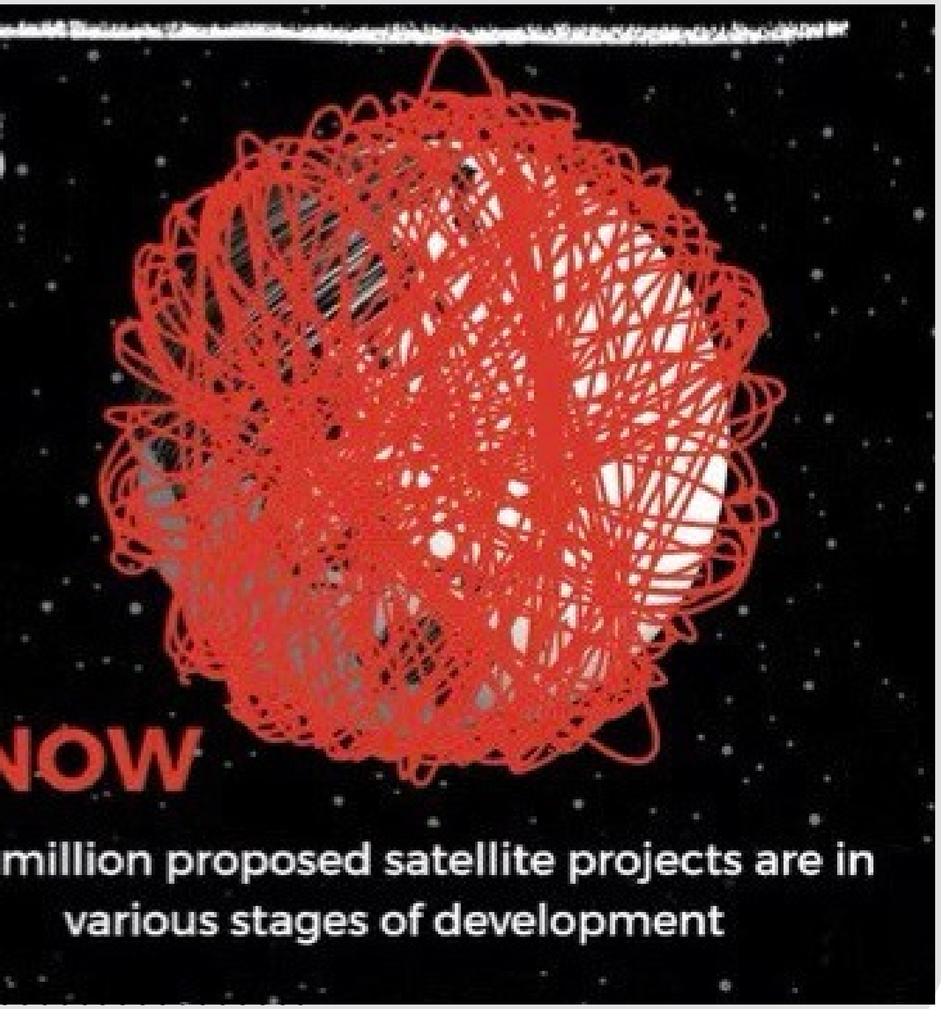
Research Presentation

Presented by: Nurlankyzy Ayazhan,
Raimzhan Satbikee

Supervisor: Mustafa Zhalgas

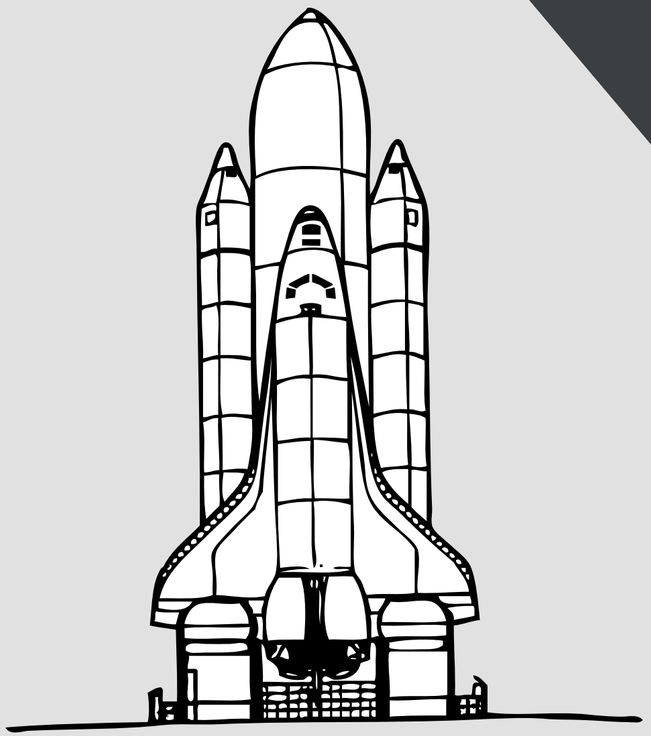
Problem

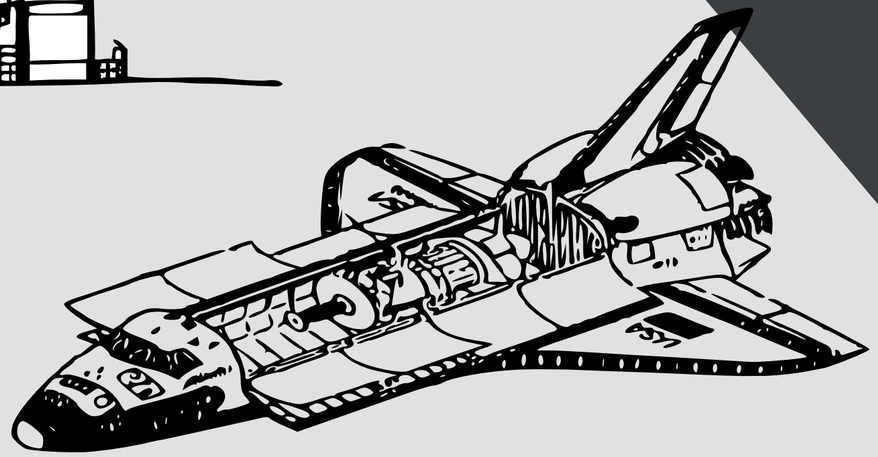


Currently, there are 2,000 active satellites orbiting Earth, more concerningly, 3,000 dead satellites and 34,000 pieces that are over size of 10 cm, also millions of smaller pieces. Such space junk can be become a cause of Kessler Effect.

In a century of deep focus on exploring space we do numerous flights and launches.There are also pieces and debris of them orbiting on Earth’s orbit like trash, more accurately “space junk”.

