



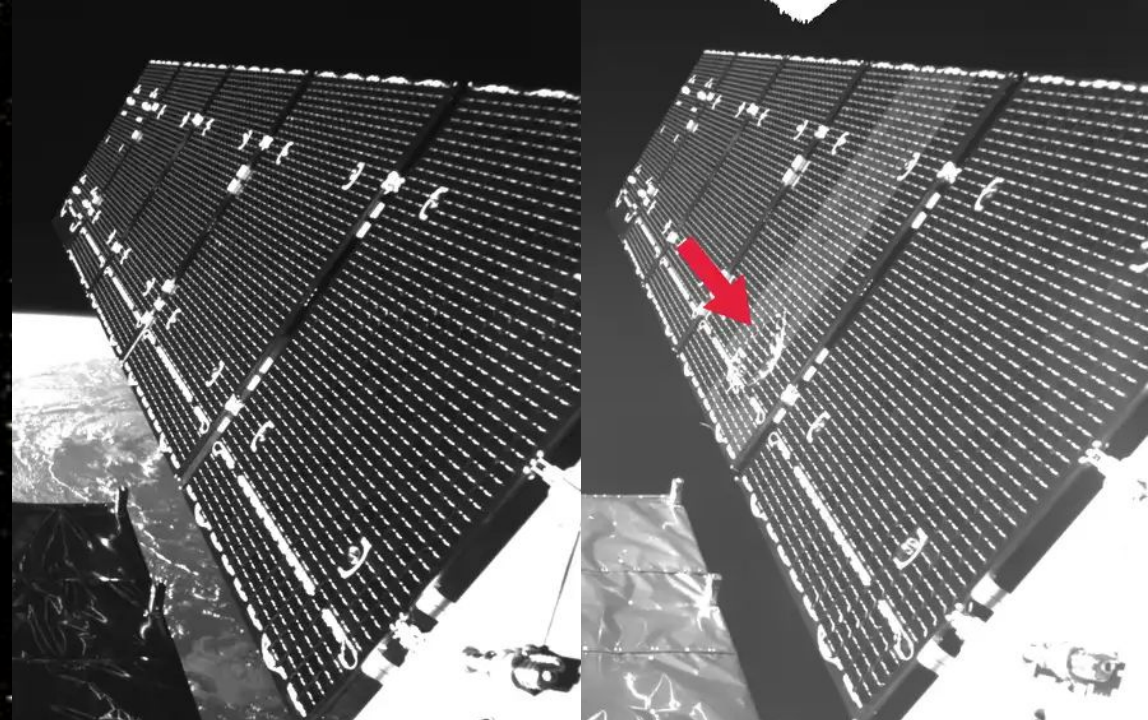
# SpaceVac

A space debris cleaning service



# Space Debris

- 100 million+ millimeter-sized debris
- Damages current satellites and communication systems
- Hinders future launches
- Kessler Syndrome - self-sustaining cascading collision of space debris in LEO





