UNLOCK THE IN-ORBIT SERVICING MARKET WITH

SOFTWARE-DRIVEN MISSION DEVELOPMENT

SPACE SCAVENGERS

Team

SPACE SCAVENGERS

Tomas **Balog**

> 10 years of R&D experience

CEO
Physicist
Technology Architect
Project Manager
Finance Analyst

Marek **Gebura**

> 15 years of R&D experience

CTO
Materials Expert
Multidisciplinary Manager
Business Development

Michal **Mlaticek**

> 10 years of experience

CIO
Multi-agent Systems Expert
Senior SW Developer

+ 3 volunteers

Problem Definition

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Space Safety Programs

Opening door to **new market** of in-orbit services and transportation

- **Autonomous Operations**
- **Satellite Intelligence**
- **Swarm Intelligence**
- **Active Debris Removal**
- **Refuelling/Refilling**
- **Cargo transportation in orbit**
- **Space Defense**
- **Managed Orbital Recycling**
- **Managed Material Storage**
- **Circular Economy in Space**
- **Sustainable Space Exploration**

Record # of Launches
New Safety Regulations
Secure Orbits
Sustainable Space

→

Market Forecast *

$14.3 bn.

in cumulative revenues from
In-Orbit Satellite Services
by 2031

Currently only preparatory activities, studies, and technology under development
(mainly for future spacecrafts and launches)

Place for multiple players

* https://www.nsr.com/?research=in-orbit-services-satellite-servicing-adr-and-ssa-5th-edition

Our **Solution**

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Space scAvengers's idea of usage of autonomous multi-agent systems **recognized by European Space Agency** for Space Transportation System and In-orbit servicing solutions

Mission Design Approach	**Hardware Centric** Mission Design: • Mission goals -> CONOPS -> Requirements -> -> **HW Architecture** -> **SW Architecture**	**Software Centric** Mission Design: • Mission goals -> CONOPS -> Requirements -> -> **SW Features** -> **HW Architecture** ! • Starting from mission objectives and CONOPS to derive software features • **Develop software architecture first, then determine necessary hardware** • Enables **flexible adjustments** based on mission requirements
Mission Analysis Approach	**Hardware Centric** Mission Analysis: • **Digital Twins** of the HW components • **Requires HW architecture** to analyse mission • Model Based System Engineering	**Software Centric** Mission Analysis: • **SW Features** with **Modular Digital Twins** of HW components • Enables to simulate the mission directly based on the business idea !

Intelligence and Control	**Localized** Intelligence:
	• **Spacecraft is/are controlled separately** through the Ground control
	• Single SC GNC tied to SC's AOCS *
		Shared Intelligence:
		• **Autonomous decisions from collective agent knowledge** !
		• Control of Agents AOCS through
		  • **Shared Guidance and Navigation**
		  • **Shared sensorics data**
		• Ground Control in the position of approvals

GNC Algorithm Development	**Expert-Created** GNC Algorithms: • Potentially using ML	**AI Training** of GNC Algorithms: • **Based on the required end states** !
Additional Service-based Features		**Contact mechanics incorporation** !!
Business Differentiators	Focus on **LEO**	Focus on **MEO, HEO and Cis-lunar space**: ! • **Applicable also to LEO**

* GNC - Guidance,Navigation and Control
SC - Spacecraft
AOCS - Attitude and Orbit Control System

