FAMU-FSU College of Engineering

# Plume Surface Interaction Scale Up Study

## Team 518


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# Sponsors

NASA

Jacobs
Space Exploration Group

Marvin Barnes

Dr. Manish Mehta

Dr. Robert Adams



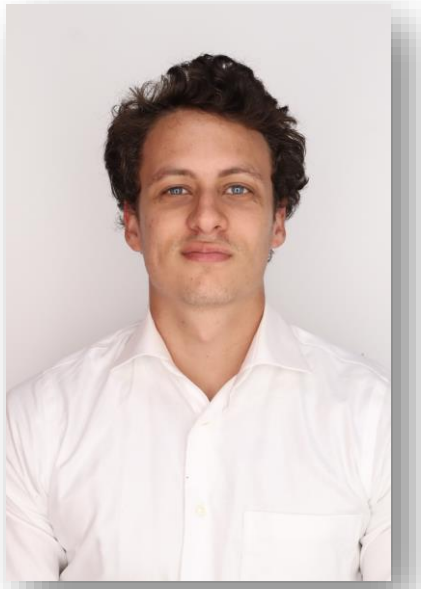
FAMU-FSU College of Engineering

# Advisor

Dr. Unnikrishnan Nair

# Team Members

Kaiah Foydel



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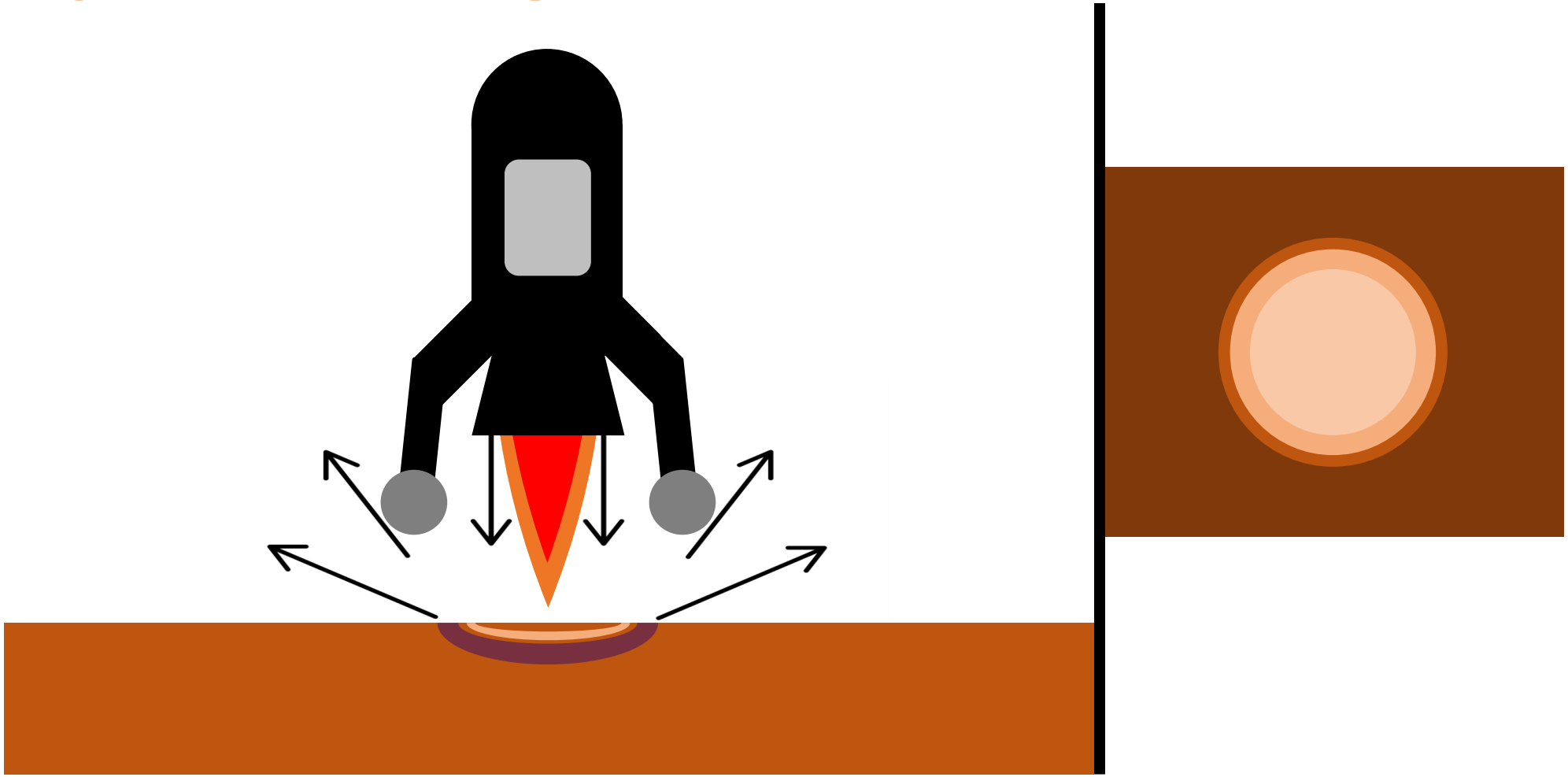
# Objective