# Consumers

Ideal Customer: Government

Alternative Customer: Satellite companies

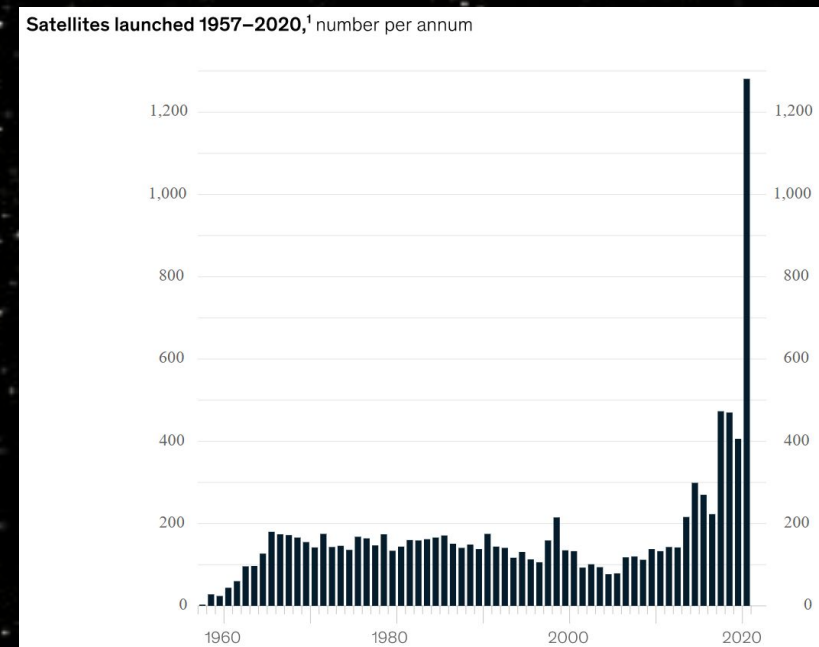
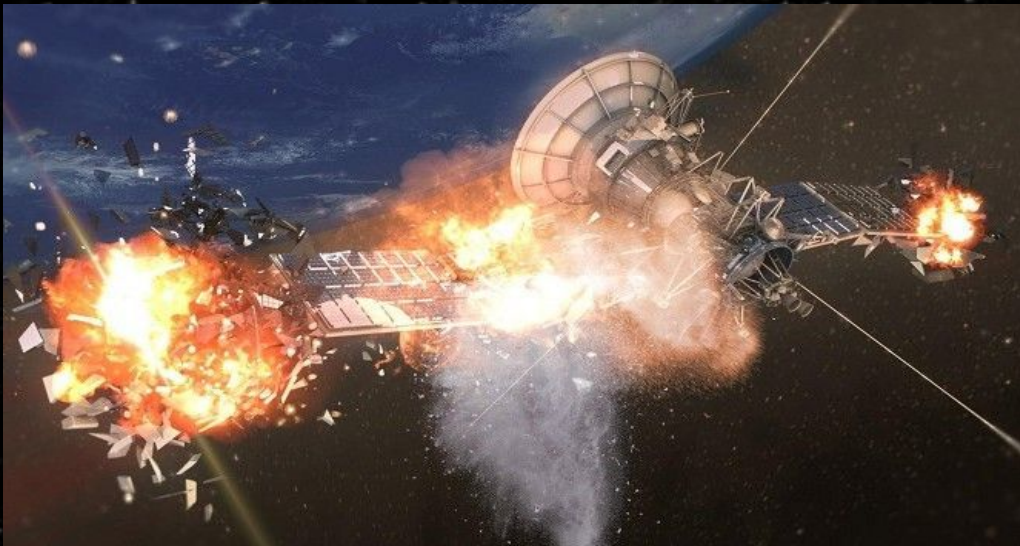
- 11,000 satellites currently in orbit
- 70,000 more satellites in the near future

## Interviews:

- Tim Balz, previous Launch and Build Engineer at SpaceX, CEO of Kalogon
- Gary Bullock, previous Research Engineer for the DoD, current owner of Pierce Aerospace
- Eric Hamilton: Worked on Amazon's Kuiper project

# Lack of Clean-Up

- Current solution: software to avoid the collision
- Solution is temporary and worsening
- ORBITS Act in Sept. 2022
- Federal Communications Commission in Sept. 2022 required disposal of LEO satellites within five years





# Solution: Debris Clean-Up

- A debris cleaning space device that collects and disposes space debris
- Use NASA's algorithms to track debris and map a route for collection
- Dispose of space debris by launching it into the atmosphere