!!! Strength of differentiation

Our **Solution**

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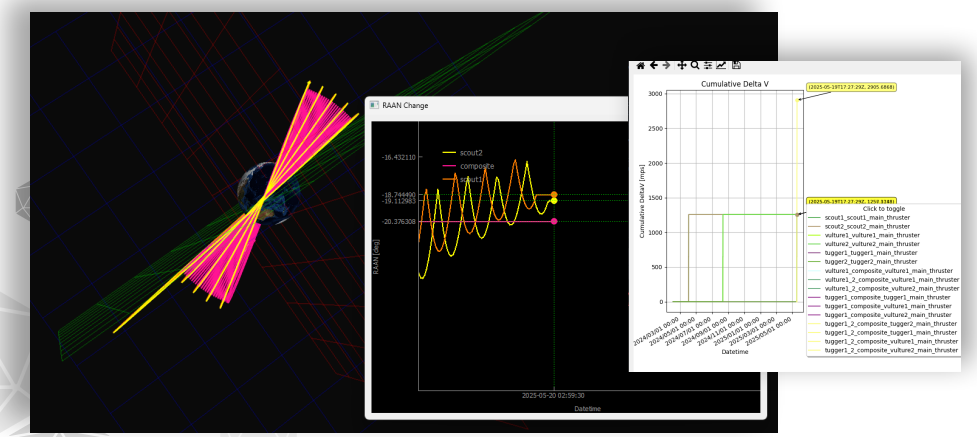
Software solutions for simulations, GNC and space services

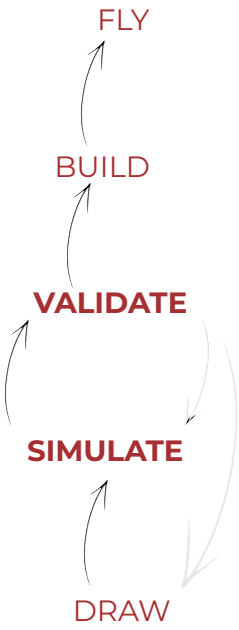
Enabling automated orbital servicing missions based on **cooperative approach**

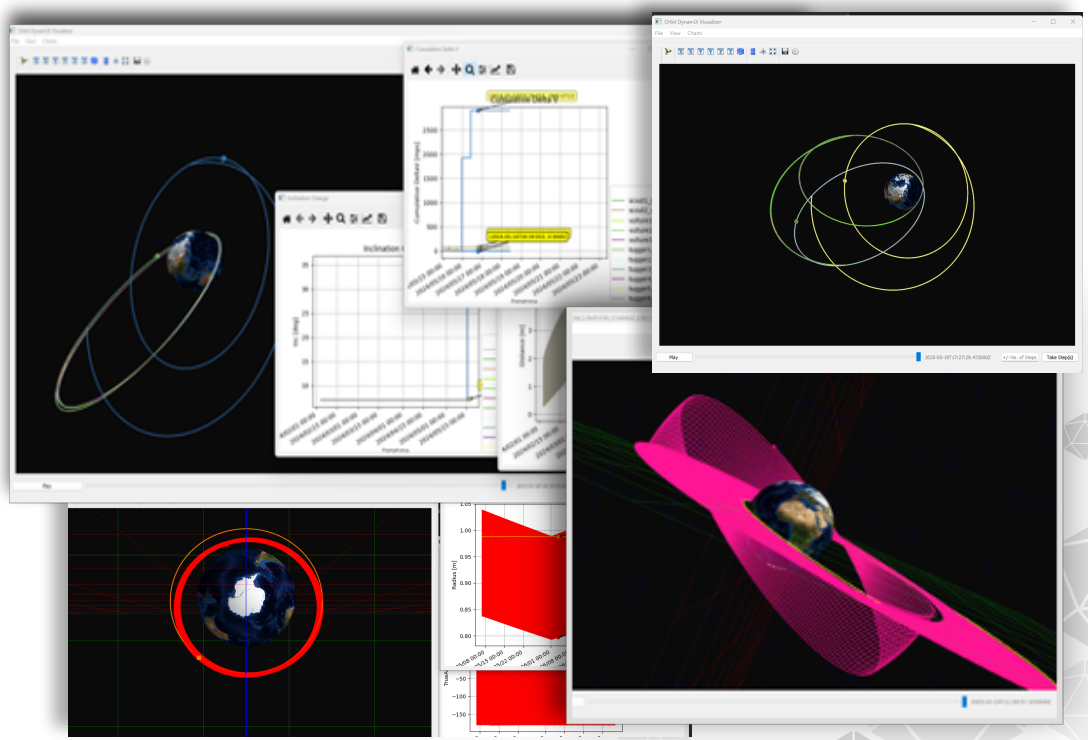
MISSION SIMULATOR | **GNC DEVELOPMENT** | **IN-ORBIT SERVICES**

Autonomous servicing missions validation

- close-proximity operations
- physical connection simulation
- AI collaborative perception
- autonomous operations







