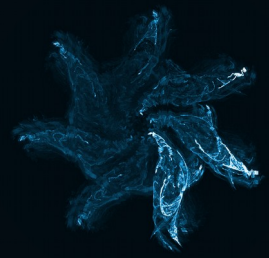


BREATHING SATTELITE

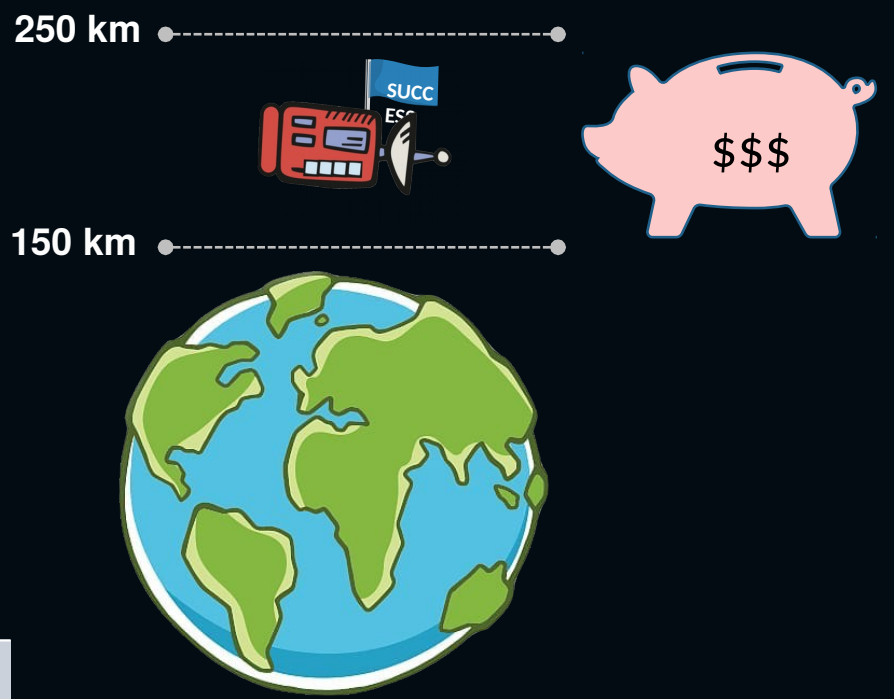
PARTICLE COLLECTION FOR AIR ENGINE IN SATELLITE

Team #38

Skoltech

Very Low Earth Orbit (VLEO) — most commercially viable orbit

$$Mass \sim Height^3$$

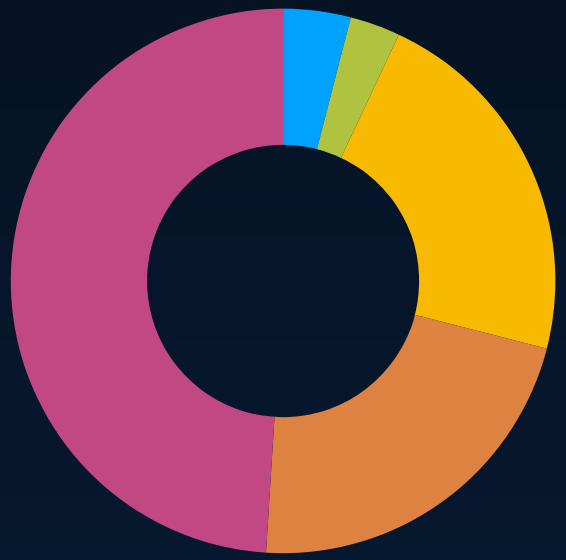


Physical Parameters	Model Predictions		
Orbital altitude (km)	200	400	800
Satellite Mass (kg)	24,4	194,8	1558,6

PROBLEM STATEMENT

- Short Lifespan of Satellites in Very Low Earth Orbit (150 - 250 km) because of fuel limitation

Forecasted Number of satellites in 2017-2026



Smallsats (<500 kg)

OUR SOLUTION:

ACTIVE PARTICLE COLLECTOR

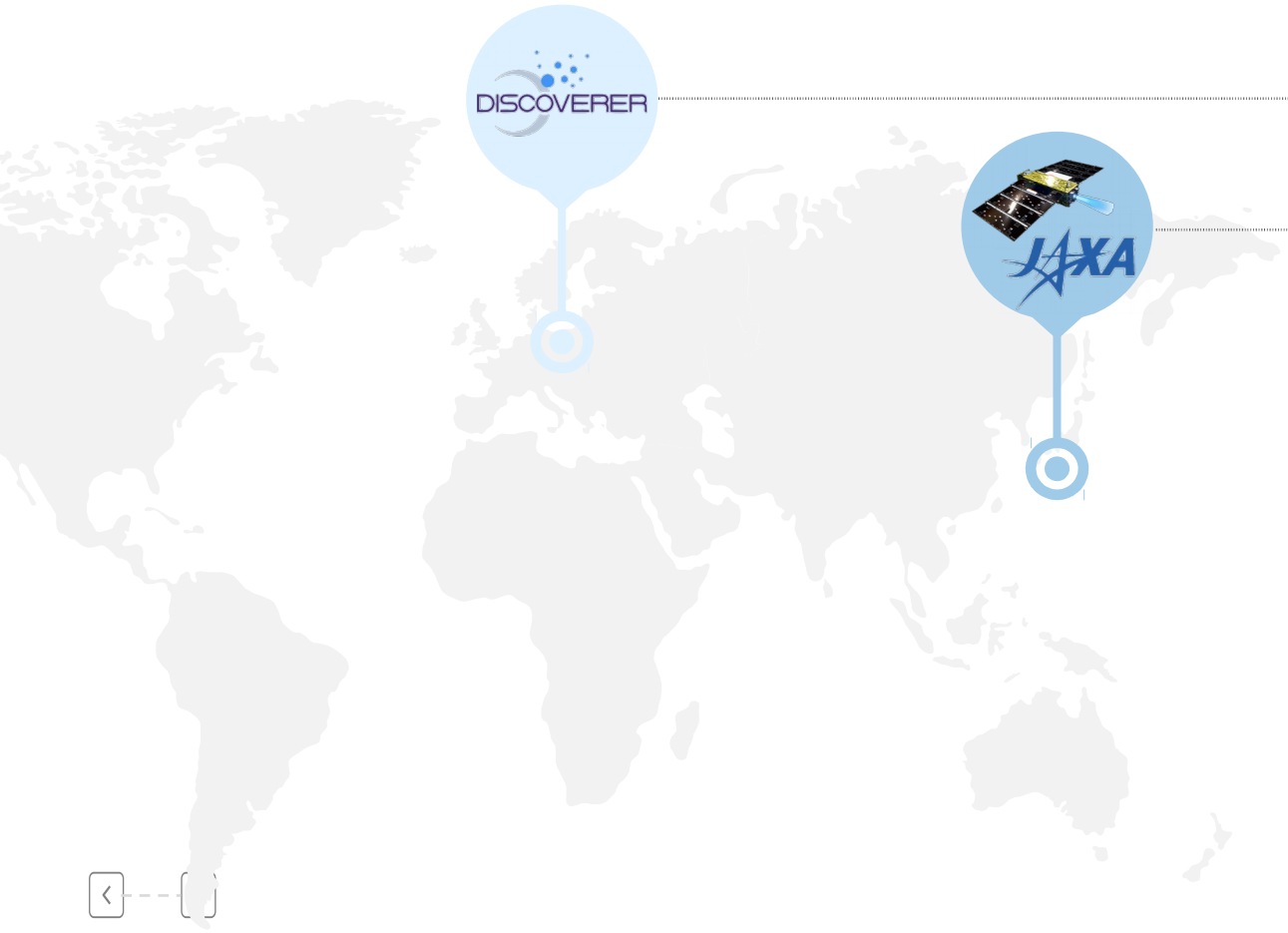
FOR SATELLITE ENGINE

Active system

- collection of air particles
- thrust generation to overcome the drag

COMPETITORS

There is no ready solution with use atmospheric air as fuel



European Space Agency Project

Japan Aerospace Exploration Agency

The Super Low Altitude Test Satellite "TSUBAME"