Movement

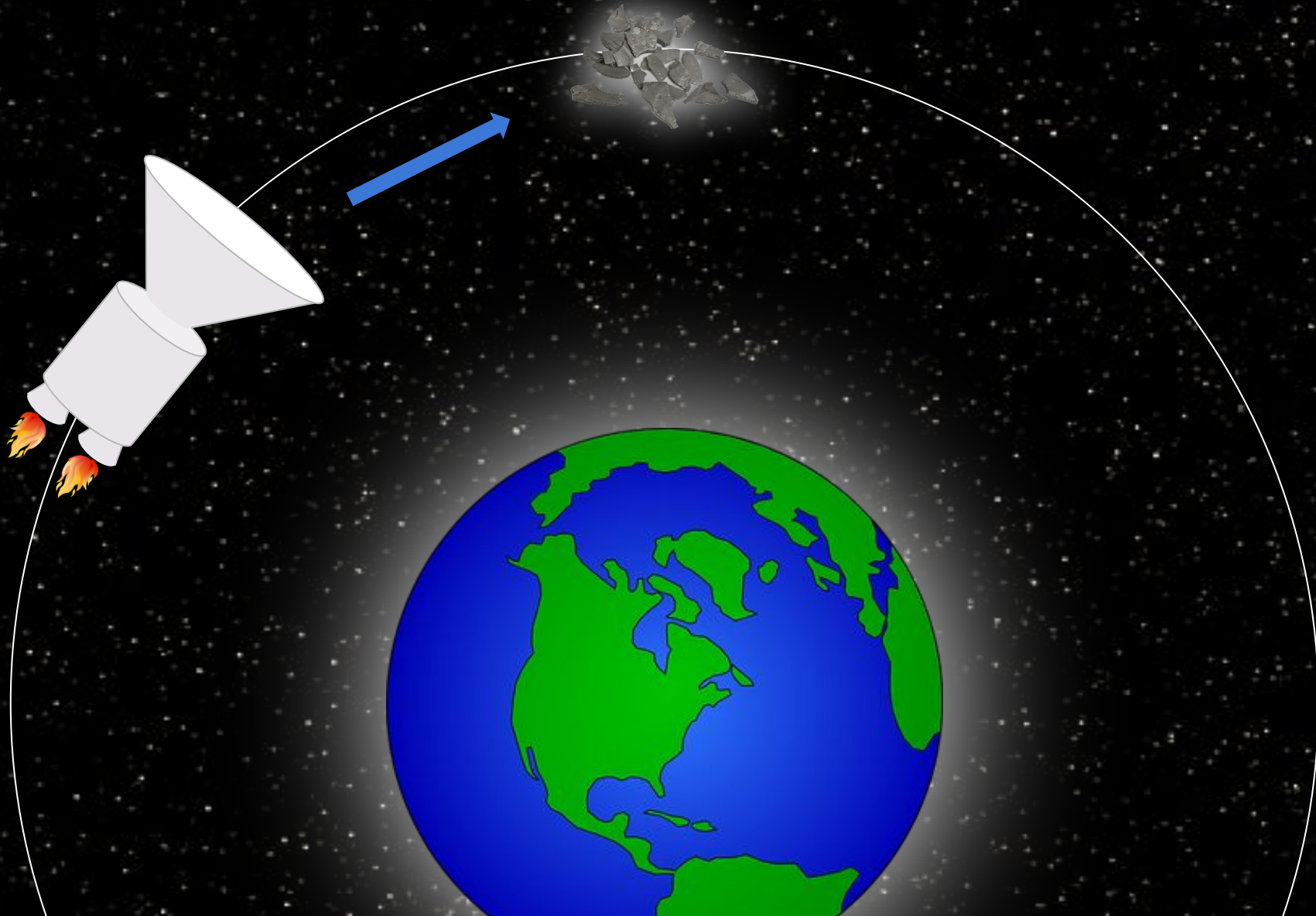
Collection

Storage

Deposit

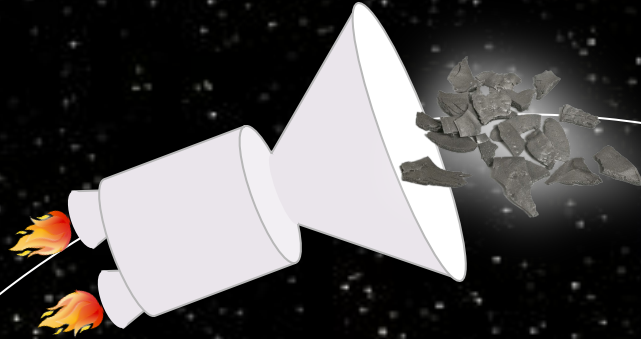


# Movement

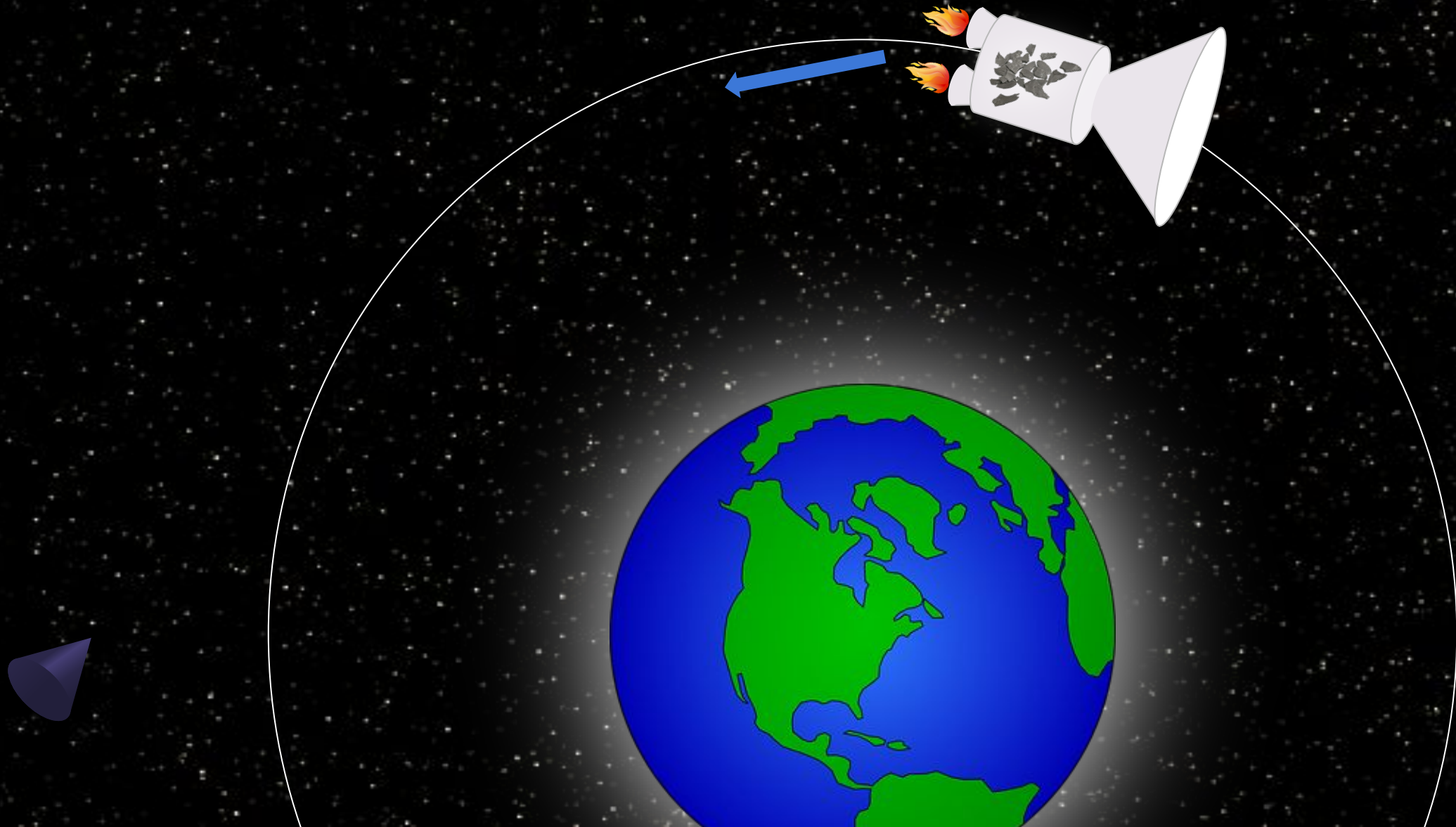




# Collection

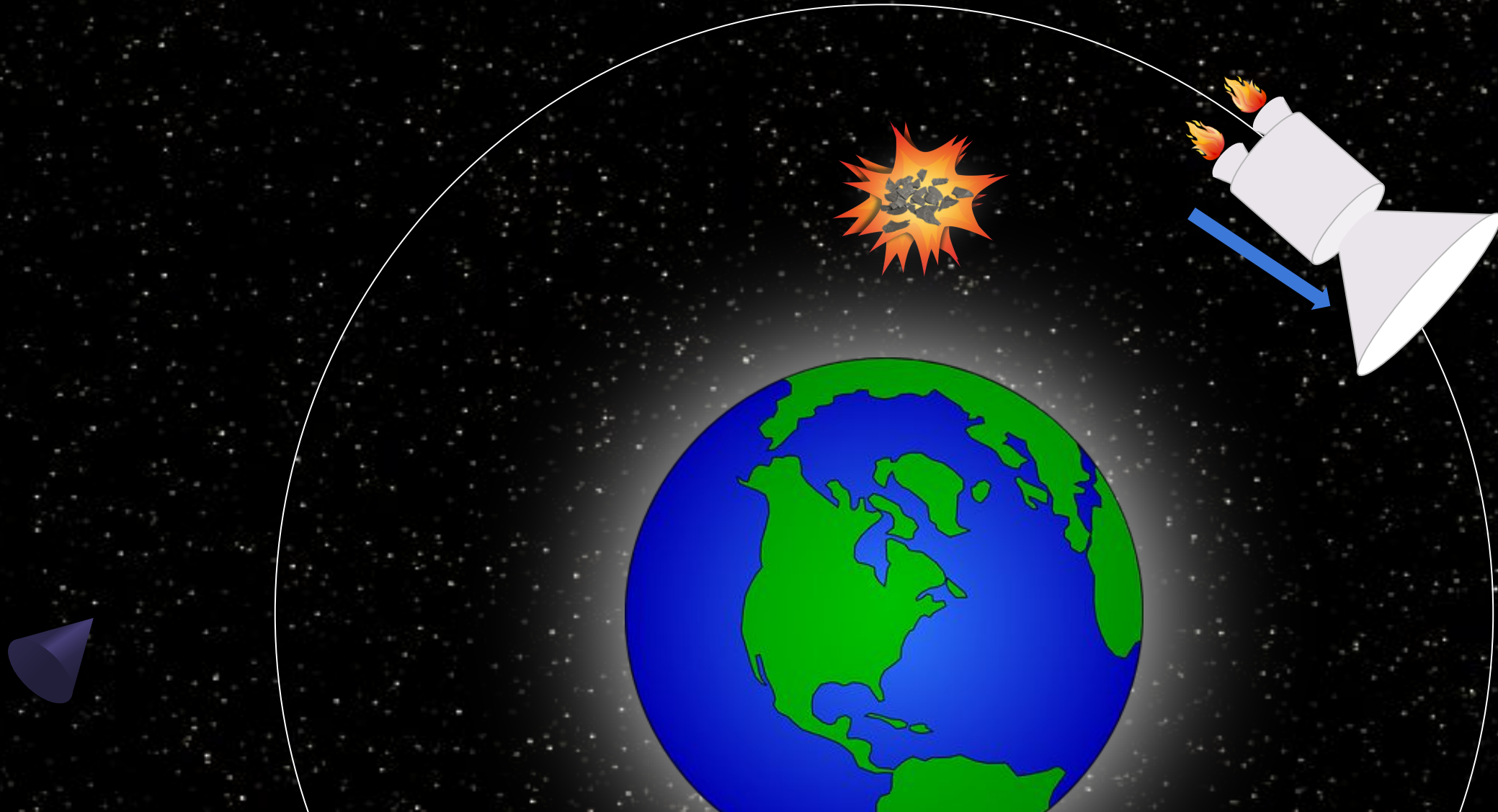


# Storage





# Deposit



# Minimum Viable Product

## Functions:

- Funnel to collect debris
- Refuel with orbiting fuel container

## Dispose:

- Ejects debris out the back at lower velocity than orbit
- Debris enters the atmosphere to be burned

“It’s likely that large players in LEO orbit will come together to pay for space debris that will interfere with their individual services.”

- Eric Hamilton, worked on Amazon’s Kuiper project





# Cost & Pricing

## Cost

- Launch Cost: \$6 million
- Design and Build Cost: \$20 million
- Ground technology: \$2 million
- Fuel Cost: \$300,000 per mission

Total Cost: \$30 million

## Pricing

- 1 mission that can clean around 1000 pieces
- Estimated to be profitable after 2 years after first launch

Price: Contracts for cleaning at \$800,000 per mission



# Funding: Where We Start

- SBIR systems under the ORBITS Act
  - Phase I Feasibility Study: \$50K-\$125K
  - Prototype run for small-scale simulations of the device in water
  - Acquire patent for collection technology
- Crowdfunding