* GNC - guidance, navigation, control

Sales **Strategy**

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Democratization of the in-orbit servicing market for all players who want a take part in new challenges related to **hereby enabled** new type of **complex and cooperative space missions**

Licences	Subscriptions	Services & Support	Models creation and simulations	Full Space Missions Simulations and Systems Engineering	Full Space Missions GNC and Operations	Full Space Missions
5 000 ÷ 100 000 €	100s ÷ 1000s €	100s ÷ 1000s €	10 000s €	100 000s €	100 000s €	100 000s €
Depending on modules ordered	Monthly/yearly Computational credits	Hourly and daily rates	Contractual	Contractual	Contractual	Contractual

ESA Validation of Simulator

- Licensing to Customer base
- Provide Coaching & Develop Models for Customers
- Gather and Implement Feature Requirements
- Provide Feature Add-Ons

Use Simulator for In-Orbit Services and Space Transportation Missions Simulation

Revenue

Business **Strategy**

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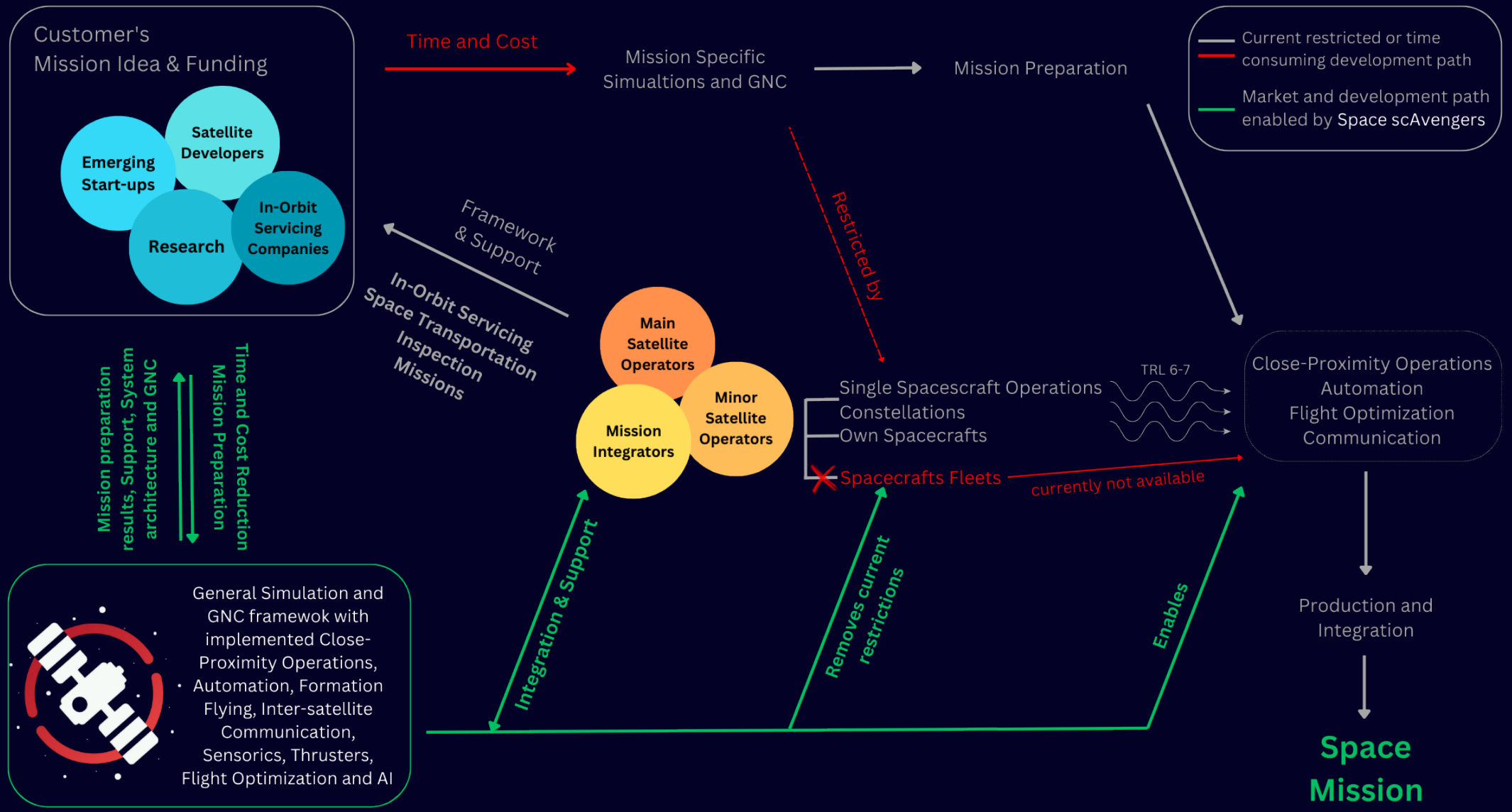

