

# Relative Dynamics

*Kush Patel*

CEO

**RELATIVE DYNAMICS**

*(RE)THINK SPACE*



# Our Mission, Our Story

**Goal:** At Relative Dynamics, we value *knowledge as a process* rather than *knowledge as an answer*. Founded in 2011, our goal is to define the new space era by continuously pushing the boundaries of engineering models, services and technology development.

**Mission:** Our idea is seemingly simple, and we focus on the "first principles" approach. We have mastered the art of getting the right people, putting them in situations where their abilities shine, and providing them with the freedom to think and innovate. The result is to provide our customers a level of service and solutions beyond their expectations.



# Corporate Overview



## Business Profile

Founded 2011  
Top Secret Facility Clearance  
SDB  
8(a) - 2027  
Headquarters: Greenbelt, MD  
NAICS: 541330, 334511, 517410,  
518210, 541690, 541712



## Core Competencies

Systems Engineering  
Mission Engineering  
RF and Laser Communications  
Guidance, Navigation & Control  
Astrodynamics/Flight Dynamics  
Research and Technology Development  
Satellite Operations



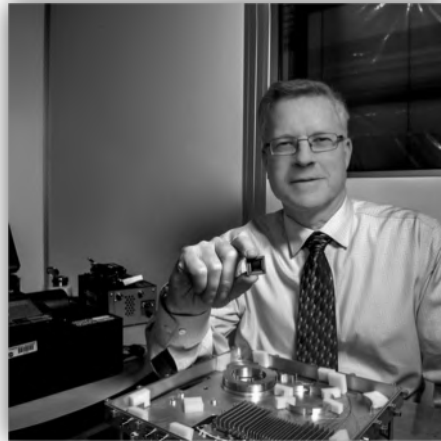
## Key Differentiators

Highly Technical Experts  
Hands-on and Customer Focused Leadership  
Product + Service Based  
Specialty Disciplines  
Trade Studies + Analysis

# Who We Are



**Kush Patel**  
*Founder & CEO*



**Dr. Michael Krainak**  
*Chief Technology Officer*



**Ms. Shuby Ambardekar**  
*Advisor Strategic Initiatives and  
Business Development*



**Antriksh Patel**  
*COO*

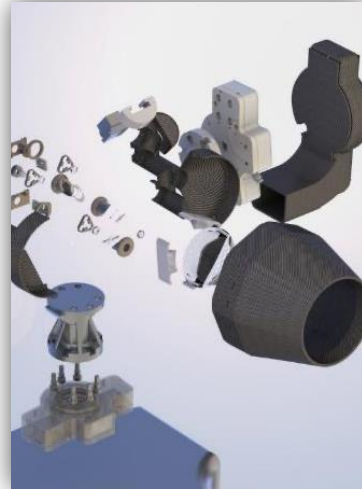
# What we do



Mission Operations



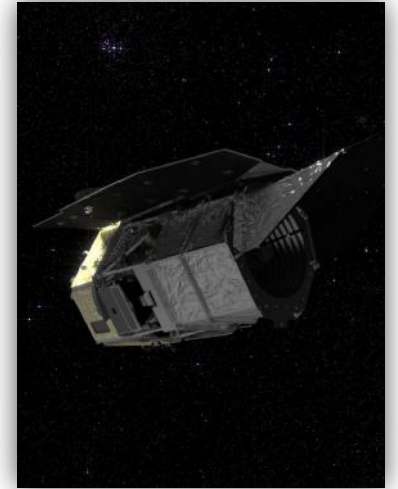
Communications



Research &  
Development

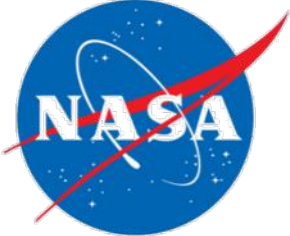


Mission Assurance



Systems Engineering

# Partners & Clients





# Engineering Contracts (Prime)

Agency	Description
NASA GSFC – 8(a) Laser Interferometer Space Antenna Optical Support Contract	Optical Systems Design
NASA – JPL – SBIR – Phase 1	Optical Communication Terminal
NASA – JPL – SBIR – Phase 1	Large Space Optics Using System Identification
Commercial Contracts	GNC, RF, Optical and Astrodynamics



