

# 1. Abstract

This Request for Proposals explores the opportunity of preventing and mitigating damage to Space Tango’s research equipment during transportation by courier companies (i.e. between Space Tango’s headquarters in Lexington, Kentucky and the launch sites elsewhere in the United States). Space Tango is a space instrument design company that allows other companies and organizations to conduct autonomous experiments in low-earth orbit on the International Space Station within portable boxes called CubeLabs [12]<sup>1</sup>.

Several stakeholders are considered in the framing of this opportunity, including the employees of Space Tango along with the company’s clients, who both desire the shipments to be as well-protected from physical damage as possible. The companies that transport the CubeLabs are FedEx, to and from launch sites, as well as the companies that launch CubeLabs into space, including NASA, SpaceX, and Northrop Grumman. Moreover, our team, along with those affected by the environmental and economic impacts of the implementation of the solution are considered secondary stakeholders in this opportunity.

The opportunity arises due to approximately half of CubeLabs arriving with physical damage after being transported to or from the launch sites by FedEx’s trucks and cargo planes [34]<sup>2</sup>. This incurs fiscal and timeline costs to Space Tango and its clients, and jeopardizes the relationship between Space Tango and its clients.

This document outlines a requirements model that can quantify how well a potential shipping solution can meet the needs of the various stakeholders. The requirements model was created with the needs of all stakeholders in mind using metrics and tests whose uses are justified using research.

When considering the given metrics, a few reference designs are available for comparison. Firstly, Pelican cases with foam—the status quo—are introduced, as the opportunity would only be successful if a design that performs better in most metrics is identified. Another enclosure occasionally used when appropriate is the Powered Ascent Utility Locker (PAUL), which carries up to two CubeLabs and acts as a constant power source in addition to providing protection from physical damage. Lastly, for inspiration on implementing in-transit monitoring, including the live tracking of temperature, location, and acceleration during its transportation.

With the necessary background information and key objectives and requirements established, a solution likely to succeed in fulfilling the opportunity may be found more easily.

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<sup>1</sup>ISS US National Laboratory. “Partnerships: Space Tango”. <https://www.issnationallab.org/implementation-partners/space-tango-inc/>. 2021

<sup>2</sup>Team and Benjamin Lump. *Interview with CubeLab Mechanical Engineer Benjamin Lump*. Interview. Feb. 2021