Partners & Grants

Space scAvengers

Simulator development and connection mechanism testing and validation

→ Partially covered by ESA PECS 6 & 7 projects, ESA PECS6 successfully finalized in 07/2024

TELESPAZIO a LEONARDO and THALES company

esa

Institute for Materials and Machine Mechanics Slovak Academy of Sciences

REDWIRE

MAGICS

Institute for Informatics Slovak Academy of Sciences

Jacobs Technology (Slovakia)

AIRBUS DEFENCE & SPACE

First contact established

Orbit Recycling

SLOVAK SPACE OFFICE

PRVÁ ZVÁRAČSKÁ, a. s.

STAM

Astros solutions

touch4IT

CZECH AEROSPACE RESEARCH CENTRE

POLITECNICO MILANO 1863

STU FEI

nano avionics

Climate-KIC

Co-funded by the European Union

CASSINI EU SPACE

* Letter of Intent

* Potential customer

TELESPAZIO a LEONARDO and THALES company

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Your Ref./ Ihr Zeichen:	Doc. Ref./Dok.-Ref.:	Date/Datum:	Extension/Durchwahl:	E-Mail:
	LAC.COR.2024-002	09.02.2024		marc.niezette@telespazio.de

Letter of Intent for Supporting Collaborative Inspection of Target utilizing Lidar data from Multiple Cooperative Spacecraft – Elementary CPO Module for Multi-Agent Spacecraft Simulation Platform

Dear Dr. Gebura,

This letter confirms our interest in your innovative approach to Multi-Agent Spacecraft and their application to In-Orbit Servicing, including the specific topic of Collaborative Inspection of Target utilizing Lidar data from Multiple Cooperative Spacecraft. We intend to support the development of your solutions through cooperation with Space scAvengers and other partners, with the objective to eventually deploy and operate services based on this technology.

In the future, we intend to operate Multi-Agent Spacecraft missions and services, including the usage of cooperative spacecraft with high level of autonomy. We will require predictive simulation to support Multi-Agent Spacecraft missions and services, including proper simulation platform/tools for GNC of such missions and services, potentially with HW in the loop.

Following is a brief overview of how we propose to work with Space scAvengers to help developing this technology:

- We can provide expertise to support the project in the definition of preliminary user requirements for the simulation platform and its link to operations.
- We can provide market analysis information that would allow defining the customer segments the most appropriated to the solution.
- We can help identifying and involving additional partners when relevant.

Telespazio Germany is a European leader in space operations and space engineering solutions & services. We combine over 40 years of experience in the space sector. We have played a major role in the European Space Agency's missions, as well as other national and European programmes, providing software solutions and spacecraft operations services. Today, as the private sector is growing and the needs are evolving, we are building a bridge between this sector and the institutional one by deploying our expertise through innovative solutions more adapted to a commercial approach.