The objective of this project is to design and implement a testing apparatus to study the effects of scaling on crater formation due to Plume Surface Interaction.

# Project Scope

# Project Background





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# Key Goals

**Create Experiment**

- **Design Testing Models**
- **Ideate alternative Testing Methods**

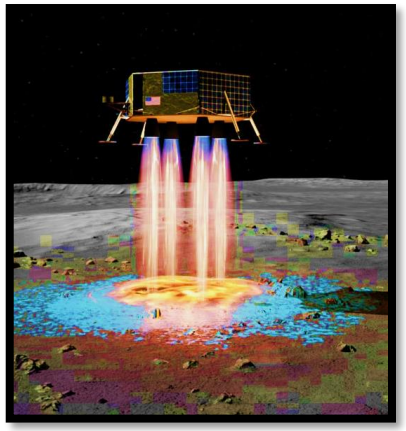
**Data Collection**

- **Effect of Nozzle diameter of Plume to Crater Formation**

**Analysis and Report**

- **Conduct Data Analysis and Report to Sponsors**

# Assumptions

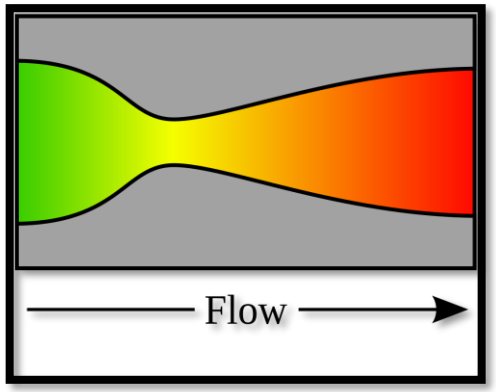


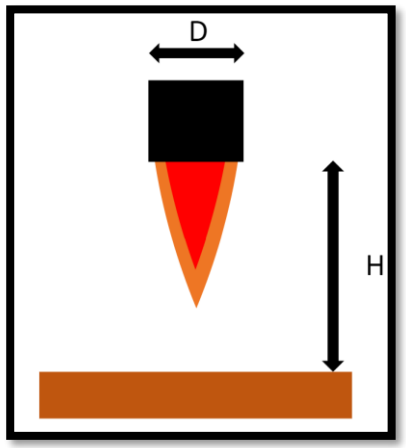
**Testing Parameters**

- Room Temp.
- Sea Level
- Single Nozzle
- Const Elevation

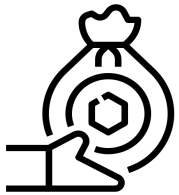
**Given information by Sponsors**

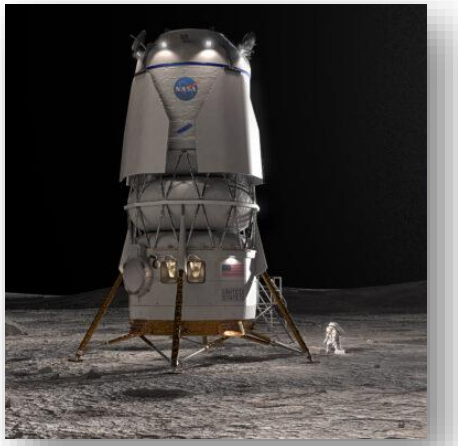
- Jet Speed
- Rocket Nozzle Geometry