# Engineering & Operations Contracts (Sub)

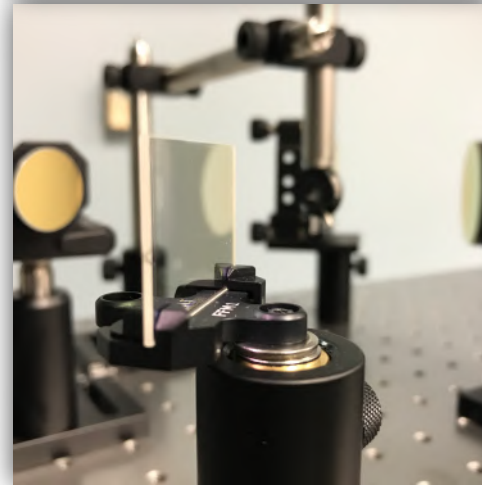
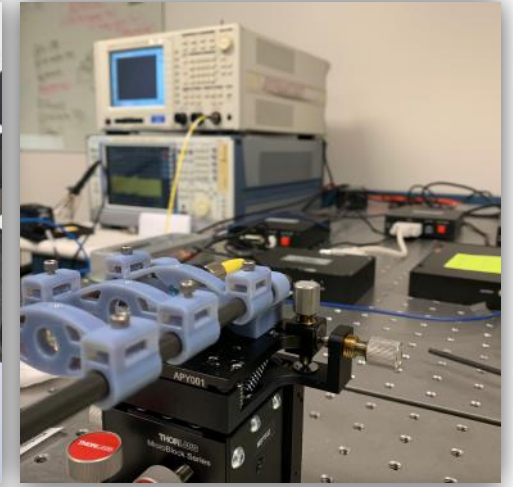
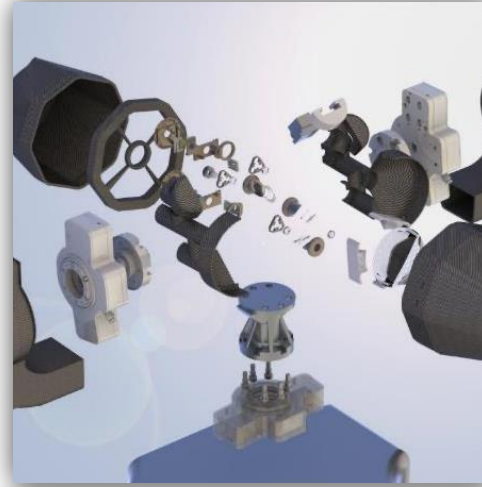
Agency	Description
NASA GSFC – Ground Systems & Mission Operations 2	Satellite Mission Operations and Engineering
NASA JSC – JSC Engineering Technology & Science Contract I	Engineering Services for ISS and Commercial Missions
NASA Wallops - Range Operations Contract 2	Launch Support Services
NASA GSFC – Landsat Mission Operations	Satellite Mission Operations
NASA GSFC – Mechanical Integrated Services & Technologies I	Instrumentation and Systems Engineering