Roadmap

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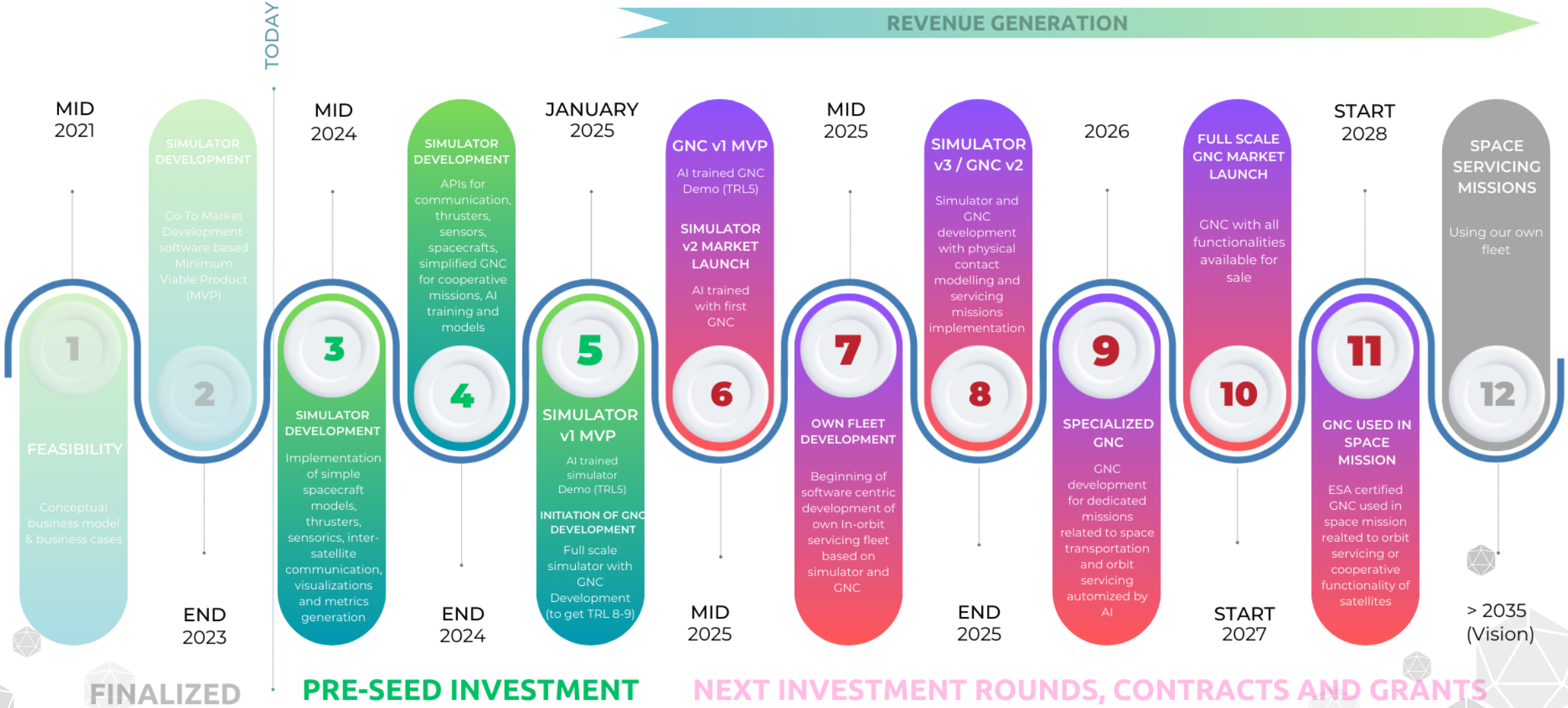

