



# Plutonics Technologies

A Survey of the Space Access Value Chain for CubeSats and the  
Future Outlook

CubeSat Developers Workshop 2021

April 27-29, 2021

# TEAM INTRODUCTION

## Who are we?



**Kishen Raghunath**

**Co-Founder & CEO**

- 8+ years aerospace and defense experience
- Venture capital investor and strategy advisor for startups
- Early stage fintech startup experience
- BS Aerospace Engineering at Georgia Institute of Technology
- MS Aerospace Engineering at Georgia Institute of Technology
- MBA University of Chicago Booth School of Business



**Dr. Jin Kang**

**Co-Founder & CTO**

- Director of US Naval Academy Small Satellite Program
- 15 years teaching and building aerospace engineering and building small satellites
- BS Aerospace Engineering at University of Michigan
- MS & DE Aerospace Engineering at Stanford
- PhD Aerospace Engineering at Korea Aerospace University

## Why Listen to Us?

- **Discuss the current space access value chain**
- **Understand how the different solutions on the market compare**
- **Learn about how new technologies are impacting the space access value chain**

# GETTING CUBESATS TO ORBIT IS COMPLICATED

Although engineering is an integral part of building a CubeSat, there is so much more...

1 Establish Mission Objectives

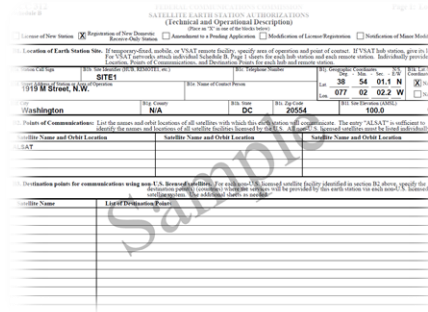
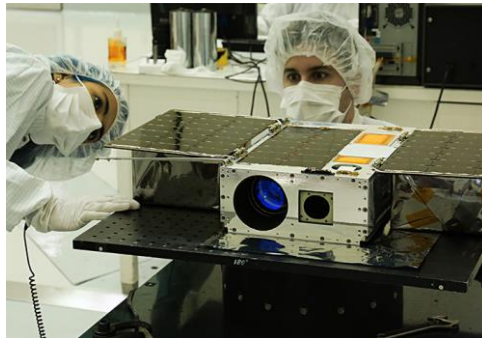
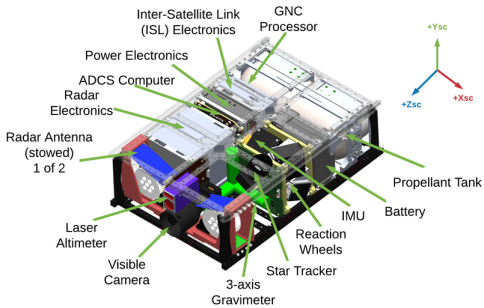
2 Component Selection

3 Assembly & Test

4 Regulatory

5 Launch

6 Operations



CubeSat manufacturing and operations is technically complex and involves multiple organizations