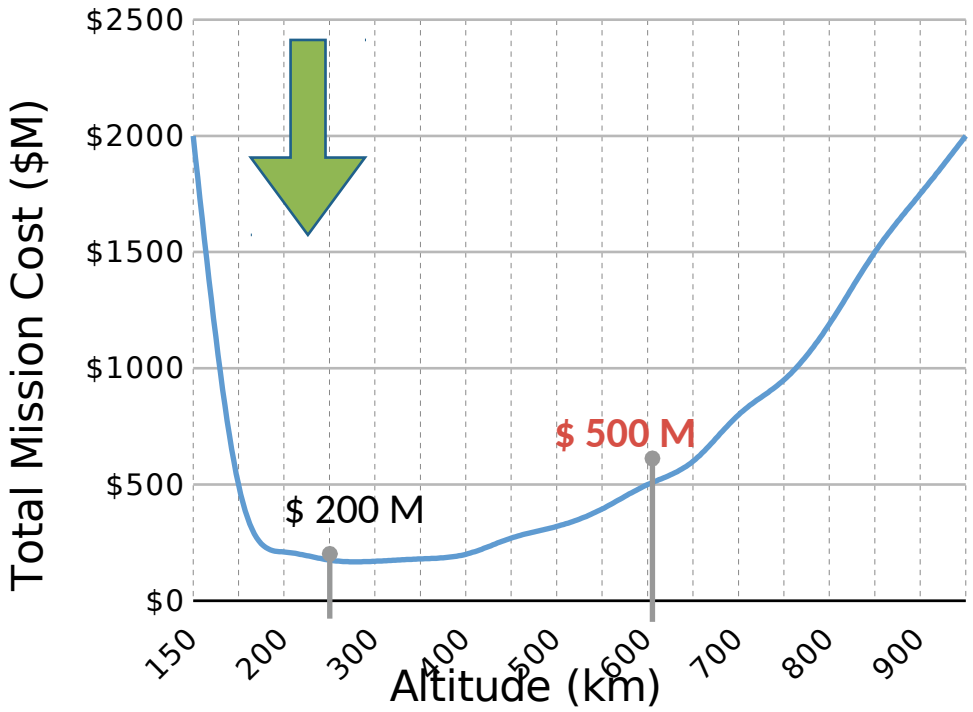
Design life	~ 2 years
Altitude	180 to 270 km

Source: https://global.jaxa.jp/projects/sat/slats/; https://discoverer.space/about-discoverer/our-vision/

BUSINESS CASE

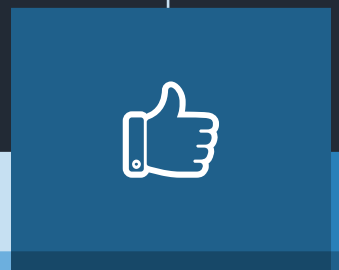
Manufacturing Cost for particle collector

