIC,
    address _fomoIC,
    address _memberNFT,
    address _nftChecker,
    address _controllerFactory,
    address _identityVerifier,
    address _dexProvider
)
function setControllerFactory(address _controllerFactory) external
onlyOwner
```

Recommendation

It is recommended that the contracts implement proper sanity check to ensure that parameters addresses are correct. By adding a verification process, the contract can ensure that the contract will function as intended.

PEVE - Potential Early Vesting Exit

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/MEMEVesting.sol#L140
Status	Unresolved

Description

The `cancelVesting` function in the vesting contract allows the contract owner to cancel the vesting for any specified account prematurely. This function is controlled by the `onlyOwner` modifier, meaning only the owner of the contract has the authority to execute it.

```
function cancelVesting(address _account) external onlyOwner {
    VestingPosition[] storage positions = vestingPositions[_account];
    for (uint256 i = 0; i < positions.length; i++) {
        if (positions[i].cancelled) continue;
        positions[i].cancelled = true;
        uint256 cancelledAmount = positions[i].amount -
positions[i].amountClaimed;
        positions[i].amountClaimed = positions[i].amount;
        memeToken.safeTransfer(owner(), cancelledAmount);
    }
}
```

Recommendation

To mitigate the risks associated with the `cancelVesting` function, consider implementing one or more of the following improvements:

1. **Multi-Signature Authorization**: Require multiple signatures from a predefined set of trusted parties to authorize the cancellation of vesting positions. This reduces the risk of a single point of control.
2. **Time-Locked Cancellations**: Implement a time delay between the initiation of the cancellation and its execution, allowing beneficiaries to prepare or challenge the action if necessary.

PRAV - Potential Replay Attack Vector

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/IdentityVerifier.sol#L37
Status	Unresolved

Description

The `verify` function in the contract implementation performs signature verification to ensure that messages are signed by a specific signer and are recent. However, it does not ensure that a message with the same timestamp and identity cannot be reused within that window. This omission can potentially allow an attacker to reuse a valid signature within the 24-hour period.

Additionally, the function does not account for the possibility of the same contract being deployed on multiple chains, which can further expose it to replay attacks across different chains.

```
function verify(address identity, bytes calldata data) external view
override returns (bool) {
    (uint40 sigTimestamp, bytes32 message, bytes memory signature) =
abi.decode(data, (uint40, bytes32, bytes));
    bytes32 expectedMessage = keccak256(abi.encodePacked('\x19Ethereum
Signed Message:\n25', identity, sigTimestamp));
    if (message != expectedMessage) return false;
    if (message.recover(signature) != _signer) return false;
    if (uint256(sigTimestamp) < block.timestamp - 1 days) return false;
    return true;
}
```

Recommendation

To fully mitigate the risk of replay attacks, it is recommended to incorporate nonce and chain ID into the message being signed. This ensures that each signature is unique and can only be used once, and it also binds the signature to a specific blockchain, preventing cross-chain replay attacks.

RSML - Redundant SafeMath Library

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/controllers/TokenIncentivesController.sol packages/hardhat/contracts/launchpad/controllers/TokenEmissionsController.sol
Status	Unresolved

Description

SafeMath is a popular Solidity library that provides a set of functions for performing common arithmetic operations in a way that is resistant to integer overflows and underflows.

Starting with Solidity versions that are greater than or equal to 0.8.0, the arithmetic operations revert to underflow and overflow. As a result, the native functionality of the Solidity operations replaces the SafeMath library. Hence, the usage of the SafeMath library adds complexity, overhead and increases gas consumption unnecessarily in cases where the explanatory error message is not used.