Capital Intensive and Time Consuming

# SOLUTIONS TODAY



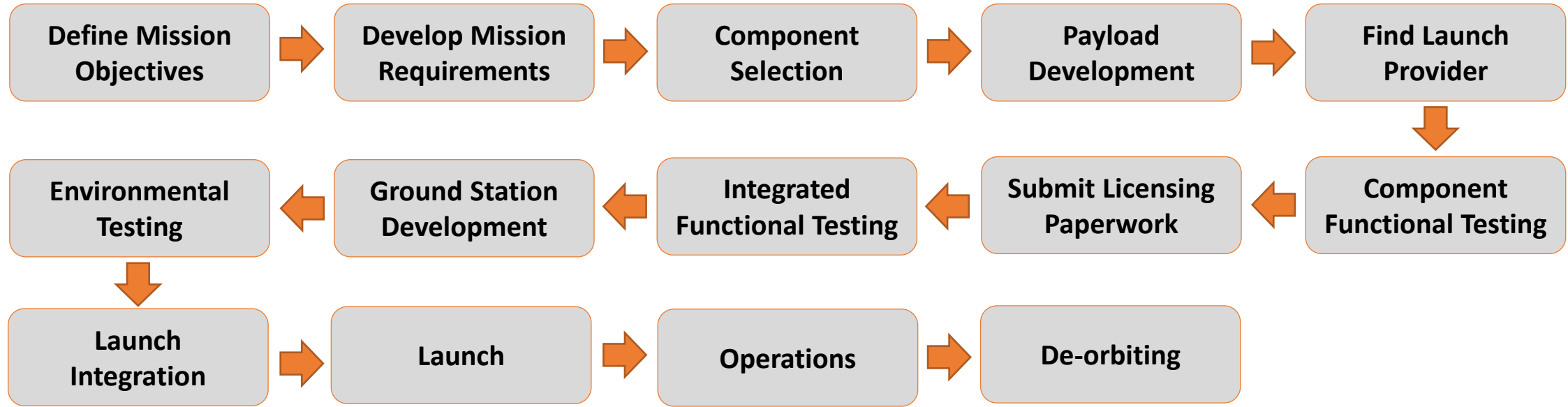
**Do-It-Yourself**



**Turnkey**

# DO-IT-YOURSELF APPROACH

Customer Journey



## Pros

- Low cost
- Highly customizable
- Learning opportunity for students and academics

## Cons

- Long development timeline
- Reliability not guaranteed
- Complicated integration
- Coordination between many different entities

**Although low cost, the DIY approach is inefficient, long, and does not guarantee reliability**

# TURNKEY SERVICES

Customer  
Journey



## Pros



















- Extremely hands-off
- Heritage configurations reduce technical risk
- Schedule is predictable
- Operations can be done by the customer or the service provider
- Don't need to have facilities to build a satellite

## Cons

- Higher cost than DIY
- Can be not as flexible as building your own
- Customization comes with a cost

**Although higher cost, turnkey services provide significant value and simplify getting payloads into orbit and operating**

# TRADE-OFFS BETWEEN SOLUTIONS

	Cost	Schedule	Available Payload Volume	Resources	Notes
<b>DIY</b>	 Starting at ~\$250k	 3 – 4 years	 Restricted volume, bus takes up to 50% of the volume	 Limited by CubeSat size 15 – 120W	 Lower reliability  High customization
<b>Turnkey Hosted Payload</b>	 Starting at ~\$0.8M	 Dependent on available opportunities	 Up to 50% of the bus volume can be used for payload	 Based on base spacecraft Up to 1kW	 Dependent on main customer payload destination  Simple operations
<b>Turnkey Free Flyer</b>	 Starting at ~\$1M	 12 – 15 months	 Restricted volume, bus takes up to 50% of the volume	 Limited by CubeSat size 15 – 120W	 Customization comes at a cost  Simple operations

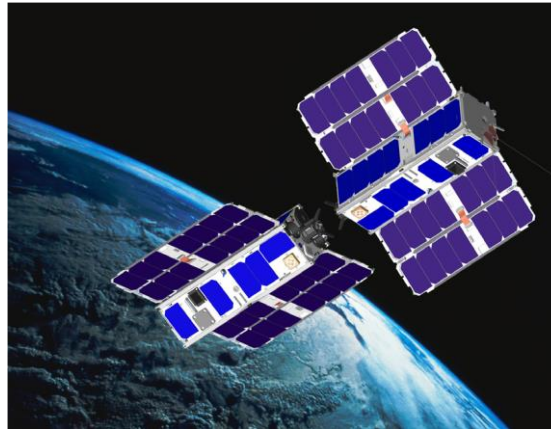
**There isn't one best solution on the market, but different options based on constraints of the mission**