# Stakeholders





**Blue Origin's Concept HLS**

# Markets

NASA

Jacobs
Space Exploration Group

SPACEX

ispace

BLUE ORIGIN

BOEING

# Customer Needs

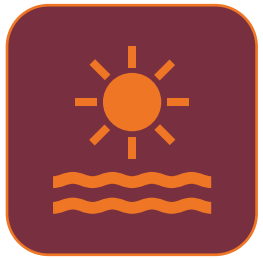
The team will produce experimental results of the effect scaling has on crater geometry.

The experiment will measure the depth, area, and profile of the crater created from the jet.

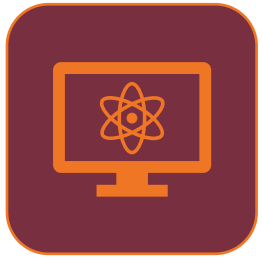
The experiment will use fine sand that mimics lunar dust, but not lunar regolith stimulant. The sand will be between 70 and 100 microns.

# Customer Needs

The experiment will only change the scale of the nozzle and not the ratio of entrance area and exit area of the nozzle.



The experiment will have fixed atmospheric properties.

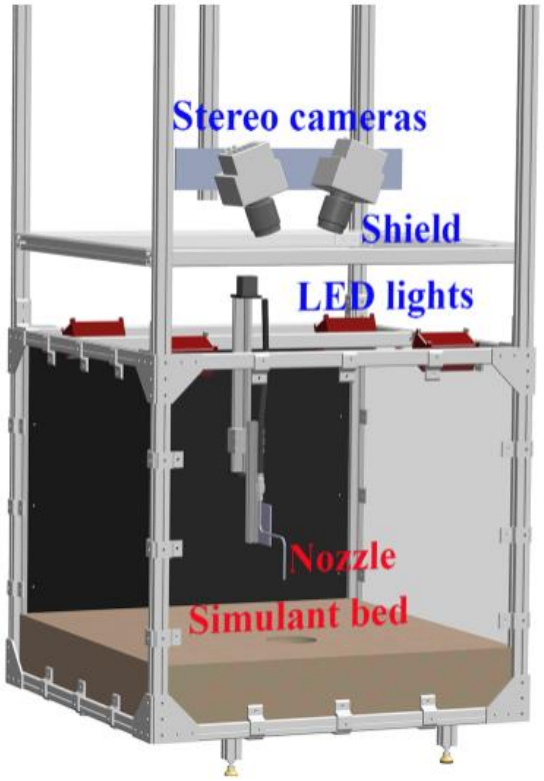


Team 518 will only be providing data based on physical measurements, no computer simulations.