Our Ask

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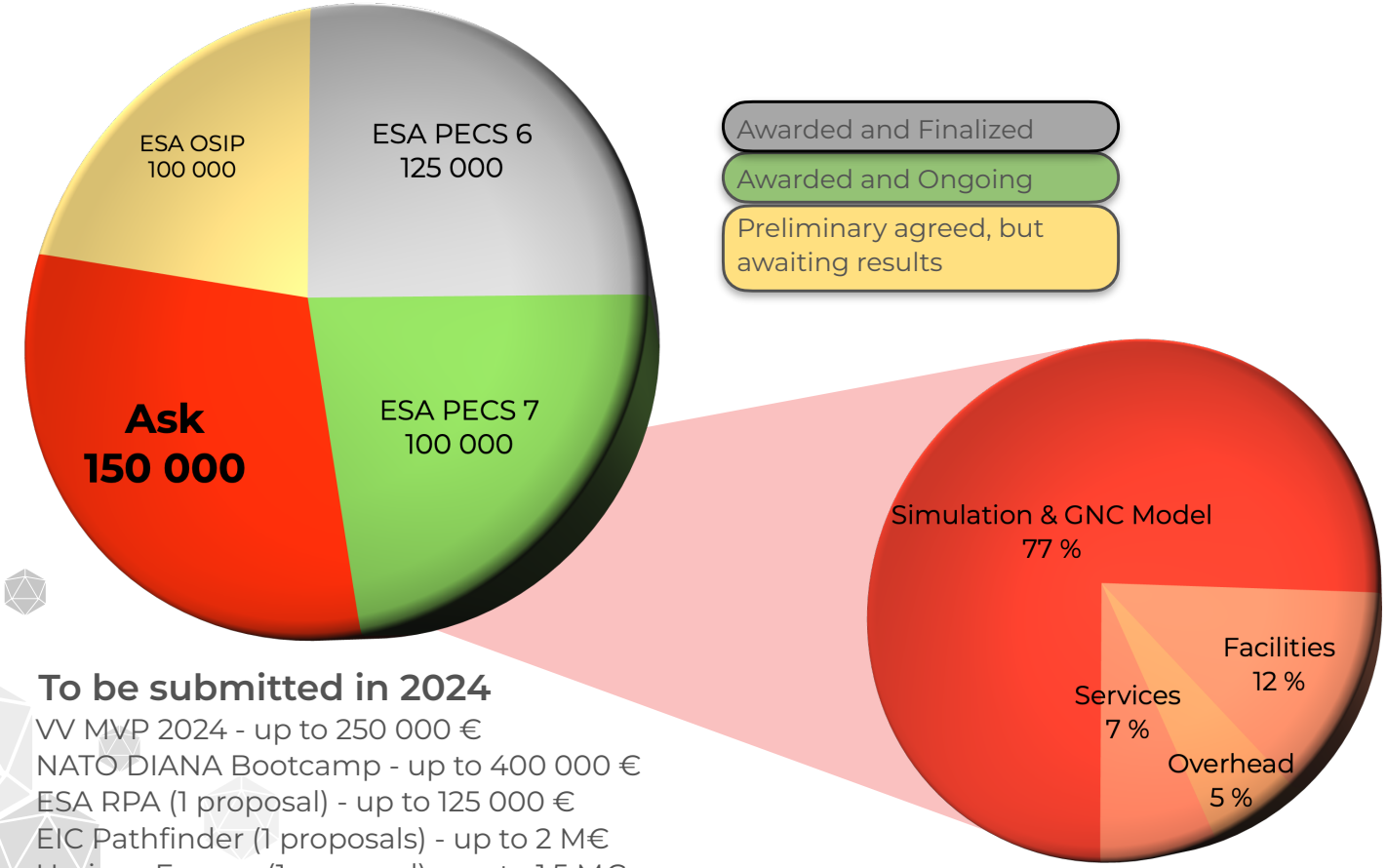
Current ask

(Pre-seed – 12 Months duration)

150 000 €

To bridge over time-period until financing from potential grants becomes available



To be submitted in 2024

VV MVP 2024 - up to 250 000 €
NATO DIANA Bootcamp - up to 400 000 €
ESA RPA (1 proposal) - up to 125 000 €
EIC Pathfinder (1 proposals) - up to 2 M€
Horizon Europe (1 proposal) - up to 1.5 M€

Truly **Autonomous** Space Operations Finally **Enabled**

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Contact

Phone: **(+421) 911-866 272**

Web: **spacescavengers.sk/investors**

Email: **info@spacescavengers.sk**

USP and IP

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USP

Democratization of the in-orbit servicing market for all players who want a take part in new challenges related to **hereby enabled** new type of **complex and cooperative space missions**

Revolutionary Mission Simulator: Automating orbital services with AI-powered, multi-agent simulations for precise, close-proximity operations

Innovative GNC Development: Tailored advanced GNC software for automated space missions, enhancing inter-satellite communication and autonomy.