# TECHNOLOGIES ENABLING NEW OPTIONS

## Rendezvous, Proximity Operations, and Docking (RPOD)



**Altius Space CubeSat  
Connectors**



**NASA 3U RPOD  
Demonstration**



**ESA 6U RPOD  
Demonstration**

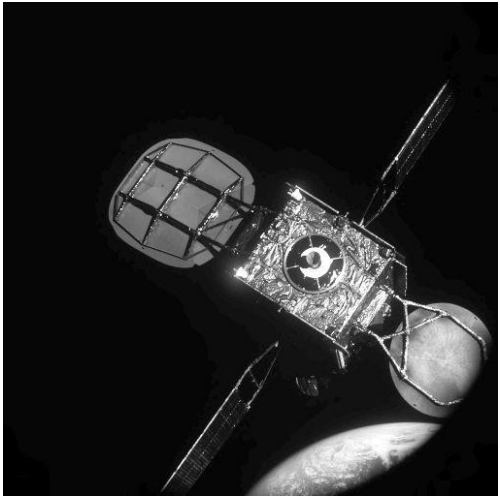


# RPOD AS A GAME CHANGING TECHNOLOGY



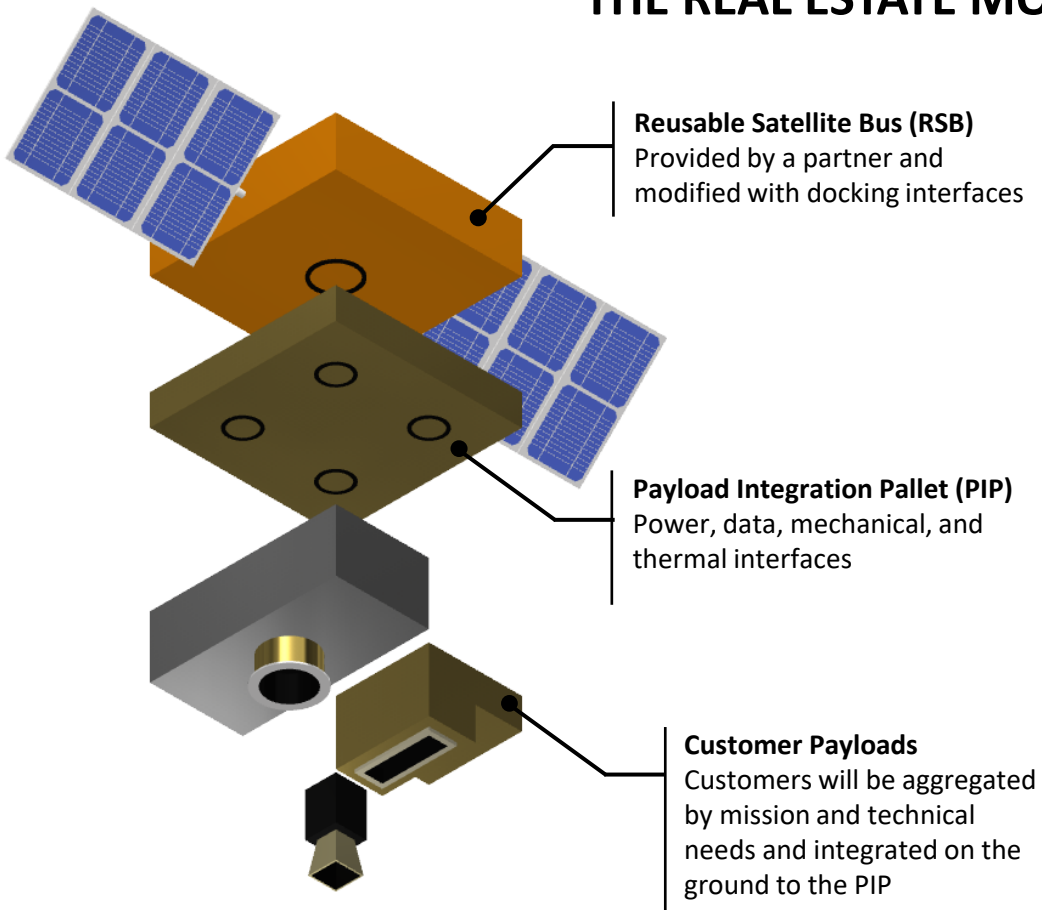
- **Recent successful docking of Northrop Grumman's Mission Extension Vehicle** has proven that this technology is at a mature state for **satellite operations**
- **On-orbit servicing and manufacturing (OSAM), enabled by RPOD**, has come to light as a **key capability of interest** by governments and commercial organizations to enable:
  - Modularity
  - In-orbit satellite servicing and de-orbiting
  - In-orbit refueling
  - Large space structures
  - Persistent platforms

**RPOD technologies will enable persistent in-space infrastructure that will help reduce costs and increase efficiencies of spacecraft operations**