# Engineering & Operations Services

# Research & Development

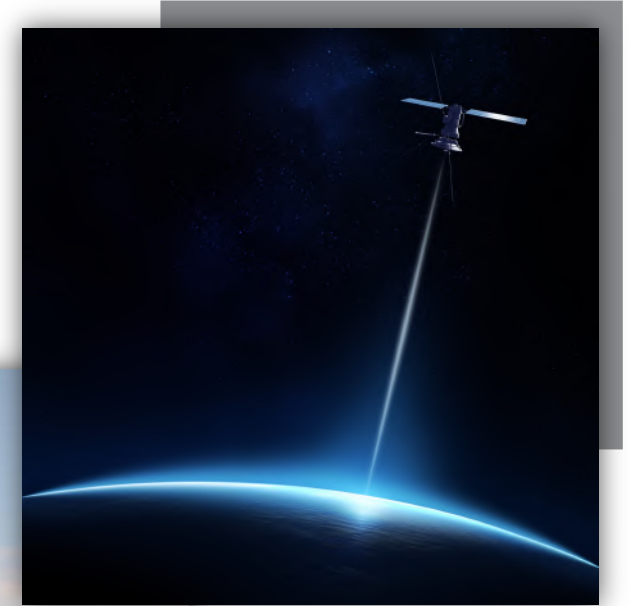
Our advanced development group brings expertise from multiple engineering disciplines working on problems allowing the aerospace industry to truly reach for the stars. Some of the current active areas of research are optical laser communications, thermal adaptive optics systems, systems identification methods, and hybrid RF/Optical systems.



# Communications

Relative Dynamics has an extensive background in:

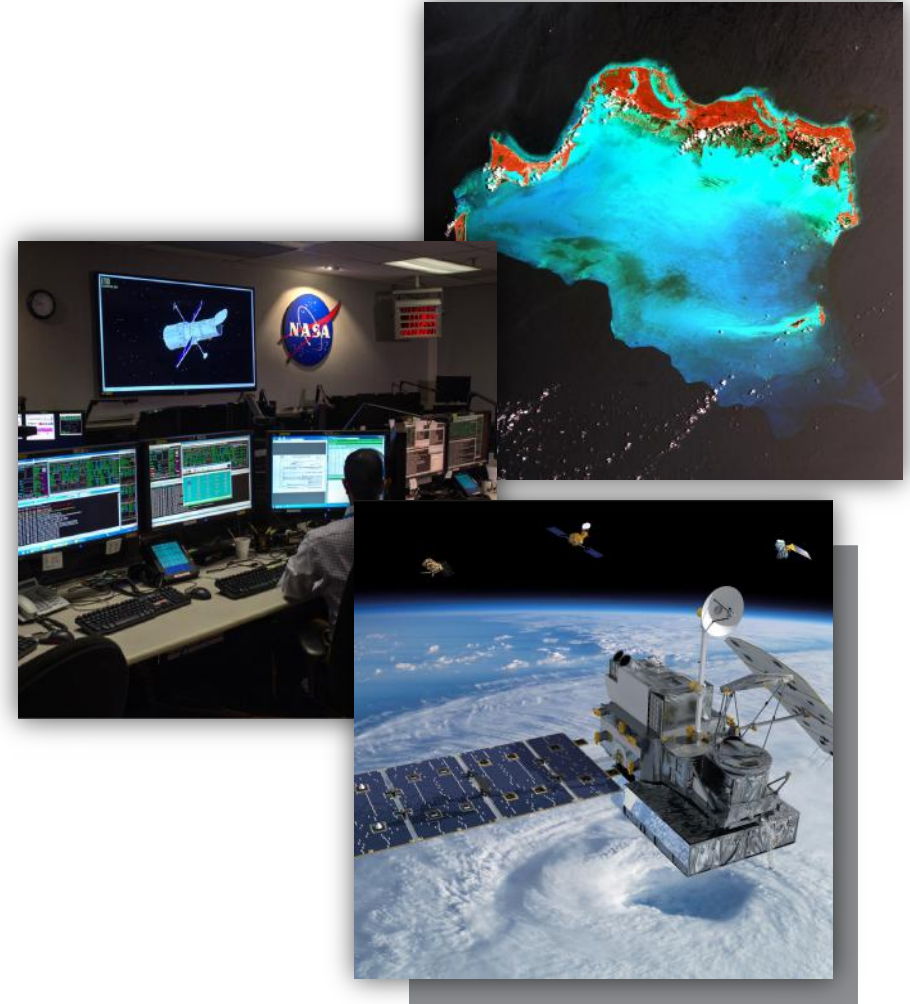
- Designing state of the art optical and RF communications systems
- Engineering precise solutions to line-of-sight problems for satellite communications systems
- Link-margin analysis
- Spectrum analysis
- Spectrum allocations analysis
- Multi-path Communication trade studies
- Modulation design and analysis
- Programs include: Artemis, Lunar Gateway, Human Space Flight & International Space Station.