Introduction



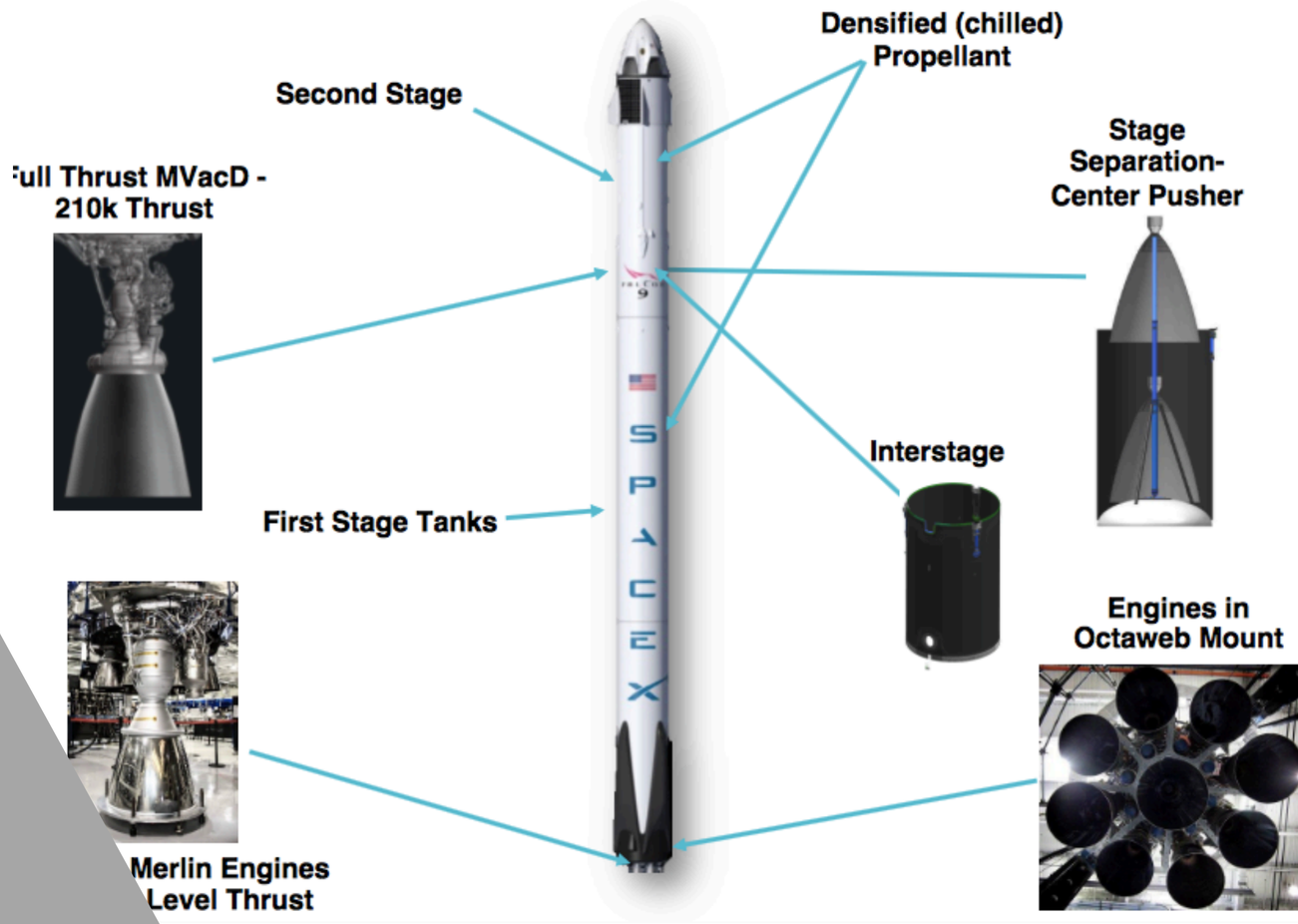


So, our project “second stage, second life” is aimed to make an impact on cleaning Earth’s orbit by modifying the existing technology.

To design the second stage (booster stage) of a rocket so, that after finishing its main purpose it will grab the nearby piece of space junk and take it with itself back to Earth.