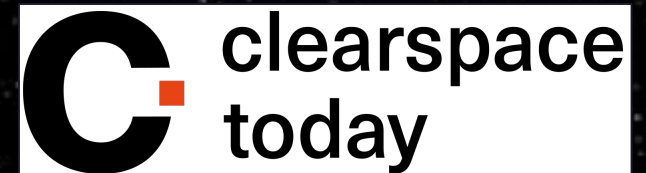


# Value Proposition

- Protects current satellites in orbit
- Removal of debris rather than avoidance
- Differs from competitors:
  - Focus on small-mid sized debris particles
  - Dispose of debris in the atmosphere

The logo for Astroscale, featuring a stylized black 'A' with a white orbital ring around it, followed by the word 'Astroscale' in a bold, black, sans-serif font.

**Astroscale**

The logo for ClearSpace Today, featuring a large black 'C' with a small red square inside its upper curve, followed by the words 'clearspace' and 'today' in a black, sans-serif font.

**C clearspace  
today**

The logo for Orbit Guardians, featuring a stylized white 'O' with a black orbital ring around it, followed by the words 'Orbit Guardians' in a white, sans-serif font, and 'Eliminating Space Debris' in a yellow, sans-serif font below it.

**Orbit Guardians**  
Eliminating Space Debris

# Marketing & Sales

- Direct business partnership:  
Government for general space cleaning
  - Watch regulation and laws
  - Expand into commercial cleaning
- Campaign for masses to promote issue





Thank You! Let's  
rock-it into orbit!

Questions?



# Previous Interviews

Person	Position	Company
Tim Balz	CEO, former SpaceX engineer	Kalagon
Gary Bullock	CEO, former DoD research engineer	Pierce Aerospace
Eric Hamilton	Kuiper Software Engineer	Amazon



# Future Contacts

Person	Position	Company
Aaron Pierce	CEO	Pierce Aerospace
Daniel Dvorak	Systems Engineering & Formulation Division	JPL/Caltech
Christopher Nilsen	Founder of Pluto Aerospace and Purdue Space Program	Pluto Aerospace
Hannah Snyderburn	Aerospace Engineer	Crane
Bert Pasquale	Roman Space Telescope Optical Systems Design Lead	National Aeronautics and Space Administration (NASA)
Robert Margetta	NASA Orbital Debris Program Office	NASA
Graff, Trevor	Chief Scientist, Project Manager	NASA
Abell, Paul	Chief Scientist for Small Body Exploration	NASA

# Business Model Canvas




## CUSTOMER RELATIONSHIPS

- Close-business relationship with partners
- Community with those passionate about the environment and clean-up

## CUSTOMER SEGMENTS

- Government
- Companies that launch things into space: SpaceX, Blue Origin
- Space Environmentalists

## CHANNELS

- Direct business partnership
  - Social media campaign (similar to global warming ideas)
- 



# Business Model Canvas



## KEY PARTNERS

- Satellite companies: NASA, SpaceX
- Government: ISS
- SpaceX to launch our satellite to space
- Potential non-profit shift

## KEY ACTIVITIES

- Design/maintain the satellite and software (refueling)
- Partner with manufacturing and launching company

## KEY RESOURCES


- Design plan integration
- Software and modelling
- Aerospace engineers/CS



# Business Model Canvas



## VALUE PROPOSITION

- Protect current satellites in orbit
  - Clear future path collisions for space exploration
  - Clean/preserve the environment
- 

## COST STRUCTURE

- Cost-driven model
- Manufacturing, launching, facility, and operating cost
- Team cost

## REVENUE STREAMS

- Service for company/government
  - Cleaning destroyed satellites
  - Clearing future path
- Crowdfunding
- Collecting valuable debris instead of destroying it



# Quotes from Interviews

- “Debris in the lower atmosphere is not only a financial problem, but a problem for humanity as a whole.” - Tim Balz
- “Neglecting a problem as big as this will lead to substantial problems right now and especially in the future.” - Gary Bullock
- “It’s likely that large players in LEO orbit will come together to pay for space debris that will interfere with their individual services.” - Eric Hamilton
- “People who were big space buffs discussed it... Everyone was aware it was a big problem.” – Tim Balz