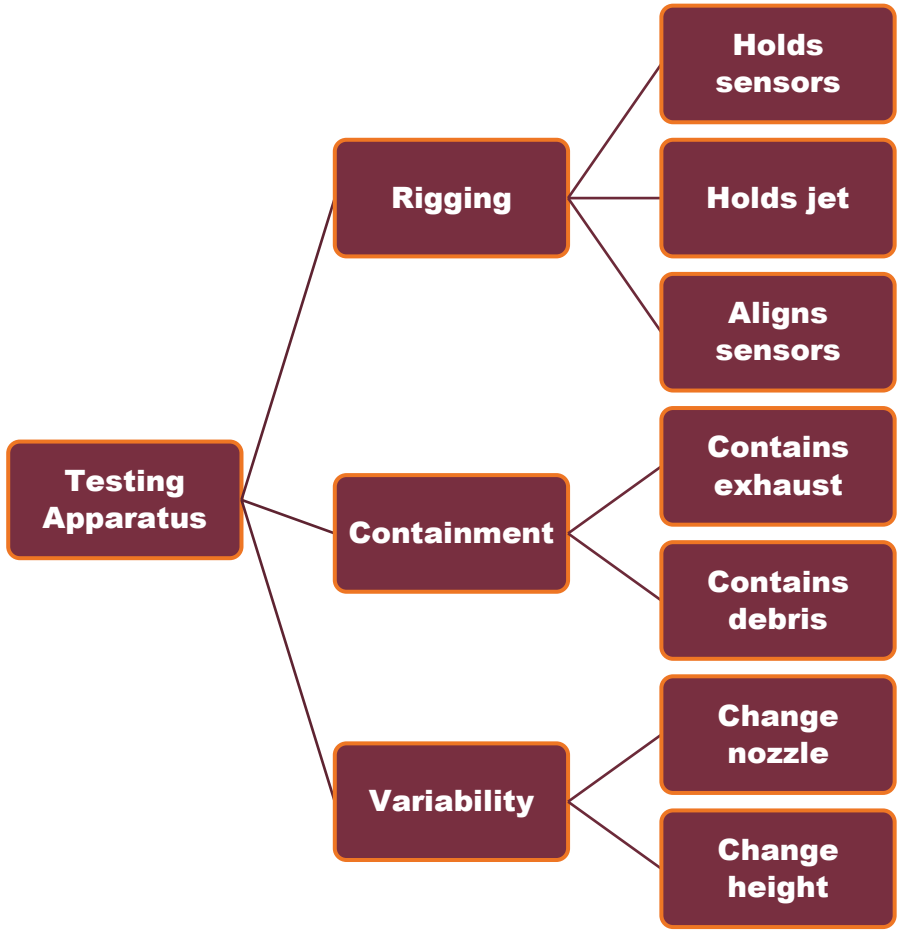
# Functional Decomposition

- Testing Apparatus
- Data Processing
- Experimental Design

# Testing Apparatus




https://doi.org/10.2514/1.J060835



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# Data Processing

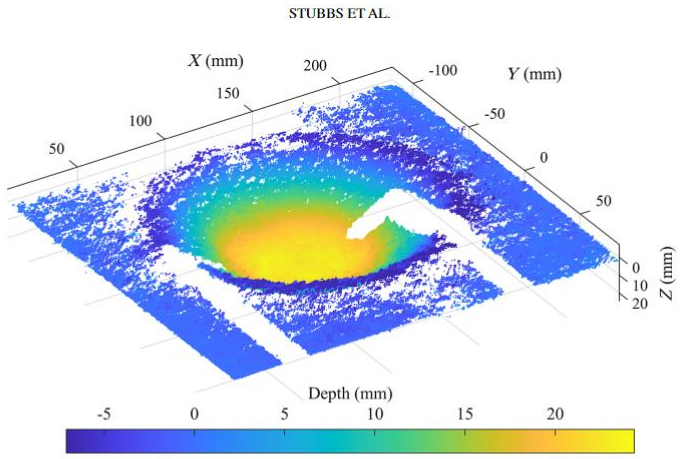


Fig. 5 A sample point cloud taken from one of the 70*D* nozzle height tests at a time of 500 ms.