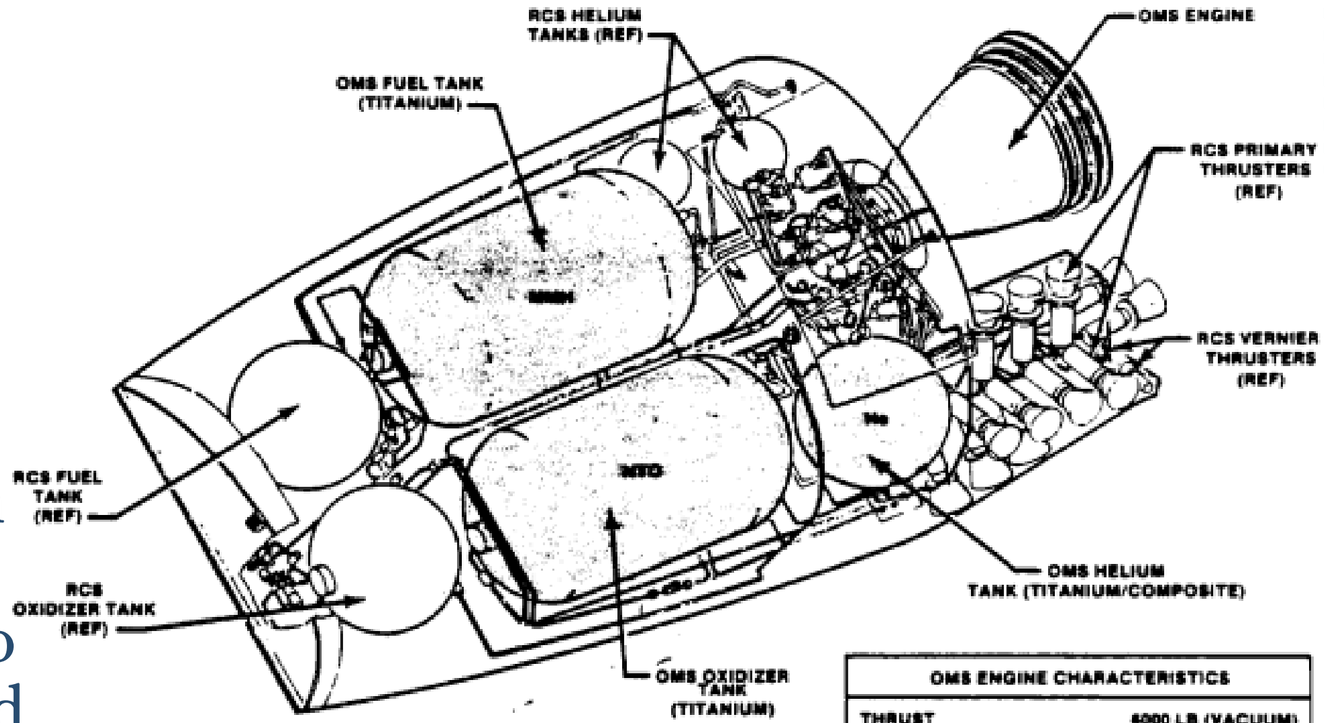
Our concept

the rocket separates into stages (2 to 4) and the second stage is just what we are aiming for. The second stage's main function is to boost and push rocket, but after that, basically, it will float aimlessly in orbit. For our project we chose the model Falcon 9 as it exactly fits the requirements. It launches much often and has two stages



Our engine

to let this system maneuver in orbit we need to supply it with small engines. For reference, we looked at “Baseline Orbital Maneuvering System” from NASA. Our engines can be simpler and does not require human supervision for controlling, so we can remove redundant system and use lighter material than titanium



OMS ENGINE CHARACTERISTICS	
THRUST	6000 LB (VACUUM)
SPECIFIC IMPULSE	313.2 SEC
CHAMBER PRESSURE	125 PSIA
MIXTURE RATIO	1.65
GIMBAL CAPABILITY	±6° PITCH ±7° YAW