# Mission Operations

Our experienced mission operations engineers have expertise providing:

- Full life cycle spacecraft operations
- Pre-Mission Support
- Flight Dynamics and Conjunction Assessment
- Orbital Mechanics, Ascent Trajectories, & Rendezvous Proximity Operations
- Flight Operations
- Ground Systems Engineering
- Spacecraft Subsystem Engineering
- Developing CONOPS
- Testing Simulators
- Conducting Readiness Testing
- Lights Out Operations and Automation



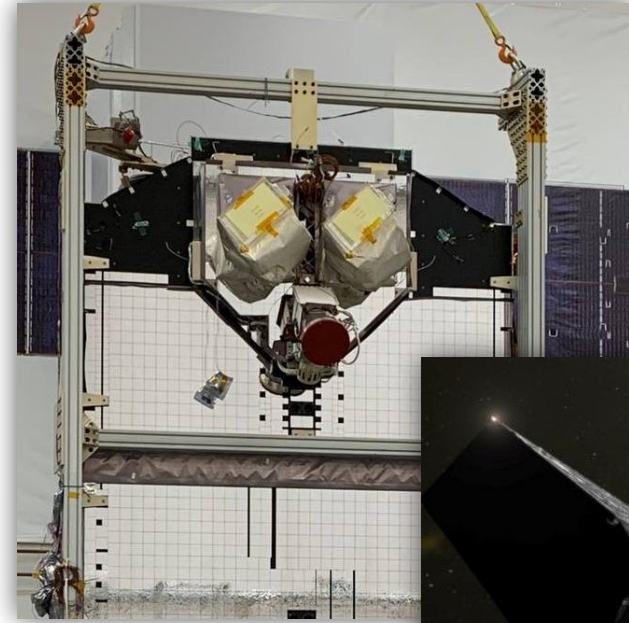
# Systems Engineering

## Expertise:

- Systems engineering
- Support end-to-end life cycle of a mission from conception, design, analysis, integration and testing through operations

## Disciplines include:

- Optical Test Beds
- Controls Systems
- Robotics
- Guidance Navigation, and Instruments Engineering
- Hardware and Software Systems



# Mission Assurance

Our Mission Engineers and Asset Managers are experts in Lifecycle management, Sustaining Engineering, Asset Management and Operations. We provide end-to-end design, testing and operational support including launch operations and mission planning support across multiple platforms.