```
library SafeMath {...}
```

Recommendation

The team is advised to remove the SafeMath library in cases where the revert error message is not used. Since the version of the contract is greater than `0.8.0` then the pure Solidity arithmetic operations produce the same result.

If the previous functionality is required, then the contract could exploit the `unchecked { ... }` statement.

Read more about the breaking change on https://docs.soliditylang.org/en/v0.8.16/080-breaking-changes.html#solidity-v0-8-0-breaking-changes.

USEA - Unrestricted Start Emissions Access

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/controllers/TokenEmissionsController.sol#L66
Status	Unresolved

Description

The function `startEmissions` within the contract poses a risk due to its lack of access control mechanisms. This function allows any user to trigger emissions and set the emission parameters, including the emissions amount and duration.

```
function startEmissions(EmissionPoint[] memory _emissions) external {
    require(emissions.length == 0, 'Emissions already started');
    require(_emissions.length > 0, 'No emissions');
    uint256 length = _emissions.length;
    uint256 emissionsSum;
    for (uint256 i = 0; i < length; i++) {
        require(_emissions[i].duration > 0 && _emissions[i].amount > 0,
'Invalid emission');
        emissionsSum += _emissions[i].amount;
        emissions.push(_emissions[i]);
    }
    emissionsStart = block.timestamp;
    IERC20(rewardTokens[0]).safeTransferFrom(msg.sender, address(this),
emissionsSum);
    _setRewardsDuration(emissions[currentEmissionsIndex].duration);
    Reward storage r = rewardData[rewardTokens[0]];
    r.balance = emissions[currentEmissionsIndex].amount;
    _notifyReward(rewardTokens[0],
emissions[currentEmissionsIndex].amount, rewardsDuration);
}
```

Recommendation

The team is advised to implement robust access controls within the `startEmissions` function. Access should be restricted to authorized addresses, such as the contract owner or designated administrators, who can be entrusted with the responsibility of initiating emissions.

L04 - Conformance to Solidity Naming Conventions

Criticality	Minor / Informative
Location	packages/hardhat/contracts/utils/Adminable.sol#L39,49,59 packages/hardhat/contracts/launchpad/NFTChecker.sol#L50,79 packages/hardhat/contracts/launchpad/MEMEVesting.sol#L50,79,95,111,119,120,140 packages/hardhat/contracts/launchpad/libraries/LaunchControl.sol#L61,62,63,153,154,155 packages/hardhat/contracts/launchpad/Launchpad.sol#L28,30,32,34,36,38,40,101,207,216,217,218,219,220,221,231,250,305,324,333,356,365,373,381,389,396,403,410
Status	Unresolved

Description

The Solidity style guide is a set of guidelines for writing clean and consistent Solidity code. Adhering to a style guide can help improve the readability and maintainability of the Solidity code, making it easier for others to understand and work with.

The followings are a few key points from the Solidity style guide:

1. Use camelCase for function and variable names, with the first letter in lowercase (e.g., myVariable, updateCounter).
2. Use PascalCase for contract, struct, and enum names, with the first letter in uppercase (e.g., MyContract, UserStruct, ErrorEnum).
3. Use uppercase for constant variables and enums (e.g., MAX_VALUE, ERROR_CODE).
4. Use indentation to improve readability and structure.
5. Use spaces between operators and after commas.
6. Use comments to explain the purpose and behavior of the code.
7. Keep lines short (around 120 characters) to improve readability.

```
address _admin
address _controller
address _incentivesController
uint256 _tokenId
address _identity
address _to
uint256 _amount
uint256[] calldata _positionIndexes
uint256 _positionIndex
uint256 _timestamp
address _account
ILaunchCommon.LaunchConfig storage _launchConfig
ILaunchCommon.TokenAddressess storage _addrs
Vars memory _vars

...
```

Recommendation

By following the Solidity naming convention guidelines, the codebase increased the readability, maintainability, and makes it easier to work with.
Find more information on the Solidity documentation
https://docs.soliditylang.org/en/v0.8.17/style-guide.html#naming-convention.

L07 - Missing Events Arithmetic

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/Launchpad.sol#L357,366,375,380,381,392 packages/hardhat/contracts/launchpad/controllers/TokenEmissionsController.sol#L251 packages/hardhat/contracts/launchpad/controllers/TokenIncentivesController.sol#L253
Status	Unresolved

Description

Events are a way to record and log information about changes or actions that occur within a contract. They are often used to notify external parties or clients about events that have occurred within the contract, such as the transfer of tokens or the completion of a task.

It's important to carefully design and implement the events in a contract, and to ensure that all required events are included. It's also a good idea to test the contract to ensure that all events are being properly triggered and logged.