Cost vs Altitude for Fixed Resolution & Coverage

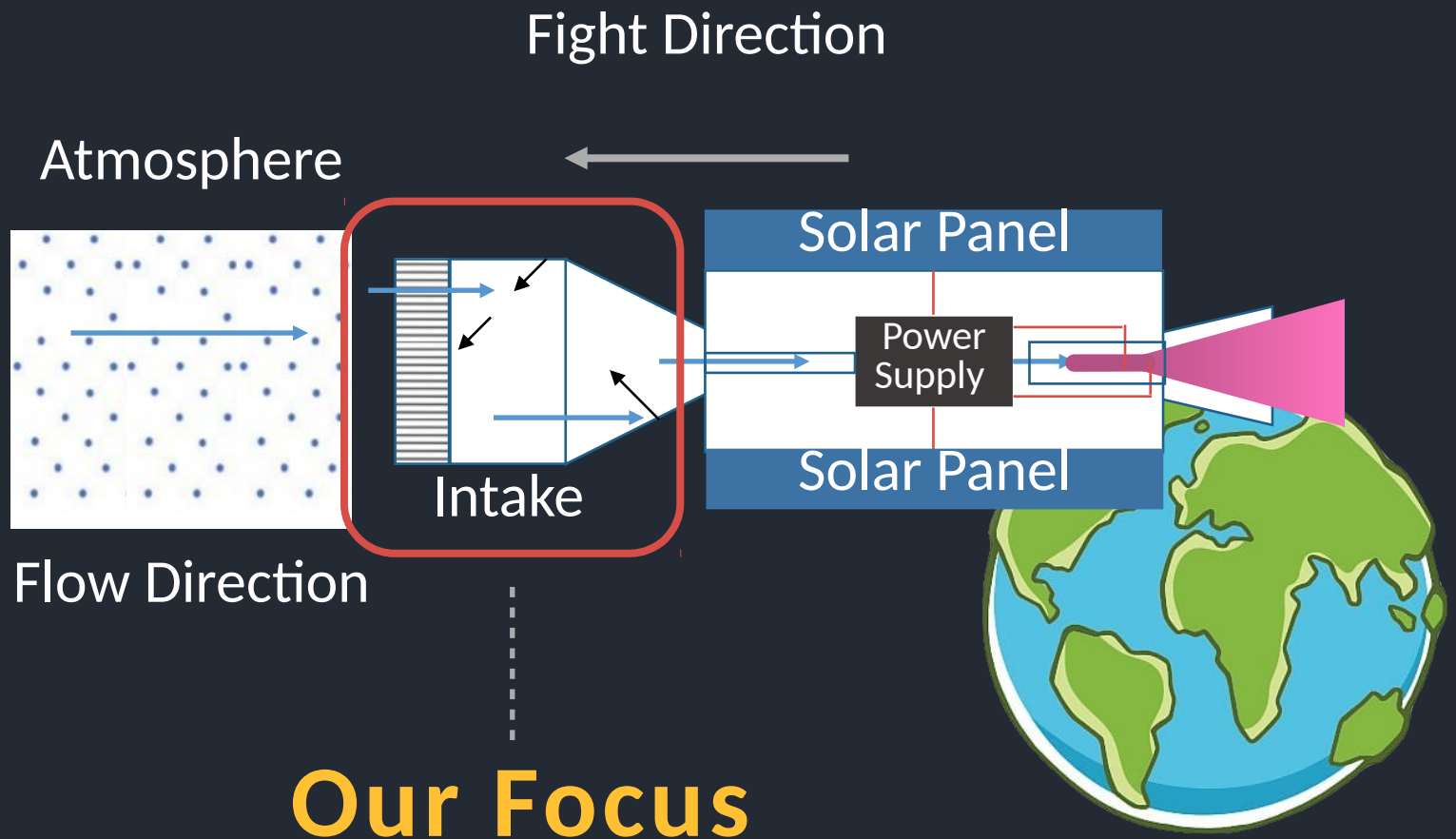


Source: https://www.researchgate.net/publication/289530028_Quantifying_the_Effect_of_Orbit_Altitude_on_Mission_Cost_for_Earth_Observation_Satellites