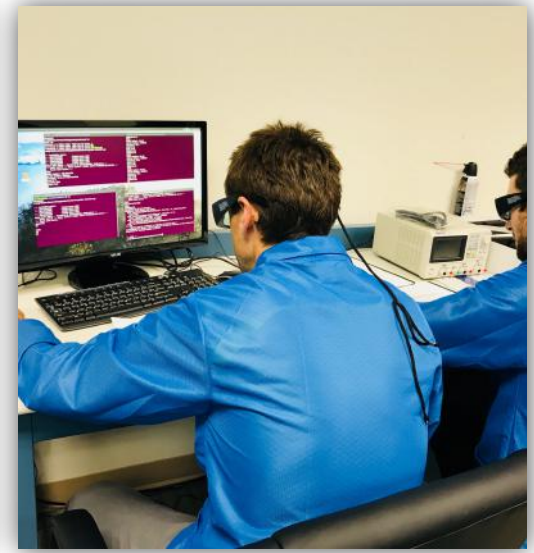
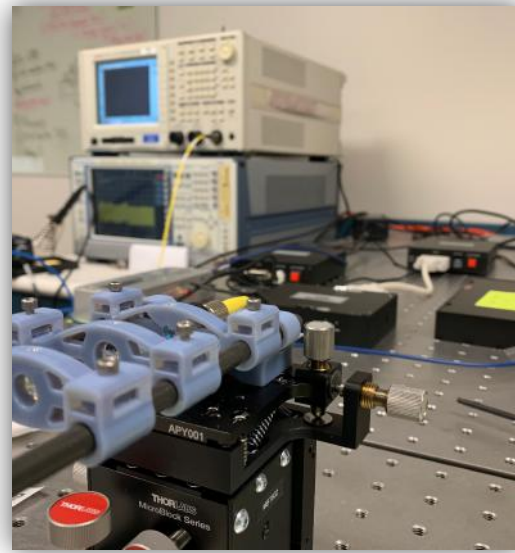
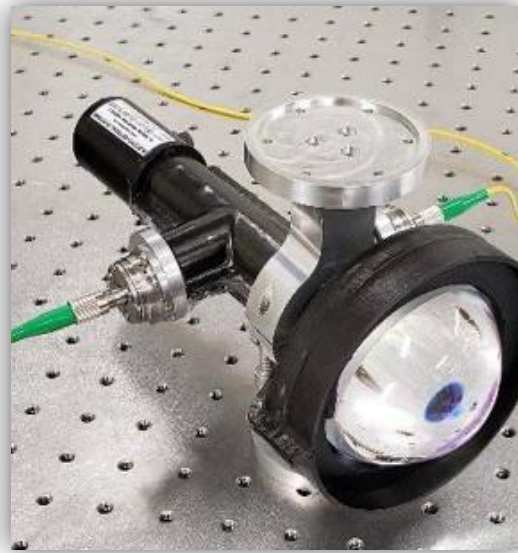
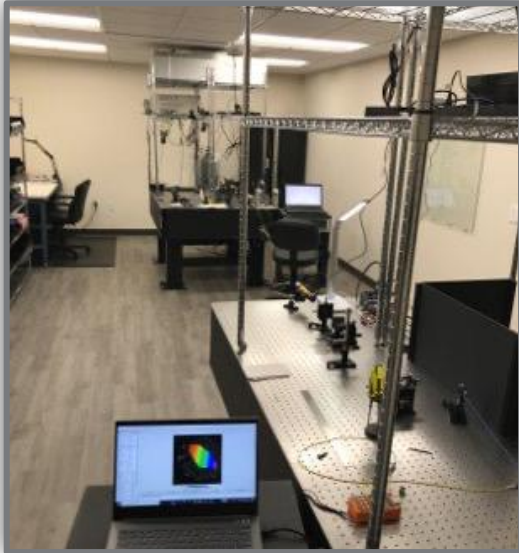
Our Quality team has 25+ years of experience in Quality Assurance, Audits, ISO Certifications, QMS, Process Improvement, Configuration Management and Risk Management supporting functions across various NASA Programs.