```
USDC_SOFT_CAP = _softCap * 1e6
USDC_MIN = _min * 1e6
PLATFORM_STEAK_FEE = _fee
PLATFORM_MEME_FEE = _fee
if (_min > 0) USDC_KOL_MIN = _min * 1e6;
if (_max > 0) USDC_KOL_MAX = _max * 1e6;
...
rewardsDuration = _newRewardsDuration;
```

Recommendation

By including all required events in the contract and thoroughly testing the contract's functionality, the contract ensures that it performs as intended and does not have any missing events that could cause issues with its arithmetic.

L13 - Divide before Multiply Operation

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/MEMEVesting.sol#L100,101 packages/hardhat/contracts/launchpad/libraries/LaunchControl.sol#L96,110,117,188,189,192 packages/hardhat/contracts/launchpad/Launchpad.sol#L104,106,285,291,474,478,480
Status	Unresolved

Description

It is important to be aware of the order of operations when performing arithmetic calculations. This is especially important when working with large numbers, as the order of operations can affect the final result of the calculation. Performing divisions before multiplications may cause loss of prediction.

```
uint256 numberOfUnlocks = timeSinceStart / 30 days
uint256 amountUnlocked = numberOfUnlocks >= NO_MONTHLY_UNLOCKS
            ? vestingPosition.amount
            : (vestingPosition.amount * (UNLOCKED_AT_TGE +
(numberOfUnlocks * UNLOCKED_MONTHLY))) / PRECISION

uint256 platformFeePercent = (_launchConfig.values[12] * DEN) / (DEN -
_launchConfig.values[11])
uint256 usdcForTeam = (usdcAmount * platformFeePercent) / DEN
maxPledgeLP < (((((user.minPledge * 1e12) / 2) / totalUsdc) * totalLP) /
1e12)
```

Recommendation

To avoid this issue, it is recommended to carefully consider the order of operations when performing arithmetic calculations in Solidity. It's generally a good idea to use parentheses to specify the order of operations. The basic rule is that the multiplications should be prior to the divisions.

L16 - Validate Variable Setters

Criticality	Minor / Informative
Location	packages/hardhat/contracts/launchpad/Launchpad.sol#L93,390 packages/hardhat/contracts/launchpad/IdentityVerifier.sol#L19,30
Status	Unresolved

Description

The contract performs operations on variables that have been configured on user-supplied input. These variables are missing of proper check for the case where a value is zero. This can lead to problems when the contract is executed, as certain actions may not be properly handled when the value is zero.