OMS ΔV CAPABILITY	1000 FT/SEC (65 000-LB PAYLOAD)
USABLE OMS PROPELLANT:	23876 LB TOTAL:
	14866 LB N_2O_4
	9010 LB MMH

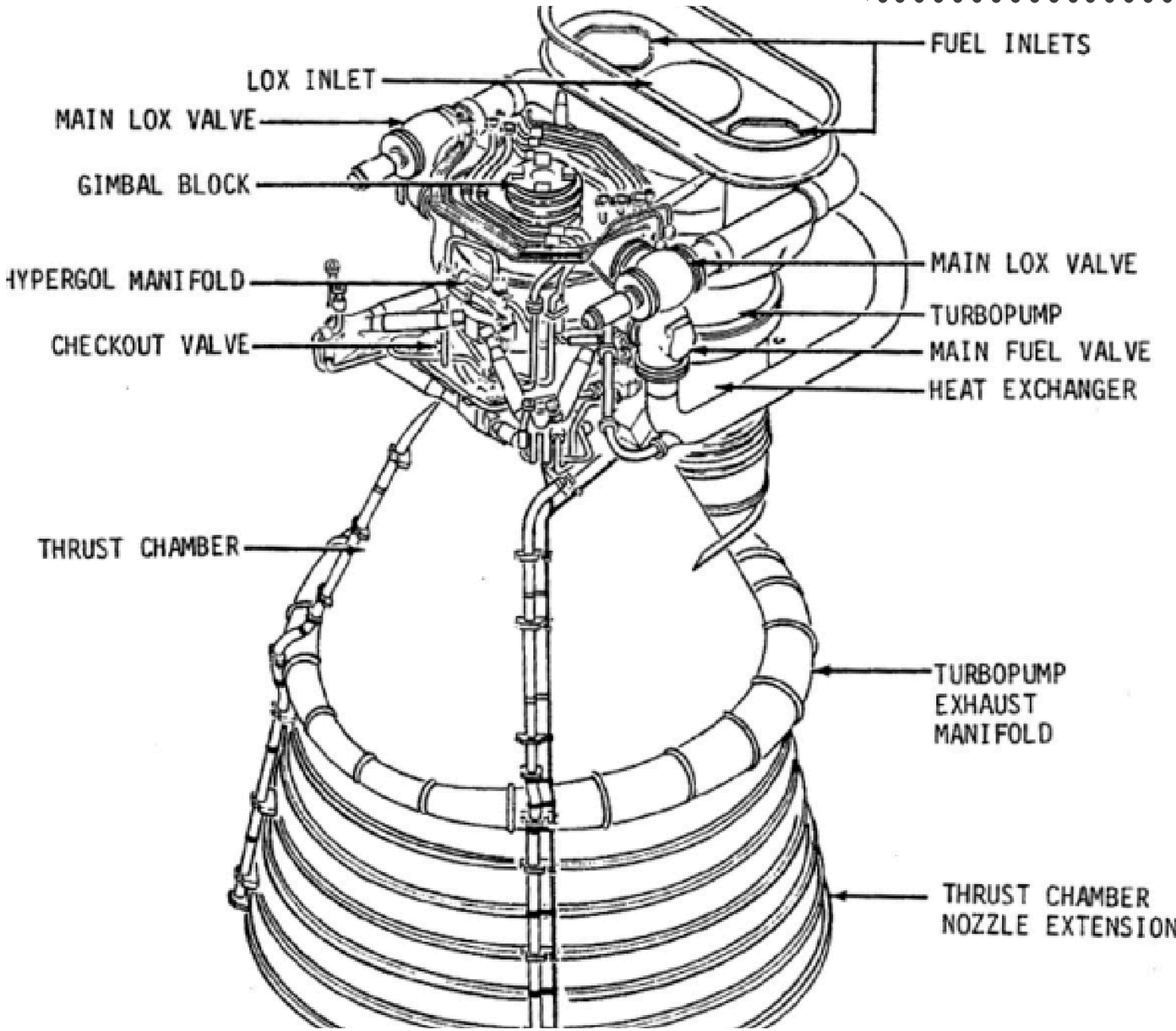
FIGURE 10.- BASELINE ORBITAL MANEUVERING SYSTEM.