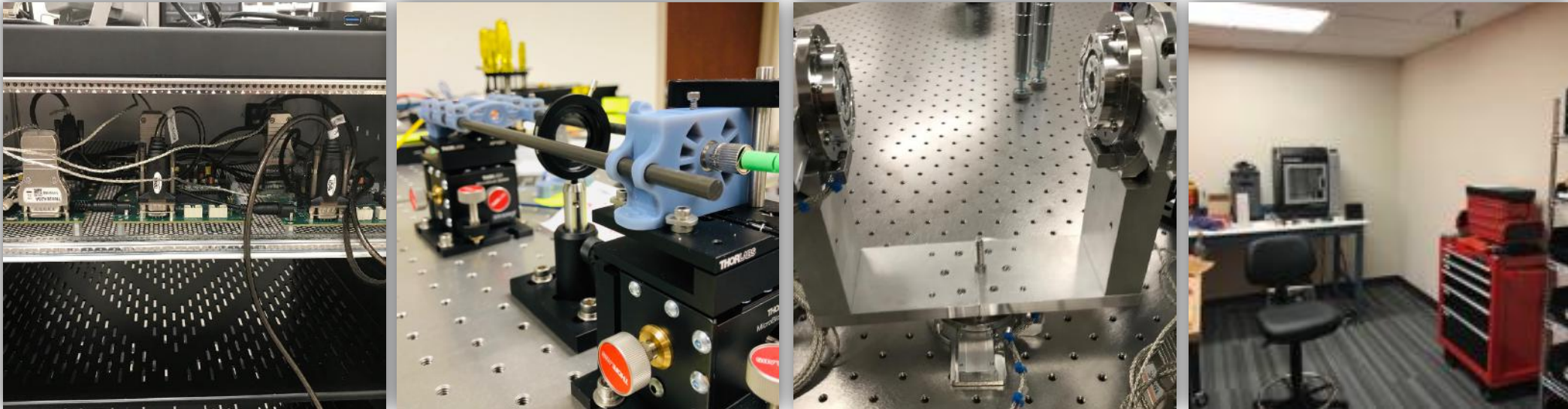
# Facilities

# Electro-Optical Lab



The RDI Optical Laboratory is a dedicated facility for product research, prototyping, development and testing. The laboratory test equipment includes an 11.25 Gbps Bit Error Rate Test set, digital oscilloscopes, power supplies, Shack-Hartmann wavefront sensor, optical spectrum analyzer, RF spectrum analyzer, tunable C-band narrowband optical filter, and programmable fiber optic attenuator. 100 Gbps wavelength division multiplexed (WDM) terrestrial, unmanned aerial vehicle, high-altitude platform and satellite free-space optical communication autonomous terminals are under development.

# Mechatronics Lab



The laboratory features electronic benches and equipment for custom electronics development including a National Instruments compact RIO controller with a processor and user-programmable Field-Programmable-Gate-Array (FPGA) populated with analog and digital input/output (I/O) modules. Includes ability for rapid prototyping with FUNMAT HT 3D printer in a variety of materials including ULTEM, PEEK and carbon fiber composites. The printer can achieve 50-micron high resolution.