SOLUTION details



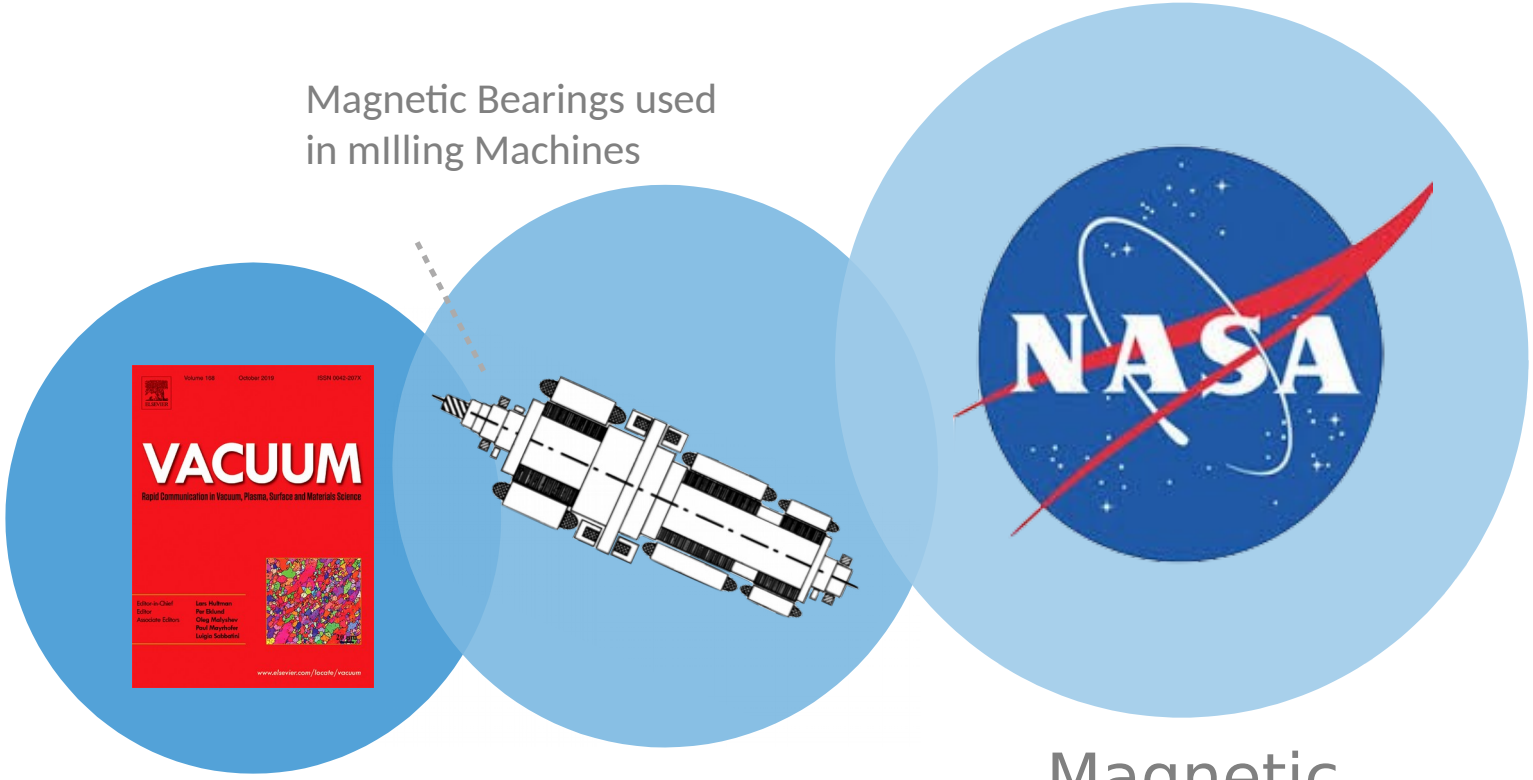
What is Air Breathing Electric Propulsion?