Total Estimated cost of our project

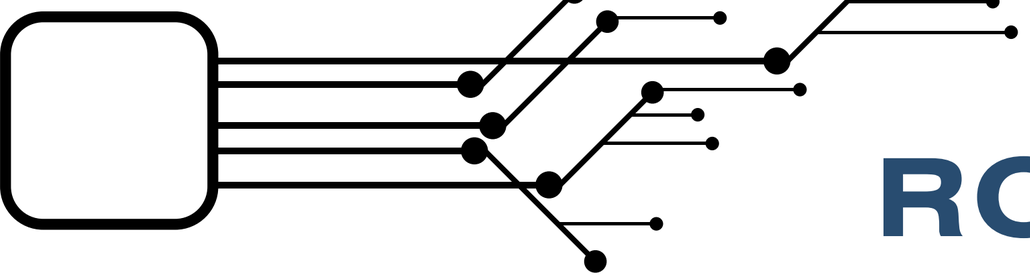
Component category	Estimated cost range
AI flight Computer	$500,000-2,000,000
Net capture system	$1,000,000-3,000,000
RCS thrusters (4-6)	$500,000-1,500,000
Propellant Tanks	$200,000-800,000
Solar Arrays (2-5kW)	$1,000,000-2,500,000
Sensor package	$1,000,000-2,000,000
Integration	$1,000,000-3,000,000

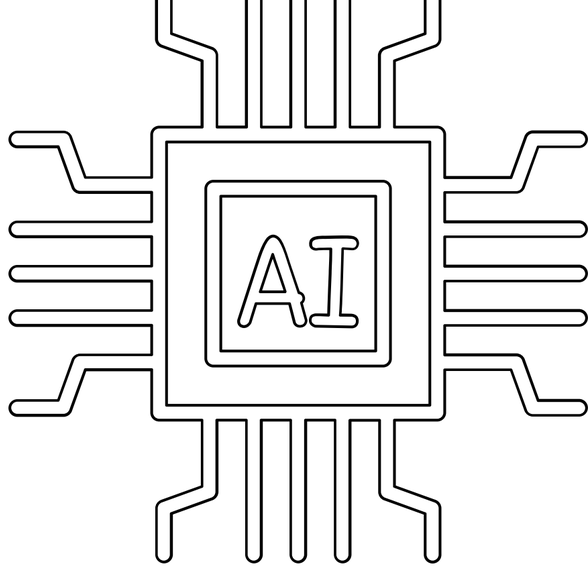
Required equipment

- small engines for maneuvering
- additional fuel tanks
- grabbing system with string net
- regulating mechanism
- power generating system
- sensor suite for navigation and recognition
- part-AI controlling system.’



ROLE OF AI





01

AI calculates best way to approach debris bumps and accidents.

02

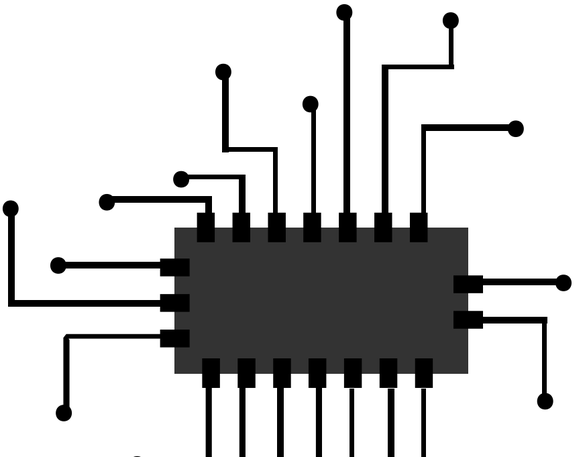
way of minimizing fuel and way of approaching to open the mesh.

03

calculates amount of fuel sufficient for returning back, size, cost and consequences

04

Moment of capturing a fractues, it evaluates shape and velocity, commands degree, sides to approach



Legal Aspects

Ownership of an space objects is an complex question and according to international rights, such objects continue belonging to the country, that lauched the object. Even if satellite broke down, or became wreckage, country still has control over it

That’s why it is mandatory to have a legal permission for grabbing space litter. However experts offer to create an international organization which will make process of permission for simple.