```
CONTROLLER_FACTORY = _controllerFactory
_signer = signer
```

Recommendation

By adding the proper check, the contract will not allow the variables to be configured with zero value. This will ensure that the contract can handle all possible input values and avoid unexpected behavior or errors. Hence, it can help to prevent the contract from being exploited or operating unexpectedly.

Functions Analysis

Contract	Type	Bases		
	Function Name	**Visibility**	**Mutability**	**Modifiers**
NFTChecker	Implementation	INFTChecker, Adminable		
		Public	✓	-
	addIncentivesController	External	✓	onlyAdmin
	removeIncentivesController	External	✓	onlyOwner
	getIncentivesControllersCount	External		-
	isNftStaked	External		-
	getStakedNFTIds	Public		-
	_verify	Internal		
	_isNftStaked	Internal		
MEMEVesting	Implementation	IMEMEVesting, Ownable		
		Public	✓	-
	vestTokens	External	✓	-
	claimTokens	External	✓	-
	availableToClaim	Public		-
	getVestingPositions	External		-
	getVestingSchedule	External		-
	cancelVesting	External	✓	onlyOwner

Launchpad	Implementation	ILaunchpad, Ownable		
		Public	✓	-
	createLaunch	External	✓	-
	pledge	External	✓	-
	pledgeWithNFT	External	✓	-
	getFundsBack	External	✓	-
	launch	External	✓	-
	claimTokens	External	✓	-
	getLaunchConfig	External		-
	setKolAddresses	External	✓	onlyOwner
	setSoftCapAndFees	External	✓	onlyOwner
	setPledgeLimits	External	✓	onlyOwner
	setPledgeLimitsForKOLs	External	✓	onlyOwner
	setSteakPlatformFee	External	✓	onlyOwner
	setMemePlatformFee	External	✓	onlyOwner
	setControllerFactory	External	✓	onlyOwner
	setSteakIC	External	✓	onlyOwner
	setFomoIC	External	✓	onlyOwner
	addDexProvider	External	✓	onlyOwner
	_pledge	Internal	✓	
	_getMultiplier	Internal		
IdentityVerifier	Implementation	Adminable, IIdentityVerifier		

		Public	✓	-
	supportsInterface	Public		-
	setSigner	Public	✓	onlyAdmin
	verify	External		-
ERC20MEME	Implementation	ERC20		
		Public	✓	ERC20
UniswapV2DexProvider	Implementation	IDexProvider		
		Public	✓	-
	createLP	External	✓	-
	getPoolBalance	External		-
	breakLP	External	✓	-
BalancerDexProvider	Implementation	IDexProvider		
	createLP	External	✓	-
	breakLP	External	✓	-
	getPoolBalance	External		-
	_convertERC20sToAssets	Internal		
LaunchControl	Library			
	launch	External	✓	-
	tryToEndLaunch	External	✓	-

	_createLP	Internal	✓	
	_startEmissions	Internal	✓	
TokenProxy	Implementation	ERC20, Ownable, ITokenProxy		
		Public	✓	ERC20
	deposit	External	✓	-
	withdraw	External	✓	-
	setController	External	✓	onlyOwner
TokenIncentivesController	Implementation	ITokenIncentivesController, Adminable		
		Public	✓	Adminable
	deposit	External	✓	-
	withdraw	External	✓	-
	stakeNFT	External	✓	-
	unstakeNFT	External	✓	-
	getReward	External	✓	-
	lastTimeRewardApplicable	Public		-
	claimableRewards	External		-
	addReward	External	✓	onlyAdmin
	setWithdrawingAdmin	External	✓	onlyOwner
	notifyReward	External	✓	onlyAdmin
	_getReward	Internal	✓	

	_rewardPerToken	Internal		
	_earned	Internal		
	_addReward	Internal	✓	
	_notifyReward	Internal	✓	
	_updateReward	Internal	✓	
	_getMultiplier	Internal		
TokenEmissionsController	Implementation	ITokenEmissionsController, Adminable		
		Public	✓	Adminable
	startEmissions	External	✓	-
	deposit	External	✓	-
	withdraw	External	✓	-
	stakeNFT	External	✓	-
	unstakeNFT	External	✓	-
	getReward	External	✓	-
	lastTimeRewardApplicable	Public		-
	claimableRewards	External		-
	addReward	External	✓	onlyOwner
	notifyReward	External	✓	onlyAdmin
	_setRewardsDuration	Internal	✓	
	_getReward	Internal	✓	
	_rewardPerToken	Internal		
	_earned	Internal		

	_addReward	Internal	✓	
	_notifyReward	Internal	✓	
	_updateReward	Internal	✓	
	_getMultiplier	Internal		
ControllerFactory	Implementation	IControllerFactory		
	createNewTokenControllers	External	✓	-

Inheritance Graph

See the detailed images in the github repository.

Flow Graph

See the detailed images in the github repository.

Summary

FOMO BULL CLUB is an interesting project that has a friendly and growing community. Its contracts implement a launchpad for automated meme token launching. The Smart Contract analysis reported no compiler error or critical issues. This audit investigates security issues, business logic concerns and potential improvements.

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