Our Focus

Scientific Validation

Magnetic Bearings used in mIlling Machines



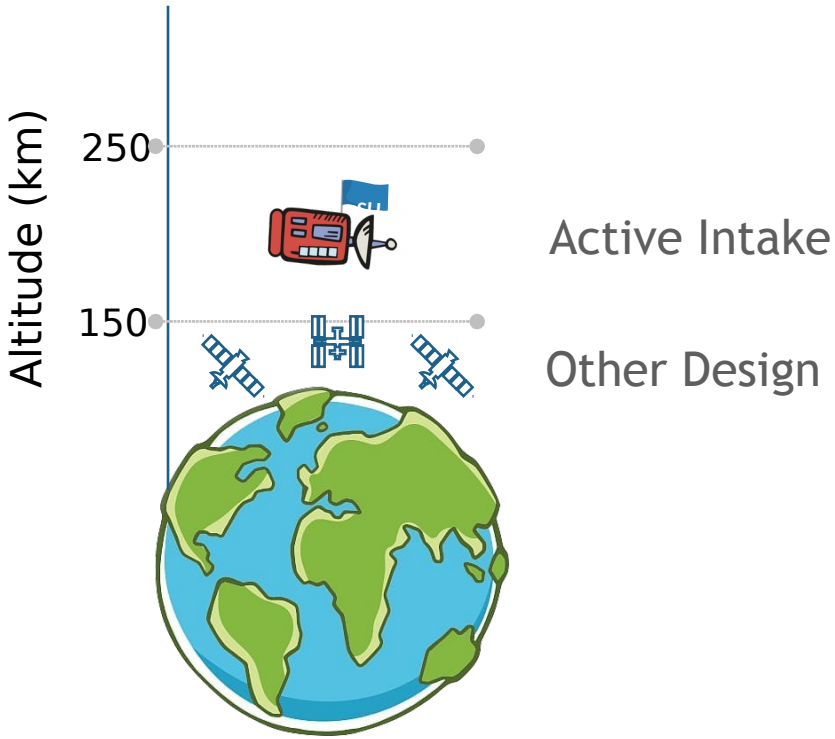
Active Intake

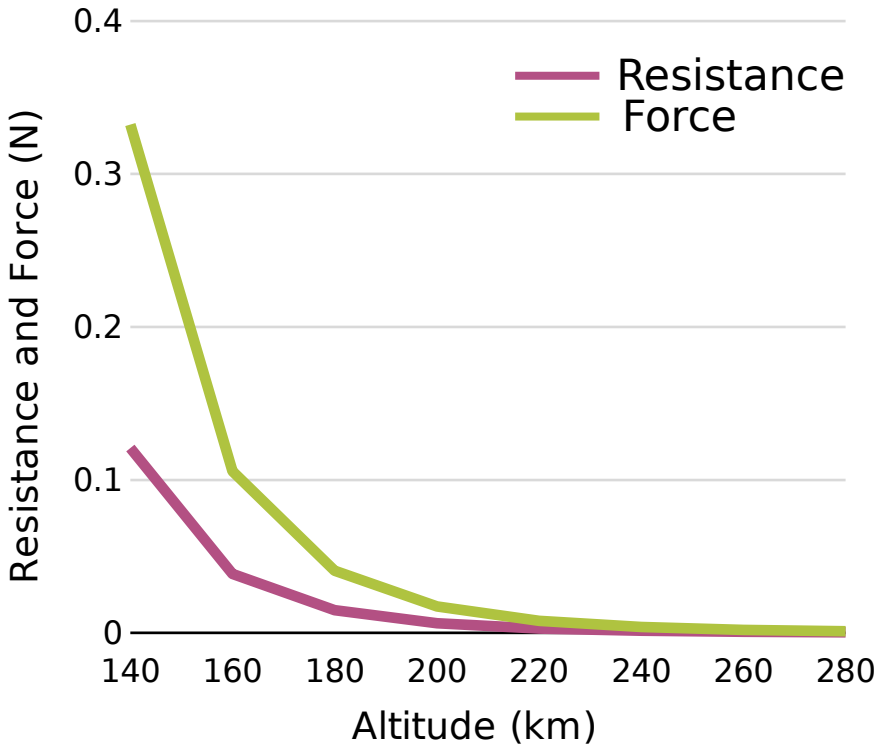
Possibility to reach 40 K RpM using Magnetic Suspension

Magnetic Suspension in Space

Engineering Validation

Operational number density of conventional 10 cm HET





Calculation based on https://ccmc.gsfc.nasa.gov/modelweb/models/nrlmsise00.php

END USER FEEDBACK

"...you'd have unlimited force available. ... it has the potential to revolutionize the space industry"

Stefano Antonetti
Technical Team Lead
Sfantonetti@gmail.com

"It`s a great option as you don't need to carry any fuel "

Anatoliy Kopik
Project Manager & Marketing Director
Anatoliy.Kopik@sputnix.ru

"Active intakes are usually heavy and not feasible, ...your solutions looks like a great idea "

Alexander Golikov
Leading Scientist
agolikov@yandex.ru

"You can use our launch platform, We will send your working prototype to Space! "