Relevance

01

We are on the verge of Kessler syndrome—an effect in which collisions generate new debris, making orbit unusable for decades

02

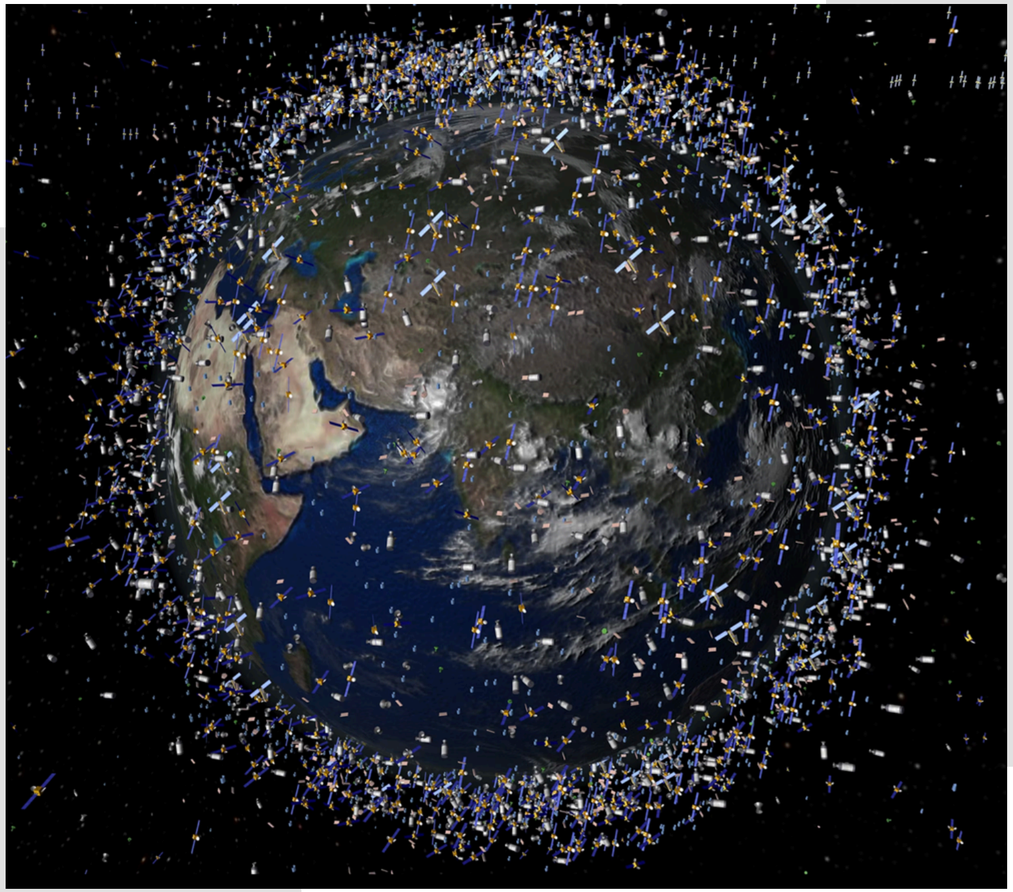
Economic losses are growing. Every year, satellite operators spend billions of dollars on enhanced hull protection, and insurance.

