

# EmTDLab

## Space Division

### Revolutionizing Space Radiation Shielding with A.I.

Investment Pitch Deck

Updated September 2024 – Version 14

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# High radiation levels in space significantly impact satellite performance and lifespan

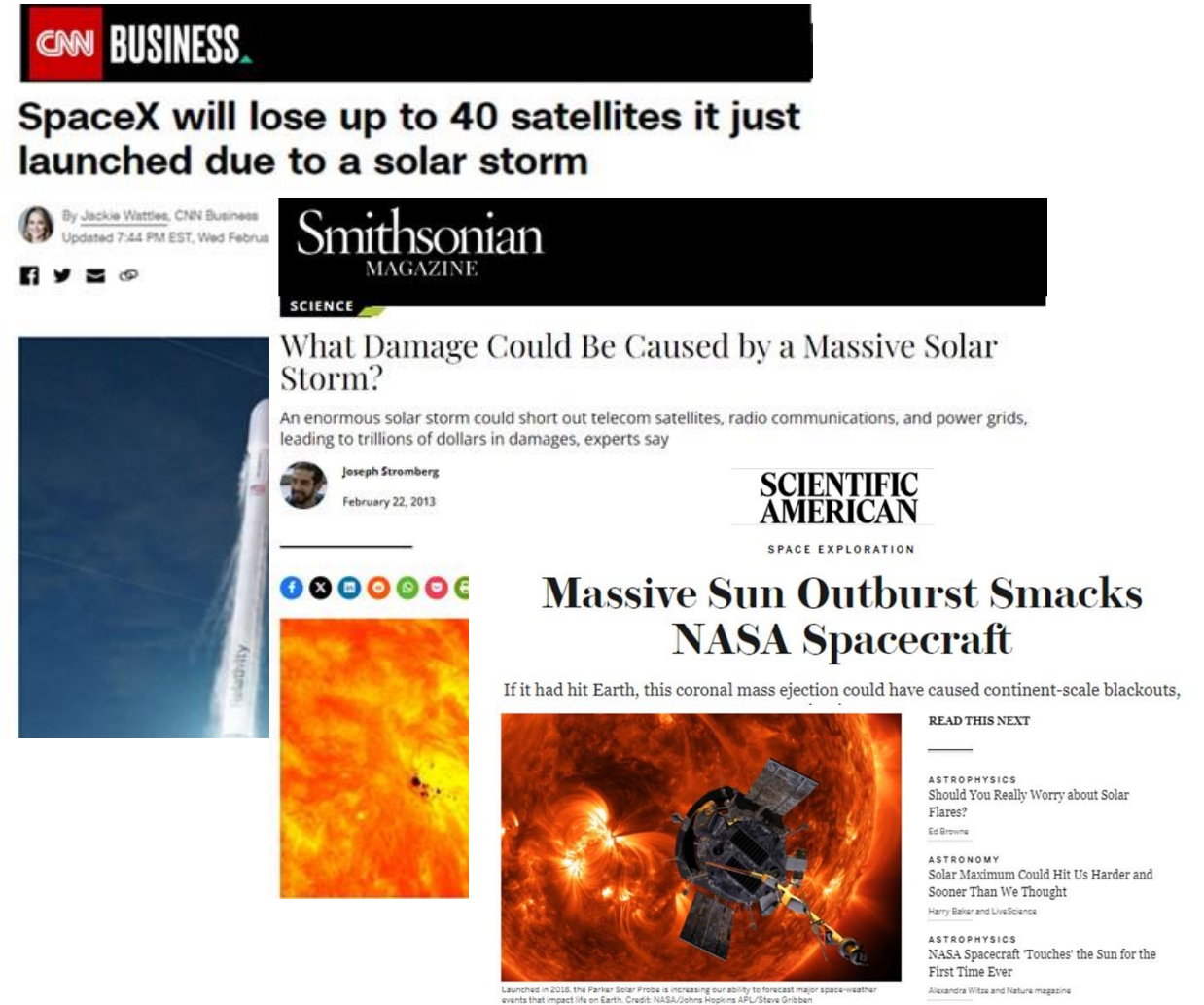
One of the major challenges the space industry faces is the high amounts of particle radiation in their missions.

