# Cost and Risk Considerations for Testing Unmanned and Autonomous Systems of Systems

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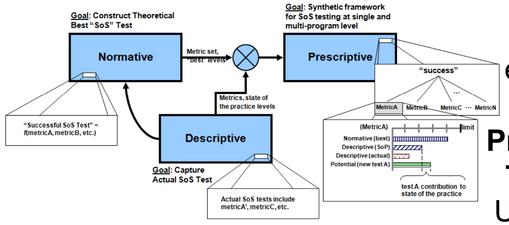
## Introduction

Unmanned and Autonomous Systems of Systems (UASoS) have become increasingly complex and bring interesting challenges to testing and evaluation. Currently no traditional testing techniques or programs of record exist.

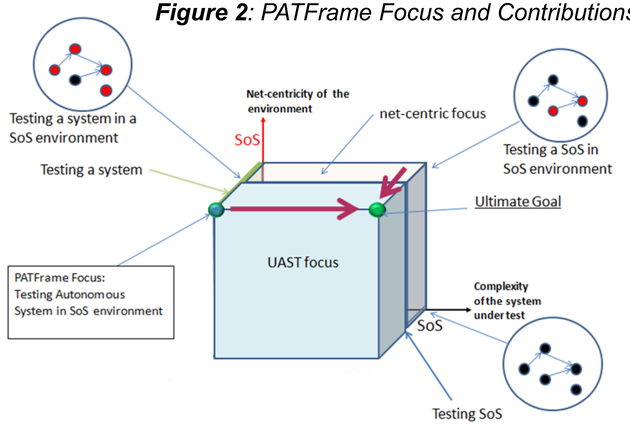



To ensure UASoS are effective, safe, suitable and survivable the **P**rescriptive and **A**daptive **T**esting **Frame**work for UASoS is being created.

***Figure 1**: PATFrame Approach*

## Problem Focus

***Figure 2**: PATFrame Focus and Contributions*




## Problem Statement

Current T&E processes lack the ability to determine the effort required for testing UASoS. The questions arises, "When am I done testing?" We hypothesize that the effort required for testing is directly related to the risks as well as technical and organizational cost drivers, which influence the testing and evaluation process. By using a risk based testing and cost model approach we seek to answer this question to determine the ultimate test stop point.

## Current Work

Literature review → Case Studies → Interviews → Surveys

### SPHERES Case Study

***Figure 3:** SPHERES at International Space Station*

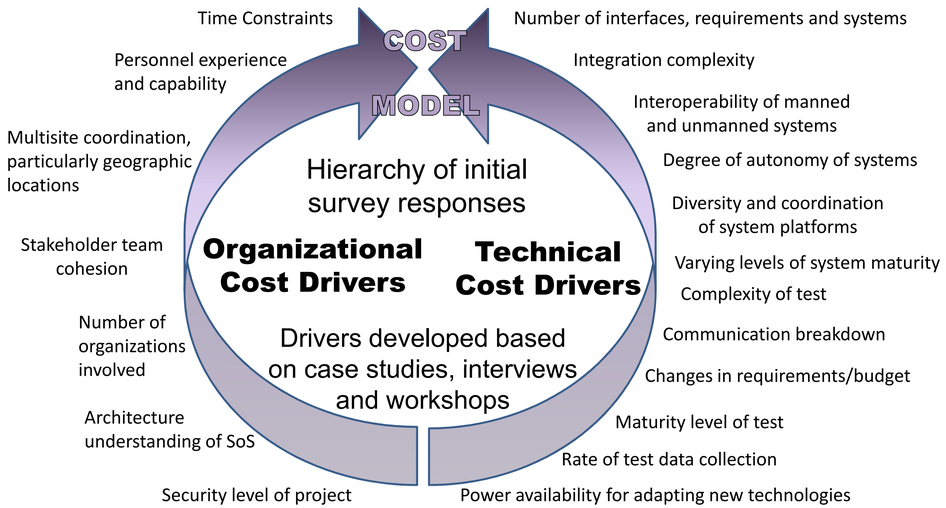
The **S**ynchronized **P**osition **H**old **E**ngage **R**eorient **E**xperimental **S**atellites testbed serves a dual role as both a risk mitigation unit and distributed satellite system of systems

**Principles of Risk Mitigation**

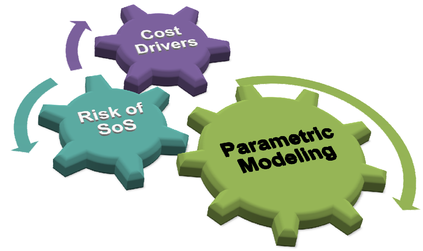
- ❑ Modularity
- ❑ Requirements Balance
- ❑ Enabling field of study
- ❑ Iterative Research
- ❑ Incremental Technology Maturation
- ❑ Optimized utilization of Resources

**PATFrame covers five domains – space, air, land, sea and undersea**

### Initial Technical and Organizational Cost Drivers




## Future Work




…continue knowledge acquisition to minimize risk by developing PATFrame as a decision support system for testing and evaluating UASOS

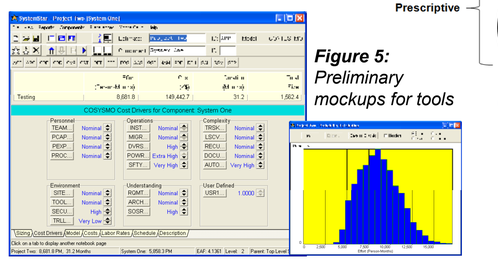
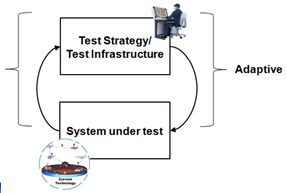
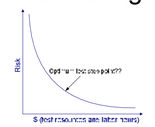


***Figure 5:** Preliminary mockups for tools*




…use both qualitative data from subject matter experts and quantitative data from test projects to validate inputs and ultimate stop point for testing




…develop the inputs for a tool to be used by test planners and testers to determine the effort required for testing

…include parameters that will calculate the probability of accomplishing a task in given resources and test cost driver inputs


## Acknowledgements

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