03

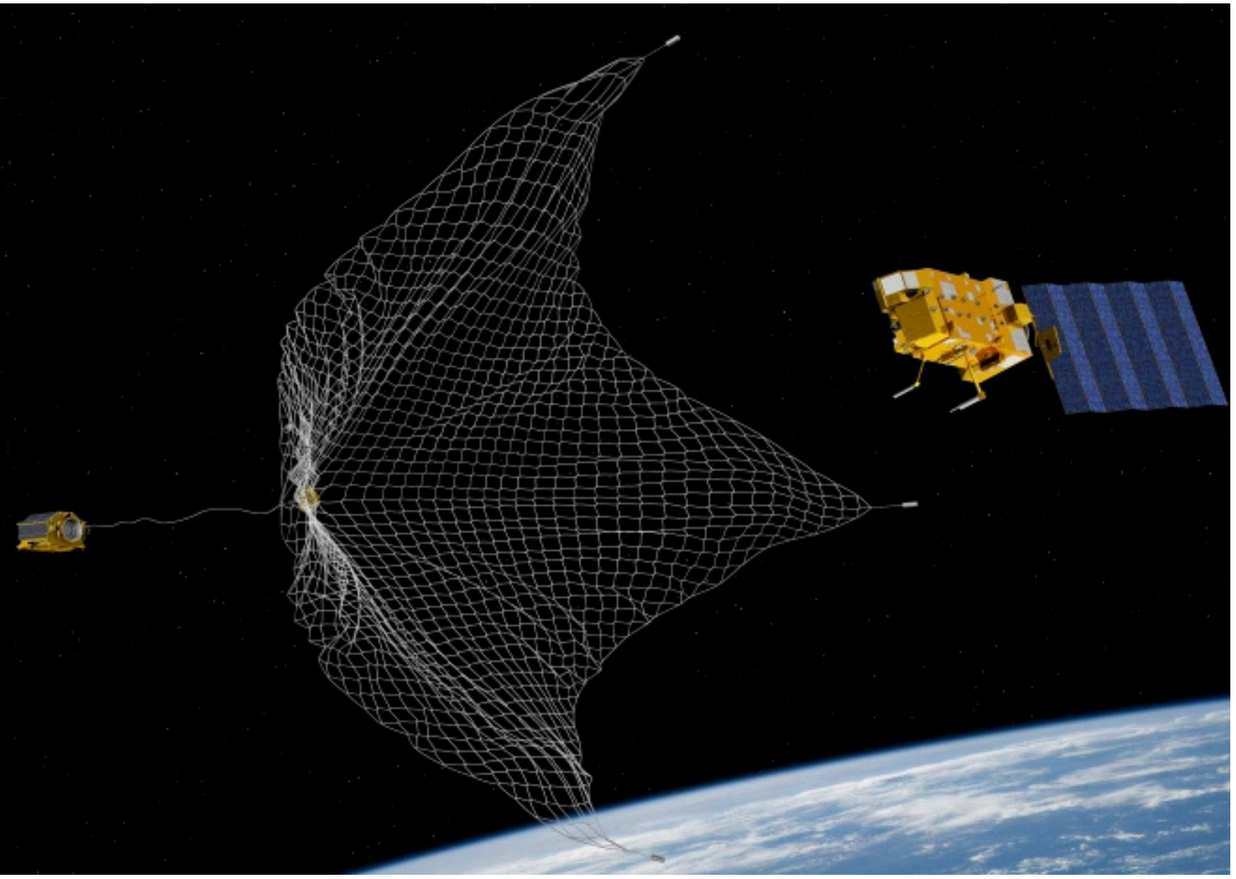
Resource recycling. Our project is unique in that it solves the debris problem without creating new debris.

Trends

First of all, spaceflight operated on the principle of not delving deeply into the remains of a rocket in space. Now the trend is changing. SpaceX is returning the first stages. Secondly, modern missions can no longer rely solely on ground control. Signal latency makes manual debris capture impossible. Thirdly, reducing launch costs thanks to reusable rockets (Falcon 9, Starship) makes missions previously considered science fiction economically viable. Our idea takes full advantage of this advantage



Conclusion



It is technically feasible. Upgrading the stage with a grid, sensors, and AI is within the capabilities of current technology. Using an such platform reduces the cost significantly compared to building a specialized vehicle from scratch. The launch has already been paid for by the client. Modification costs ($15-$33 million) are recouped with a contract price of $20-$50 million for the cleanup of a large object. Despite the complexities of ownership, the world is moving toward the creation of international payment mechanisms for cleanup. Early market entry will allow for customized standards. The project also gives a second life to an object doomed to become debris, while simultaneously cleaning up orbit.

Thank You

Our contact information:
Ayazhan: +7 775 451 4251
email: ayazhan.nurlan@gmail.com
Satbikee: +7 776 014 5729
email: satbikee1@gmail.com