LONG TERM PLAN

01 Prototyping

02 Market Research (Intellectual Property)

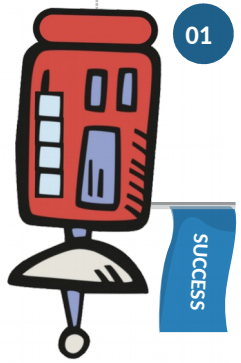
03 Digital Prototyping

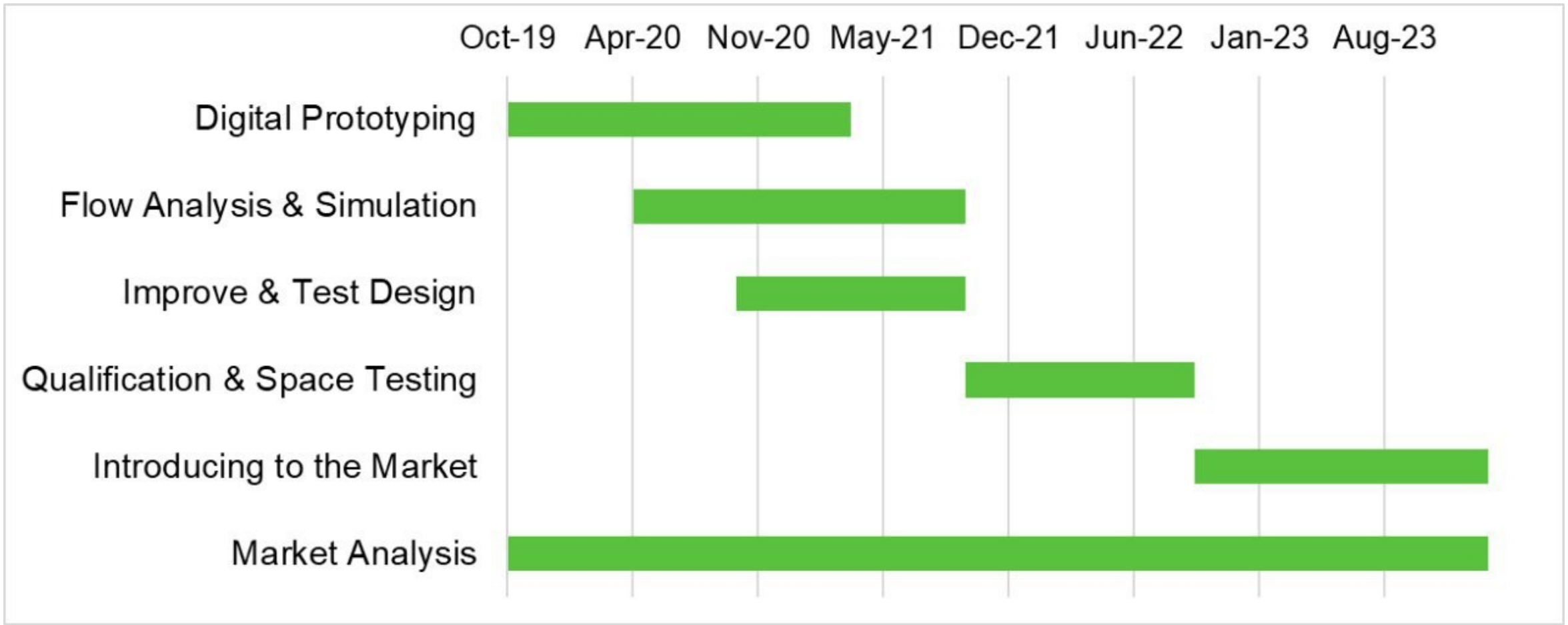
04 Flow analysis & simulation

05 Test Design

06 Qualification & Space Testing using Sputnix Platform

07 Sat Exhibition




Oct-19
Apr-20
Nov-20
May-21
Dec-21
Jun-22
Jan-23
Aug-23
Digital Prototyping
Flow Analysis & Simulation
Improve & Test Design
Qualification & Space Testing
Introducing to the Market
Market Analysis