# Collisions

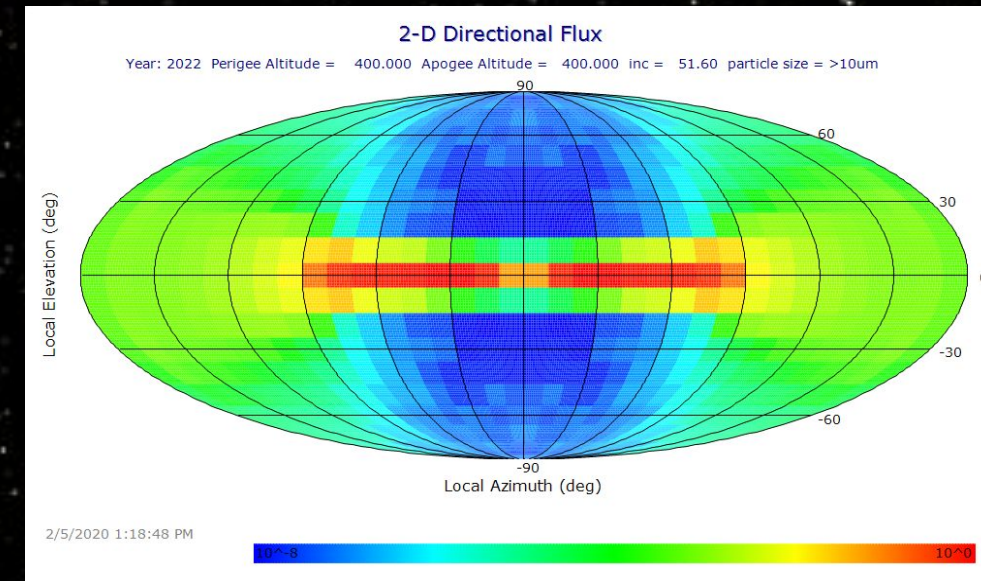
- 2009: Inactive Russian satellite and U.S. Iridium satellite collision
- 2021: Chinese satellite was hit by debris from a Russian rocket
- ISS Debris Avoidance Maneuver





# NASA Orbital Debris Program

- LEGEND: 3D/OD Evolutionary Model
  - provide an understanding of how the orbital debris environment evolves in the future
- ORDEM 3.2: OD Engineering Model
  - a large set of observational data that reflects the current debris environment
  - covers the object size range from  $10\text{ }\mu\text{m}$  to  $1\text{ m}$
  - model output lists debris fluxes by distinct material characteristics (intact, to varying density objects as well as sodium-potassium droplets)



ORDEM 3-dimensional average cross-sectional area flux for a spacecraft assessment, mapped to a 2-D directional flux projection.

# The Process

Using the already designed algorithms to track space debris and map out an efficient route to collect pieces of space debris.

Funnel the debris into the base of the funnel that opens and allows new debris to enter the collection chamber while also not allowing the prestored debris to exit the chamber

Work with a company like SpaceX that has reusable rockets to have a connection and refuelling system for the debris collector

Locating

Movement

Collection

Depositing

Refuelling

Accelerate to a speed faster than that of the debris and come up behind it getting ready to collect

Slow down to the speed of orbit or slower and project the material out the back so that it is dislodged from orbit and will eventually fall into the atmosphere and burn up





# Price Break Down

- Fuel cost per mission: \$300,000
- Time of mission: 2 Weeks
- estimated cost of damage per hit: \$1,000,000
- Maneuver reductions: 25
- cost per maneuver: \$20,000



# Possible Next Steps

- Work with European Space Agency or other international government space programs
- Provide service to private satellite companies to abide by regulation
- Sell technology as a patent to large companies





# Product Specifications

- Debris target: 1.0 mm to 0.5m
- Within LEO orbit: up to 2500 km
- Debris collector: 3.0m x 3.0m x 5.0m
- Titanium and aluminum do not release environmentally-dangerous chemicals



# Competition

## ClearSpace

- Working on clearing large rocket fuel capsules



## Orbit Guardians

- Centered around droplets of Sodium Potassium in orbit



## AstroScale

- Primarily focused on Japanese rocket parts that are very large





# Satellites in Orbit