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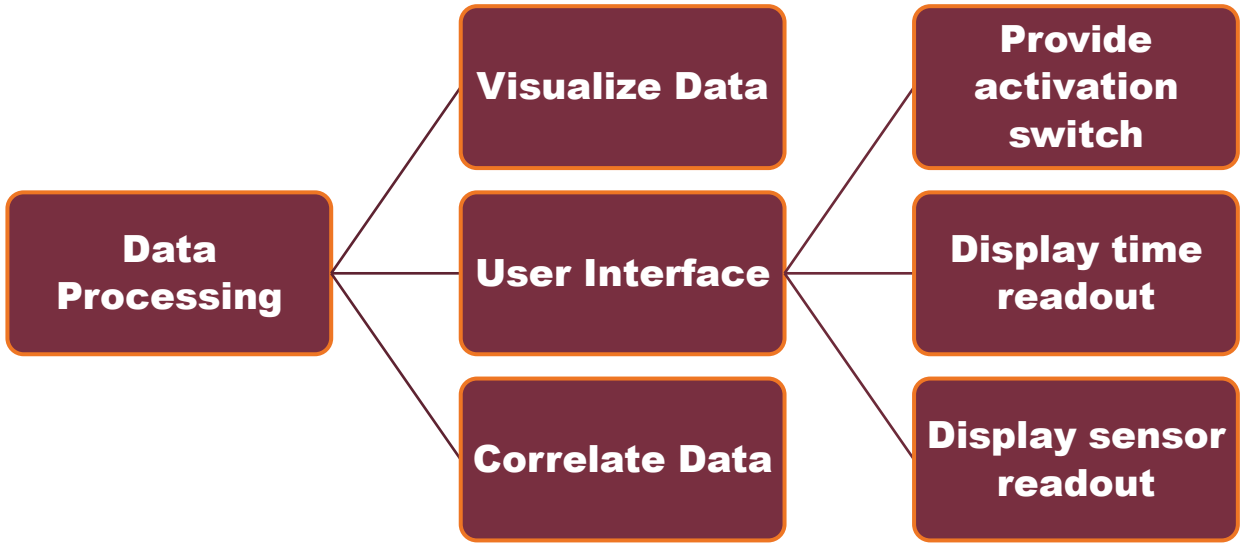
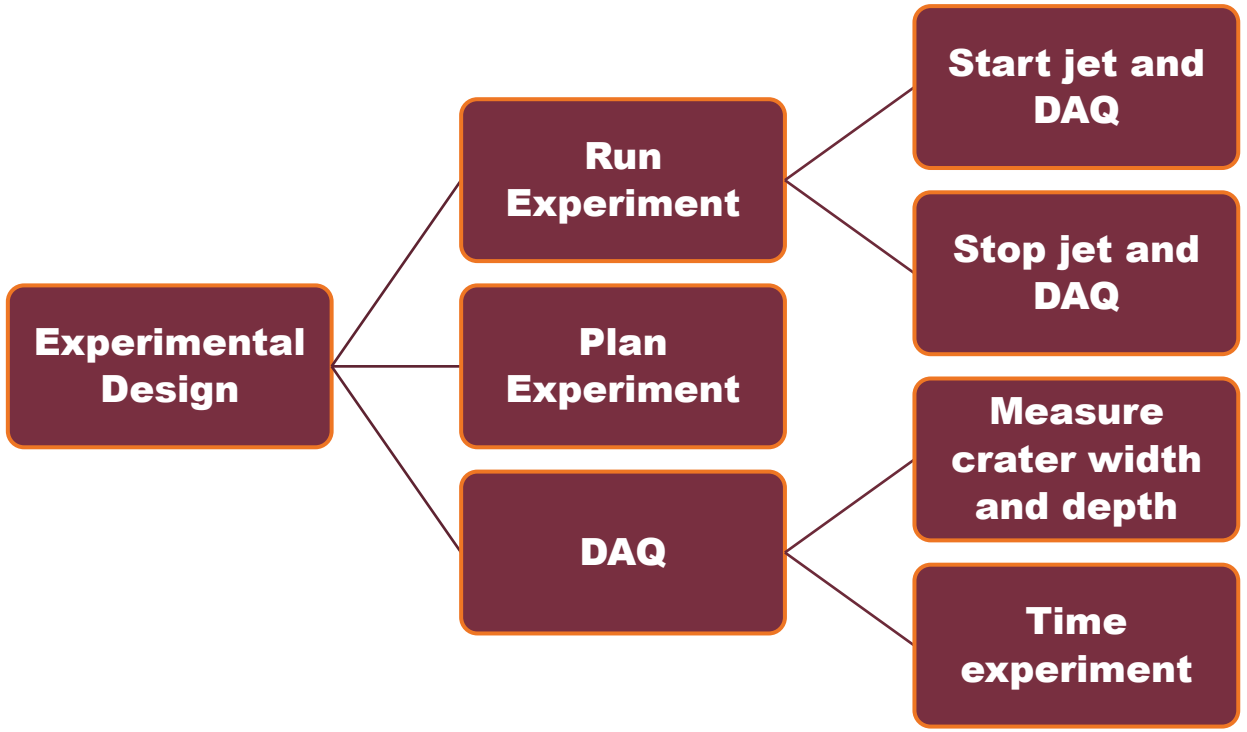
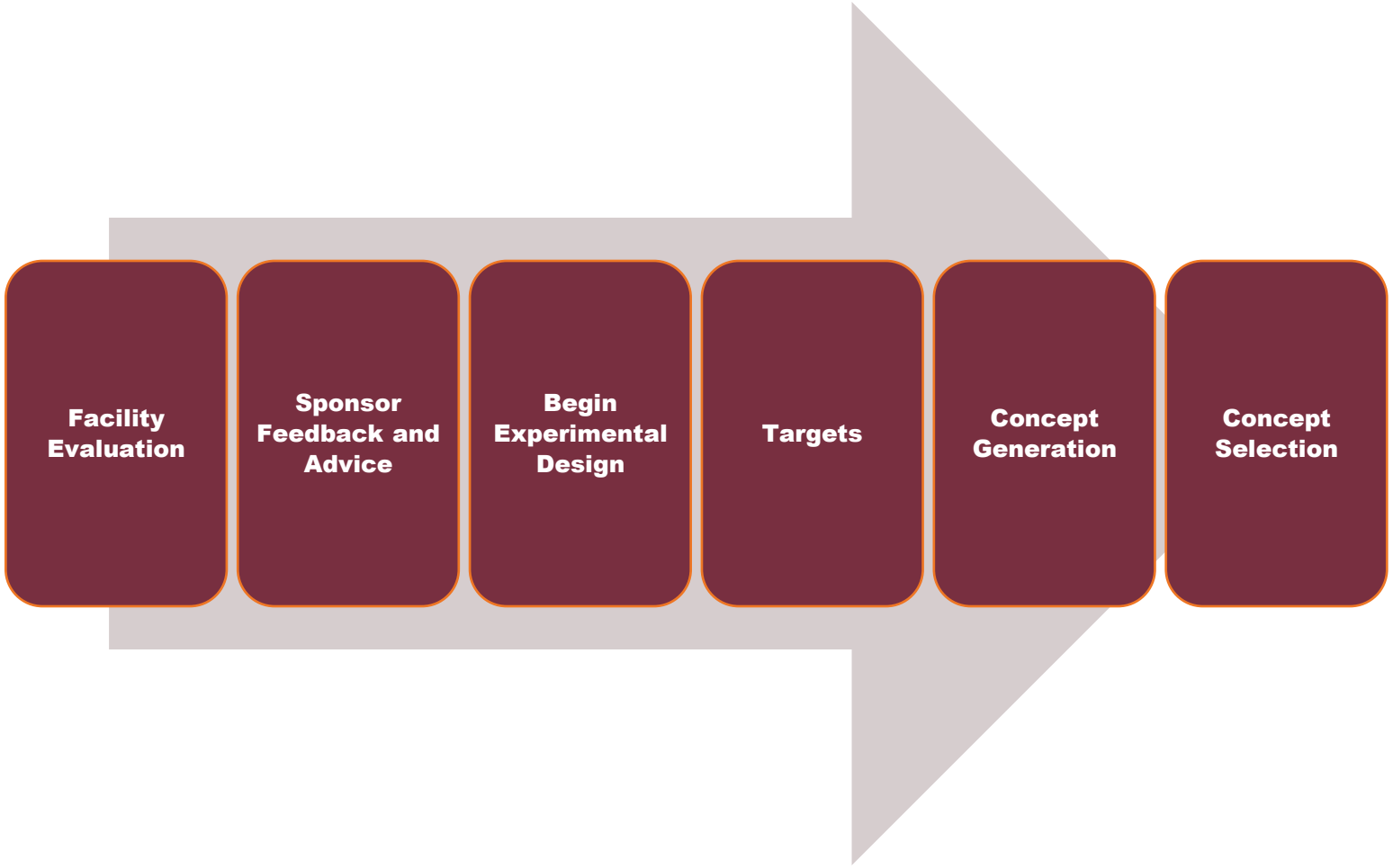


# Experimental Design



# Future Work


Facility Evaluation
Sponsor Feedback and Advice
Begin Experimental Design
Targets
Concept Generation
Concept Selection

# “It’s not an experiment if you know it’s going to work.”

- Jeff Bezos



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