



Audit Report for BrainTrust - August 15, 2021

## Summary

Audit Report prepared by Solidified covering the BTRST smart contracts.

## Process and Delivery

Three (3) independent Solidified experts performed an unbiased and isolated audit of the code.  
The debrief on 7 June 2021.

## Audited Files

The source code has been supplied in the form of a GitHub repository:

<https://github.com/Snowfork/BTRST-Contracts>

Final Commit number: **7ff8fb76010925634ab5b23425208c67c2f11f62**

Deployed at:

<https://etherscan.io/address/0x799ebfabe77a6e34311eeee9825190b9ece32824#code>

The scope of the audit was limited to the following files:

```
contracts
├─ BTRUST.sol
├─ GovernanceDecisions.sol
├─ GovernorAlpha.sol
├─ SafeMath.sol
└─ Timelock.sol
```

## Intended Behavior

The smart contracts implement an ERC-20 token and a governance voting system.

## Code Complexity and Test Coverage

Smart contract audits are an important step to improve the security of smart contracts and can find many issues. However, auditing complex codebases has its limits and a remaining risk is present (see disclaimer).

Users of a smart contract system should exercise caution. In order to help with the evaluation of the remaining risk, we provide a measure of the following key indicators: **code complexity**, **code readability**, **level of documentation**, and **test coverage**.

**Note, that high complexity or lower test coverage does equate to a higher risk. Certain bugs are more easily detected in unit testing than a security audit and vice versa. It is, therefore, more likely that undetected issues remain if the test coverage is low or non-existent.**

Criteria	Status	Comment
Code complexity	Medium	-
Code readability and clarity	High	-
Level of Documentation	Medium	-
Test Coverage	Medium	-

## Coverage Report:

File	% Stmts	% Branch	% Funcs	% Lines	Uncovered Lines
contracts/	63.21	48.75	67.65	63.47	
BTRUST.sol	78.26	73.81	78.95	78.26	... 178,179,266
GovernanceDecisions.sol	100	100	100	100	
GovernorAlpha.sol	58.65	36.67	66.67	58.95	... 306,310,311
SafeMath.sol	11.11	5.56	10	11.11	... 168,183,184
Timelock.sol	60.98	50	88.89	60.98	... 101,103,105
contracts/tests/	33.33	0	50	33.33	
TimelockHarness.sol	33.33	0	50	33.33	25,29,30,34
All files	62.59	48.15	66.22	62.82	



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### Issues Found

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Solidified found that the BrainTrust contracts contain 1 warning, no critical issues, no major issues, 3 minor issues, in addition to 3 informational notes.

We recommend all issues are amended, while the notes are up to the team's discretion, as they refer to best practices.

Issue #	Description	Severity	Status
1	Centralized Admin Privileges	Warning	Acknowledged
2	BTrust.sol: Token susceptible to approve attack	Minor	Acknowledged
3	GovernanceDecisions.sol: Allows duplicate values	Minor	Acknowledged
4	GovernorAlpha.sol: List of proposals might not be executable within a single transaction	Minor	Acknowledged
5	GovernorAlpha.sol: Unused import	Note	Resolved
6	Inconsistent Solidity versions	Note	Acknowledged
7	Duplicate SafeMath implementations	Note	Acknowledged

## Warnings

### 1. Centralized Admin Privileges

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The full supply of tokens is allocated to one specific address during the contract deployment. This inherently allows the same address to hold complete voting power at the beginning. The contract does not include any token distribution logic or on-demand minting based on usage. Since the tokens (and the voting power) are distributed manually, there is no way to validate the fair distribution from the smart contract.

Furthermore, the `guardian` account has the privilege to change the admin of `Timelock.sol` at will. This allows the address to execute any proposal without going through the whole voting process.

#### Recommendation

Consider reducing centralized admin privileges.

#### Team Response

*"Fair Token Distribution is not an on-chain problem, because even on-chain it's not possible to verify identity/prevent sybil accounts. This is something that should get attention irrespective of whether it is implemented on-chain or off-chain and the Braintrust Foundation will ensure that token distribution is done transparently and documented clearly.*

*Guardian privileges: The smart contract includes the `__abdicate` function to remove the guardian. This will be called at some point to fully decentralized the system."*

## Critical Issues

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No critical issues have been found.

## Major Issues

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No major issues have been found.

## Minor Issues

### 2. BTrust.sol: Token susceptible to approve attack

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Changing an allowance through the `approve()` method brings the risk that someone may use both the old and the new allowance by unfortunate transaction ordering. A detailed description of this vulnerability can be found here:

[https://docs.google.com/document/d/1YLPtQxZu1UAvO9cZ1O2RPXBbT0mooh4DYKjA\\_ip-RLM](https://docs.google.com/document/d/1YLPtQxZu1UAvO9cZ1O2RPXBbT0mooh4DYKjA_ip-RLM)

#### Recommendation

One possible solution to mitigate this race condition is to implement `increaseAllowance()` and `decreaseAllowance()` functions.

### 3. GovernanceDecisions.sol: Allows duplicate values

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The functions `addMarketplaceCategory()` and `addFoundationMember()` do not validate the input and this allows duplicate values to be present in both `marketplaceCategories` and `foundationMemberships` array.

#### Recommendation

Consider checking for duplicates before adding new items to the array if this is not an intended feature.

### 4. GovernorAlpha.sol: List of proposals might not be executable within a single transaction

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The function `execute()` attempts to execute all the submitted proposal calls within the same transaction. While a limit of 10 calls is placed on the proposal, 10 calls are more than enough to fill a block (depending on the calls). This would result in an always failing and un-executable proposal.

#### Recommendation

Allow for partial proposal executions (i.e. resume execution) or run transaction simulations to ensure that no proposal will be un-executable.

## Informational Notes

### 5. **GovernorAlpha.sol**: Unused import

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The following debug import has been left in the code:

```
import "hardhat/console.sol";
```

#### **Recommendation**

Remove the unused import.

### 6. Inconsistent Solidity versions

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The contracts use different compiler versions defined by pragmas. It is considered best practice to stick to a single compiler version throughout the codebase.

#### **Recommendation**

Choose a single compiler version.

### 7. Duplicate SafeMath implementations

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The contracts all use their implementations of secure arithmetic operations.

#### **Recommendation**

Consider using a single safeMath library for all contracts.



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## Disclaimer

Solidified audit is not a security warranty, investment advice, or an endorsement of BrainTrust or its products. This audit does not provide a security or correctness guarantee of the audited smart contract. Securing smart contracts is a multistep process, therefore running a bug bounty program as a complement to this audit is strongly recommended.

The individual audit reports are anonymized and combined during a debrief process, in order to provide an unbiased delivery and protect the auditors of Solidified platform from legal and financial liability.

*Solidified Technologies Inc.*