Meet The Team

Salman Ali Thepdawala

Space Engineering

Ekaterina Trofimova

Data Science
Economics

Alexey Bunkov

Electronics
Quantum and Photonics

Lev Popyvanov

3d printing
Prototype Designe

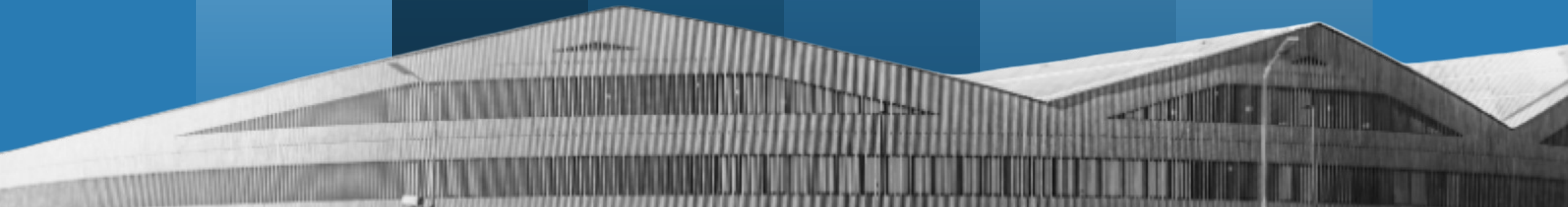
Liliya Mironova

Advanced Manufacturing Technologies
Computer Science

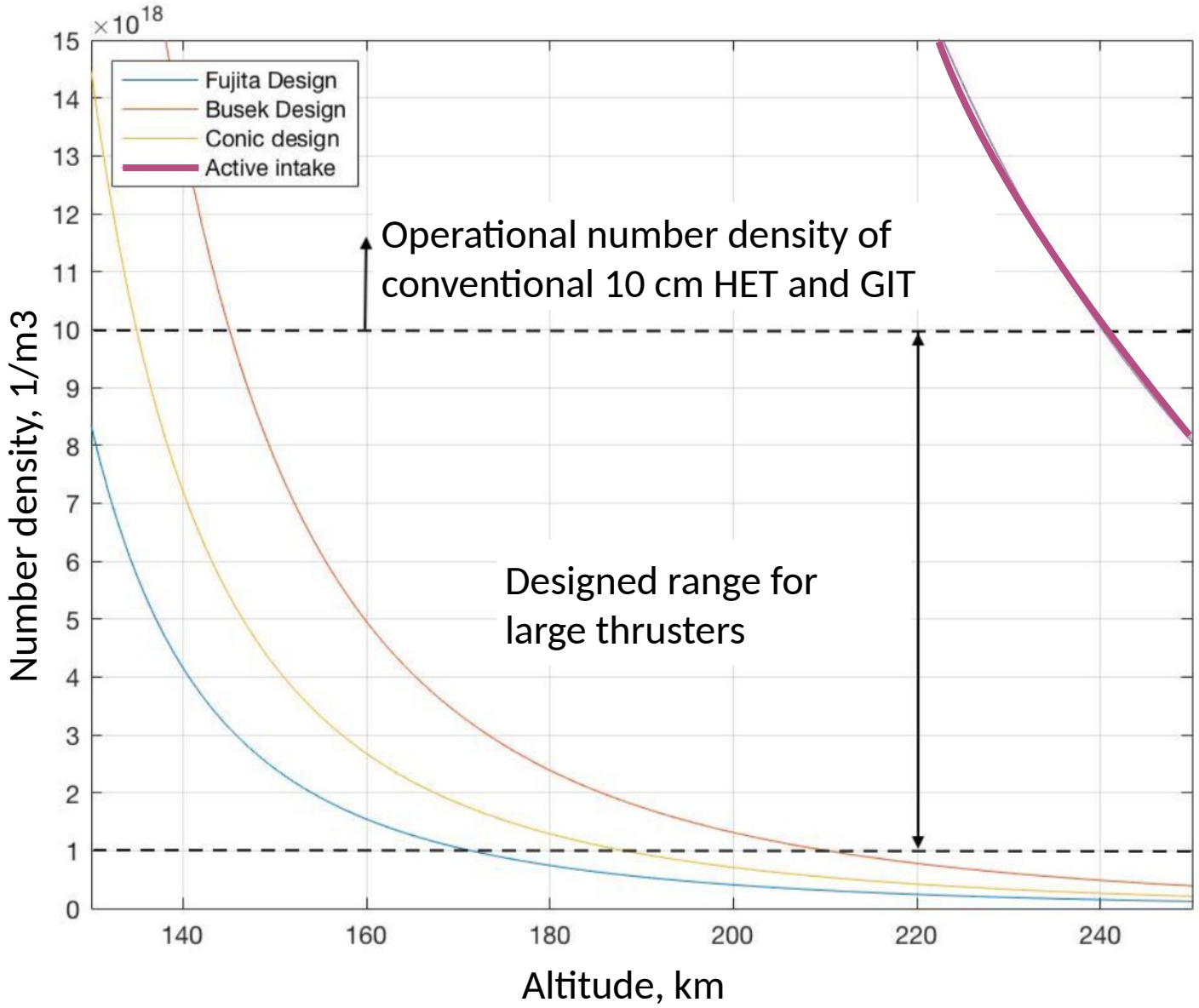
Iurii Lebedev

Records Manager

THANKS FOR WATCH



Appendix 1. Density dependence on Altitude



Appendix 2. Parameters

Altitude: 206 km

GSR = 100 cm

Geometry:

Diameter: 0.5 m

Length = 1.46 m

Solar Arrays Area = 1.9 m2

Body Drag = 3.77 mN (Cd = 2.87)

Solar Panel Drag = 1.65 mN (Cd = 19.1)

Overall Drag = 5.42 mN

Available Thrust = 6.9 mN