

# The Science of Algorithmic Collateral: Executive Summary

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Our research activities will focus on two complementary thrusts, one geared toward recommending practical (yet rigorous) improvements to the BitShares MPA system, and one geared toward advancing a deeper scientific understanding of algorithmically-collateralized asset design. In this executive summary, we briefly discuss our proposed activities and their expected outcomes.

## Key Research Thrusts

1. **Recommend concrete improvements to the BitShares MPA system.** This thrust will have highest priority in the initial phases of the project, as we intend to provide a positive return on investment as quickly as possible. We will work with the BitShares community to identify high-impact areas to study and improve. For instance, we will ask if any of the following can be implemented in a way that better-incentivizes collateral maintenance *without* sacrificing price pegging:

- Dynamic collateral ratios,
- Intelligent short-squeeze protection, and
- Market-based undercollateralization safety mechanisms (insurance contracts, etc).

Strong success in this thrust will result in the implementation of a rigorously-vetted, peer-reviewed replacement of the current global settlement system and an update to the mechanisms for collateral maintenance and margin calls. Solving these challenges will require investigating several deep incentive problems, and this should readily generate an impact in the broader research community.

2. **Develop a “science of algorithmic collateral,” investigating the key design tradeoffs in the space.** Complementary to thrust #1, this is the project’s deeper scientific thrust, and will investigate how various design choices impact quality measures. The types of questions we will ask in this thrust include, but are not limited to:

- **Can the balance between short-term and long-term stability be *tuned*?** For instance, the US Dollar is a poor store of value due to its constant inflation (poor long-term stability), but it is an excellent means of exchange due to its *extremely* stable short-term purchasing power for consumer goods (excellent short-term stability). Can the asset designer have both, or must he select between the two?
- **Is there a fundamental tradeoff in collateralized assets between manipulability and short-term stability?** That is, if the price of a stabilized asset is allowed to float slightly, does this make the asset more resistant to price-manipulation?

- **How can we assess *risk* in asset systems, taking into account the incentives seen by all parties?** In BitShares, the MPA system is meant to transfer risk from the MPA holder to the collateral BTS holder. However, a myopic BTS holder has both an interest and the means (via decentralized governance) to make decisions which transfer risk *back* to the MPA holder. That is, the BTS holder has a perverse incentive to *increase* the risk exposure of MPA holders. Can the intrinsic incentive mechanisms be designed in a way that mitigates this perverse incentive?

Strong success in this thrust includes a series of seminal papers submitted/published in the top academic venues on System Security (such as IEEE SP), Algorithmic Game Theory (ACM EC), and Automation and Control (IEEE CDC and TAC). Advancing knowledge in this deeper scientific area will confer long-term benefits to the blockchain community as a whole, and will serve as a baseline for future improvements to the BitShares protocol. Furthermore, this will represent one of the first times that distributed ledger technology and autonomous funding mechanisms have been leveraged to perform basic science; being on the leading edge of these efforts has clear public relations benefits for the BitShares Blockchain.

### **Additional project activities**

1. Travel to universities and academic/blockchain conferences to present our research.
2. Participation and outreach in blockchain community events in the greater Colorado Springs area.

### **Summary**

Our proposed research is an exciting and ambitious undertaking, as it promises both technical results relevant to the functioning of the BitShares Blockchain as well as basic science which will advance knowledge and lead to visibility and lasting impact in the broader academic community. It is our hope that in its success, this project will accomplish the following three unique things:

1. Bring new tools and theory to bear on the practical challenges faced by the BitShares Blockchain,
2. Spread awareness of the BitShares ecosystem to a previously unreached audience, and
3. Showcase the BitShares community's ability and commitment to fund higher learning projects which confer benefits beyond the insular setting of BitShares itself.