# PLUTONICS IS BUILDING SPACE INFRASTRUCTURE-AS-A-SERVICE

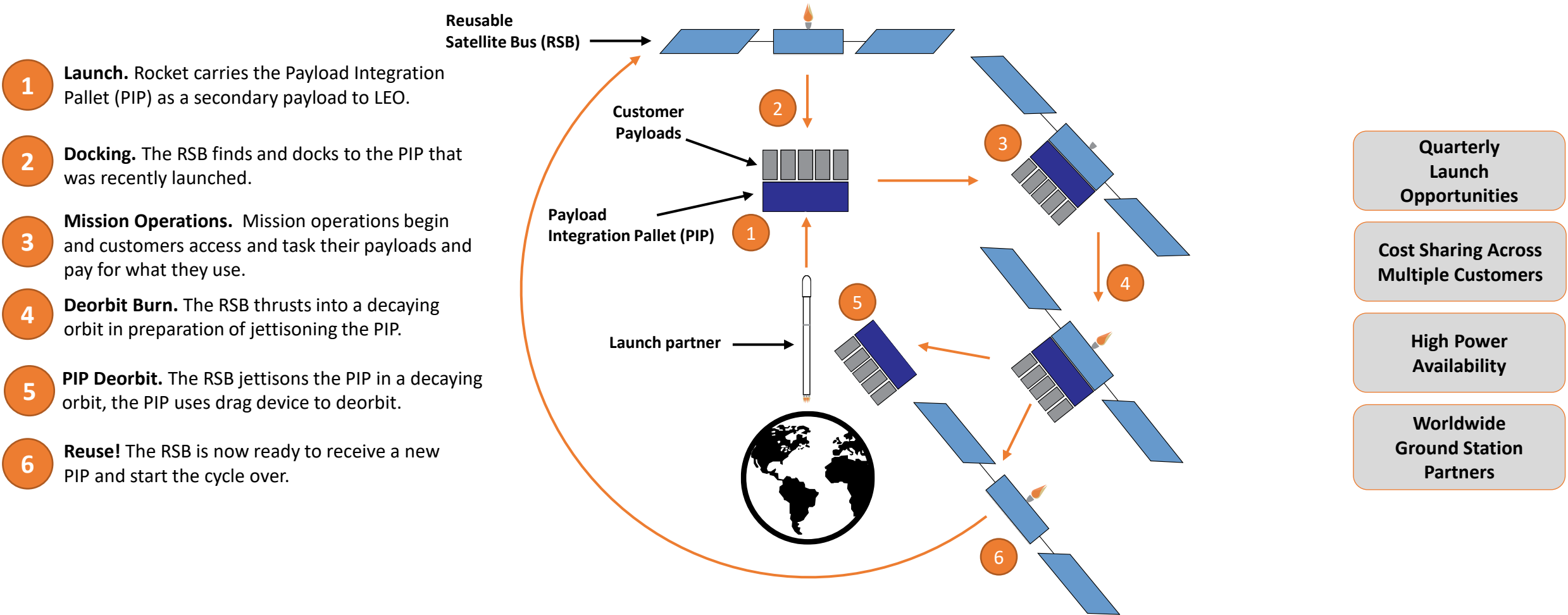
## THE REAL ESTATE MODEL IN SPACE IS ENABLED BY REUSABILITY



### PLUTONICS OFFERS...

























- **Turnkey service.** Customers provide their payloads, and we handle the rest. Customers access their payloads through an encrypted web platform for tasking and access their data.
- **Ready to go when you are.** Scheduled launches and on-orbit assets ensure customers start their missions as soon as they are ready instead of waiting for long-lead satellite components.
- **Mass Savings.** In space, mass is money, our solution saves up to 50% of a traditional satellite bus.
- **Pay-per-use model.** Customers only pay for mission time and resources they use, not an entire satellite mission.

# REAL ESTATE IN SPACE ENABLED BY REUSABILITY



Reusability enables Speed, Affordability, and High Performance

# TRADE-OFFS BETWEEN SOLUTIONS WITH RPOD TECHNOLOGY

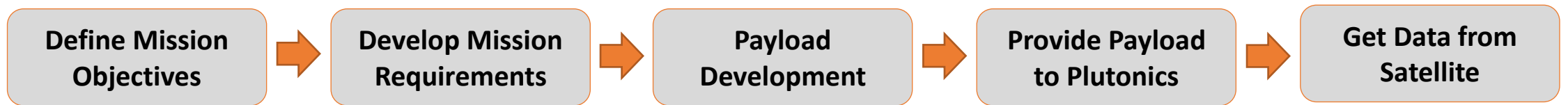
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<b>Reusable Bus RPOD Technology</b>	 Lowered cost	 Bus is ready on demand	 Up to 50% of the bus volume can be used for payload	 Based on base spacecraft Up to 1kW	 Customized orbits and placements  Simple operations

**RPOD technology can enable new architectures that can bring about the best of the solutions on the market**

# CONCLUSION

**Space is at the cusp of explosive growth, yet the infrastructure to support its growth isn't developed...**

- **Current solutions are inefficient.** The current solutions still require either a high tolerance for risk or significant capital resources to reduce technical risk.
- **RPOD technology as driver of cost and schedule savings.** Renewed interest in docking technologies along with successful commercial demonstrations offer options for new architectures such as reusable infrastructure to come to market.
- **The Plutonics Approach.** Just as rockets enabled lower costs through reusability, Plutonics is developing reusable satellite buses to reduce development costs and the time it takes to get to orbit in an affordable way with our pay-as-you-go pricing model.



**Plutonics hosts customer payloads as a turnkey service in LEO, enabled by reusable space infrastructure**



# Q&A

**Let's talk about your space mission!**

**Kishen Raghunath**

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