SPACE TANGO

# Letter of Intent
# Leveraging Spintronics, Spin-Based Quantum Sensors, and Optimization of Fluid Dynamics for Enhanced Nanocrystal Growth in Microgravity
# September 20, 2023

This letter is being provided to Ilakkuvaselvi Manoharan, in support of their NASA SBIR proposal. If an award is made, Space Tango intends to work with the researcher to prepare for further phases and to scope out potential involvement from Space Tango as an implementation partner.

Below is a statement of our capabilities relevant to the work being proposed.

## Introduction to the TangoLab and CubeLab Product Lines

At Space Tango, a major discriminator to our product line is the use of automated systems. Working with many of our biological customers they have found our automation capabilities provide opportunities for a greater number of samples, improved consistency, and repeatability while alleviating on-orbit resource bottlenecks like crew time. Space Tango provides two types of on-orbit facilities, the TangoLab and the PAUL (Figure 1). TangoLabs operate solely on the ISS and require the CubeLab to be unpowered during ascent and return. The PAUL (Powered Ascent Utility Locker) provides power and data during all phases of flight; commanding the PAUL facility (and its CubeLabs) is possible on both Cygnus and Dragon capsules.

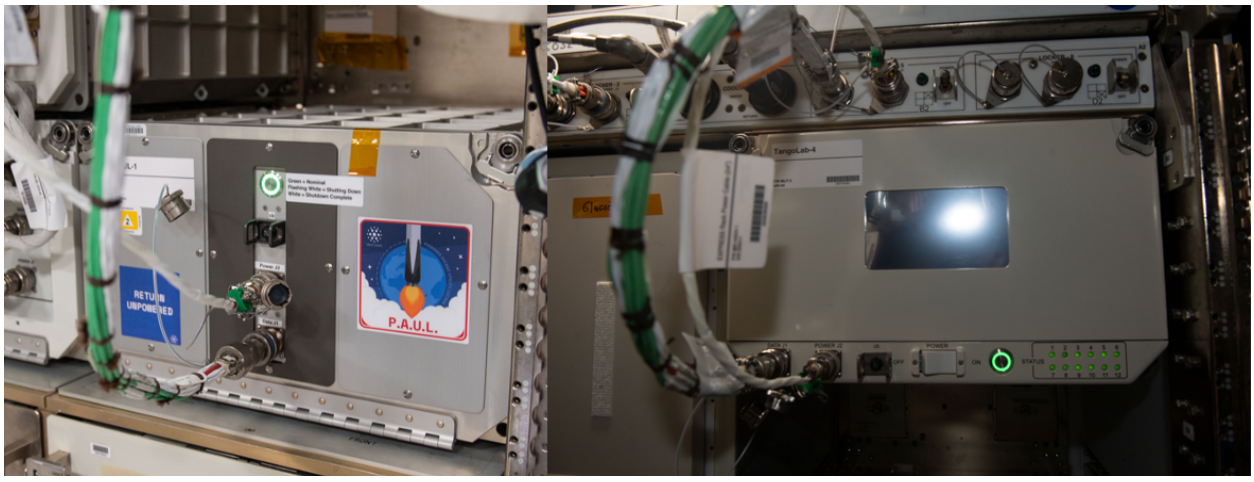


**Figure 1: Space Tango On Orbit Facilities**

CubeLabs are an experiment standard that allows for the containment of hardware required to implement a specific experiment type (Figure 2). For experiments requiring cell culture, these can include thermal control, gas containment, fluidic delivery and conditioning, and automated imaging. For physical science experiments, these include fluidic delivery, high-speed imaging, and custom lighting sequences. CubeLabs provide two levels of containment ensuring vehicle, station, and crew safety. If additional safety precautions are required, CubeLab hardware will include a third level of containment. Space Tango's facilities and CubeLabs require minimal crew time: transfer to and from the vehicle, installation, removal, and transfer to cold stowage, as appropriate.

End-to-end, Mission Operations support provided by Space Tango begins at the launch site with preflight science loading and concludes with postflight science deintegration and shipment at the return site. Space Tango's Mission Operations team and processes accommodate late-load and early destow requirements typically necessary for cell-based experiments. During ascent and descent, payload health and status can be monitored for hardware powered in a PAUL. Upon arrival to ISS, Space Tango oversees payload installation, 24x7 experimental monitoring and can provide manual intervention for off-nominal states from their headquarters in Lexington, KY. Synchronous or asynchronous ground controls are supported by additional CubeLab systems and include flight-equivalent mission operations.

## Science Methodology & Project Management

The proposed modules will build upon Space Tango's work with academia, NIH's NCATS Tissue Chips in Space program, NSF Tissue Engineering, ISS National Laboratory, and NASA.

Space Tango implements a Science Traceability Matrix for requirements tracking, this provides the reference points and tools needed to track overall mission requirements, provides systems engineers with fundamental requirements needed to design the mission, clearly shows the effects of any descoping or losses of elements, and facilitate identification of any resulting degradation to the science. A full Science Traceability Matrix (STM) will be developed at the project start. The final success criteria will be derived from the STM.

Space Tango uses a project management lifecycle process consistent with *NASA Space Flight Program and Project Management Requirements*, *NPR 7120*. During the

project lifecycle, stakeholders will be involved in major reviews such as the Project Requirements Review, Preliminary Design Review, Critical Design Review, and Project Readiness Review.

We look forward to supporting this work.

Sincerely,

Alain Berinstain
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