# Technology Development

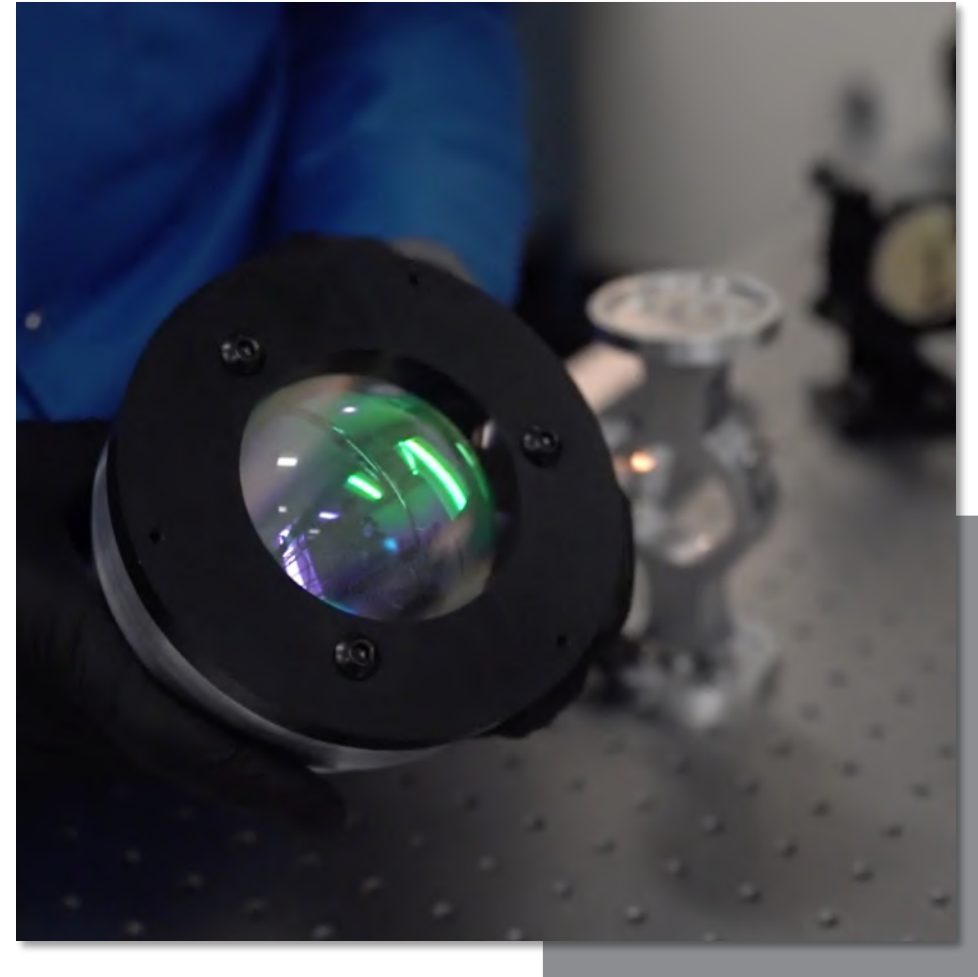
# Technology Statement

Connect satellite constellations to each other and to the world with low SWaP (size, weight, and power), Software Configurable Laser Communications System.