Dynamic In-Orbit Services: Optimized systems for modular, AI-driven spacecraft fleets for versatile space missions, ensuring efficient coordination and risk reduction.

IP

1. Simulation, ML Models and algorithms protection

- release early (base featured) version as open source
- access to higher value features will be through remote api (for security reasons)
- copyrighted **ML Models and algorithms** for cooperative mission execution
- **Copyrights for full version**

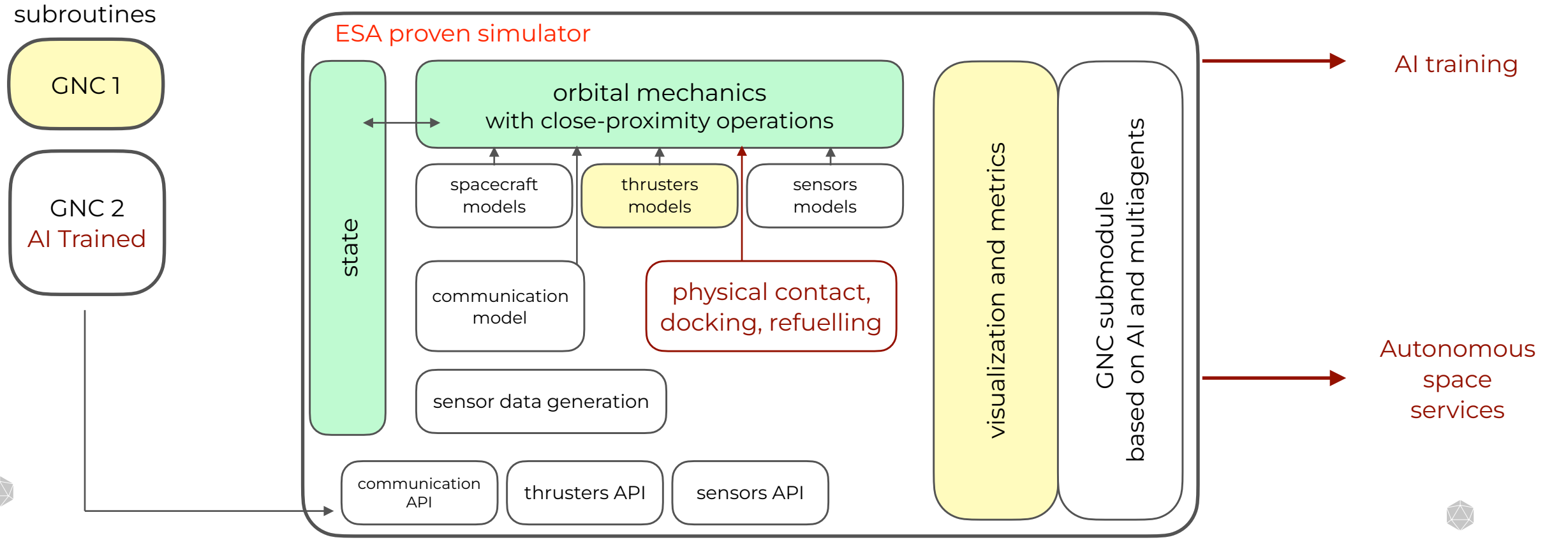
2. GNC protection:

- **patents** for GNC logics and particular sequences (connection, circumnavigation, etc.)

3. HW Technology protection:

- **patents** according to the development progress - i.e. connection mechanism, special sensors developments etc.