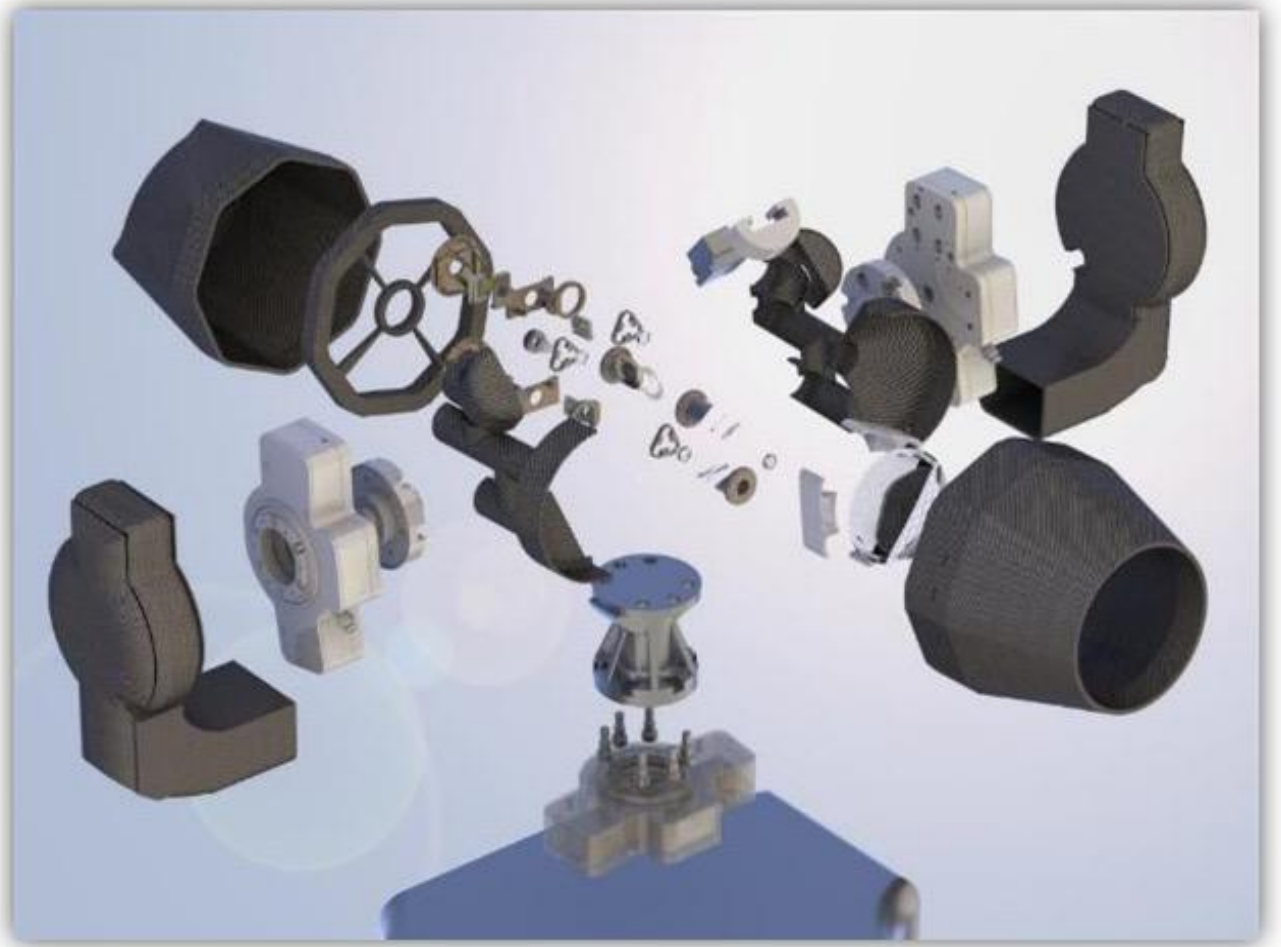
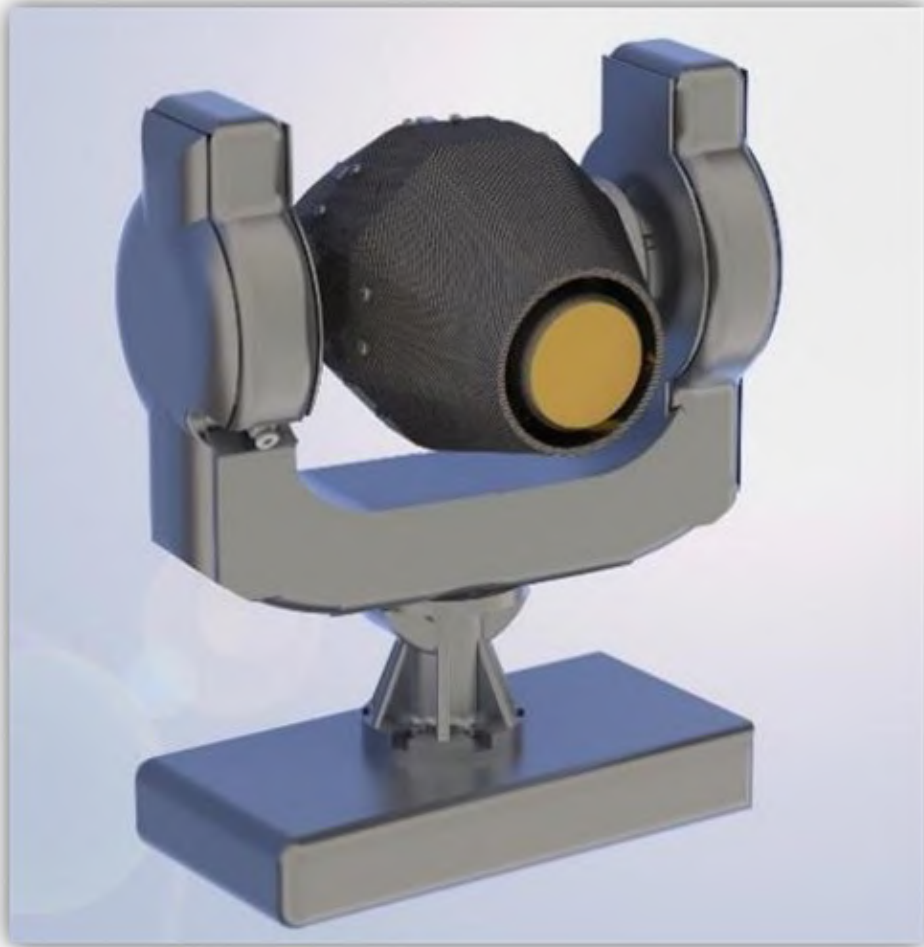


# SCOUT Overview

- ConnSatellite payloads in LEO, GEO and beyond are constrained by how much data that can be delivered from space to ground.
- Direct-to-Earth optical communication links based on modifying existing technologies that can operate at high data rates.
- Low-cost end-to-end solution for Laser Communications to increase data rates up to 20 Gbps with potential of even higher data rates in the future iterations.
- Major improvements to SWaP: Integrated systems that combines laser, modulators, coders, modem and control electronics in one optimized unit.



# Technology Design



# Points of Contact



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