Ongoing development of simulator tool



* GNC - guidance, navigation, control

Developed | Ongoing | TBD

Our Ask

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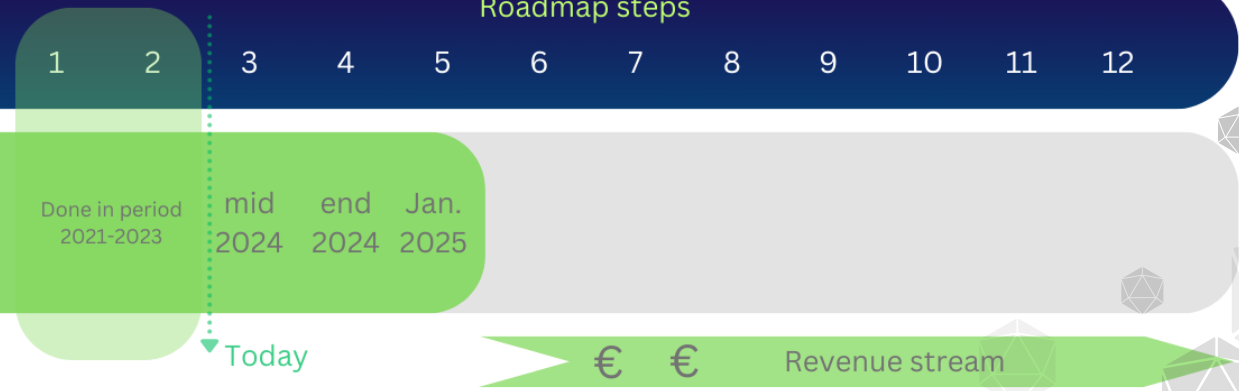
INVESTMENT ASK

PRE-SEED ROUND

Investment	Equity	Achievements and deliverables	Roadmap steps	Timeline reduction	Revenue generation	Hire
150 000 €	**10%**	Focus on simulator development until v2 of it is achieved • Implementation of simple spacecraft models, thrusters, sensorics, inter-satellite communication • APIs for communication, thrusters, sensors, spacecrafts • Simplified GNC for cooperative missions • Visualizations and metrics generation • Simplified AI training and models **Output**: Simulator MVP at level TRL 5 as usable Demo version which can be already licenced and generate revenue	1 2 **3** **4** **5**	**None** Ends: Jan. 2025	€	**None**

Investment	Equity	Duration	Timeline reduction	Hire
150 000 €	**10%**	**12 mo.**	**None**	**None**



Partners

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Company	Type	Relationship	Active projects
Telespazio	Satellite Operator	Potential customer and Strategic partner; Letter of intent; ESA OSIP contract	ESA OSIP: Short system study for Cyclic economy in space – Managed Recycling Orbit Operated by Multi-Agent System Preparation of EIC Pathfinder project proposal
VUZL	Czech Republic owned Satellite and Mission Integrator	Potential customer; ESA OSIP contract	
ESA	Space Agency	Existing customer; catalyst for MVP	OSIP; 2x PECS; all focused on MAS + FLPP directorate interested
IMSAS	Academy with potential for joint spinoffs	Potential customer; Joint R&D contract; ESA PECS contract (subcontractor);	ESA PECS: Contact Capacitor Discharge Welding Gear for In-Orbit and Lunar Applications
First Welding Company	SME selling welding systems	Potential customer; Joint R&D contract; ESA PECS contract (subcontractor)	
Redwire Europe	Large private company – space robotics and GNC	Potential customers; worked together on two Horizon Europe proposals	Preparation of EIC pathfinder proposal addressing Recycling in Space
Nanoavionics	Small satellite mision integrator		
Orbit Recycling	SME; Space recycling		
STAM	Space engineering company		
Politecnico di Milano	Academy, university	Research partners; worked together on two Horizon Europe proposals	
Airbus	Defense and Space	Potential customer; first connection	
Jacobs Technology (Slovakia)	Technology provider for nuclear industry / space	Potential customer; first discussions	