Not only harmful for living organisms, high levels of radiation (130x higher than that found on Earth, naturally) also affects the performance of satellites and the underlying IT systems.

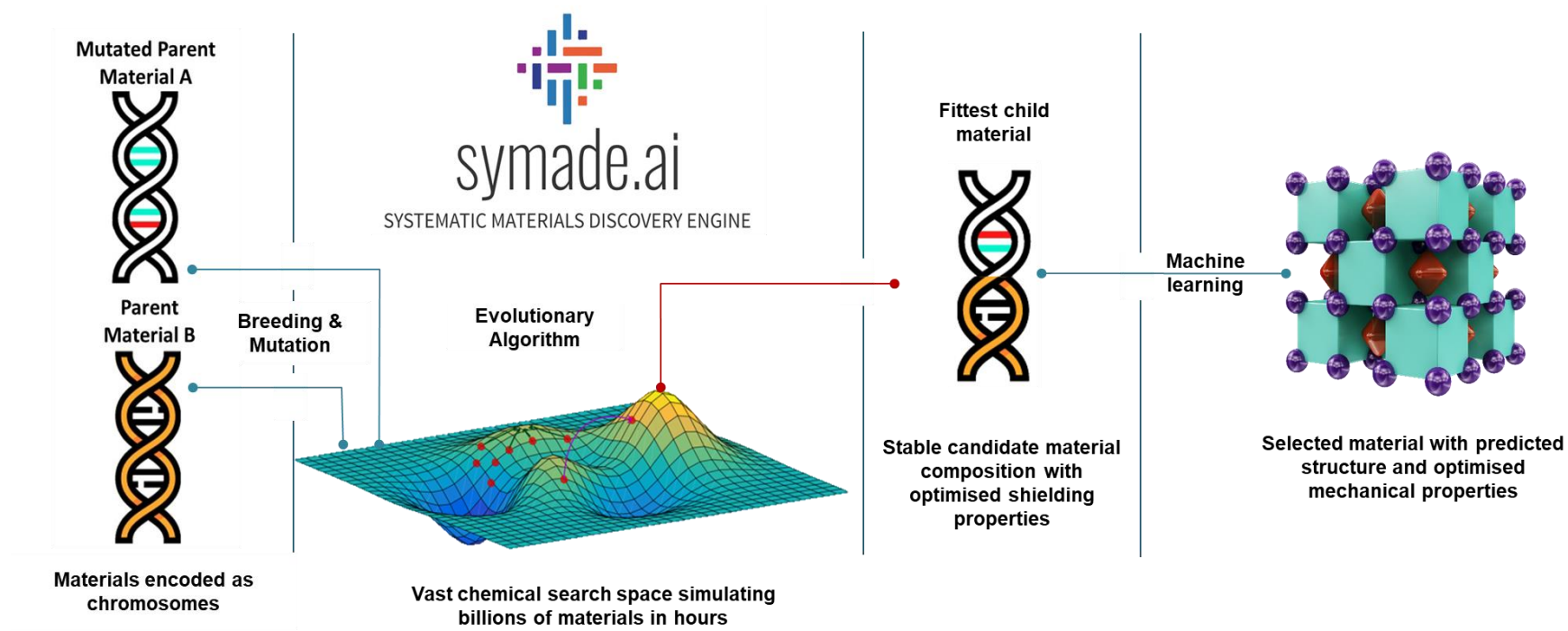
Microchips & processors' lifespan and performance are greatly reduced, causing large disruptions, replacement costs, and complexity.

Satellite operators and their clients are constantly struggling to protect the most valuable components, the microchips, and processors, from the high levels of radiation through costly and inadequate protective shields.

Current shields are even not prepared to protect advanced processors from unexpected flares of cosmic radiation (cfr. articles) causing billions of USD in losses.



# Current radiation shields are costly and insufficient for protecting advanced processors



EmTDLab is focused to create a class of new materials capable of being an effective shield against radiation.

- ❑ Like the concept of natural selection found in nature, EmTDLab targets an initial population of materials, make small changes to it, then tests it against radiation. Following the results, the best attributes of the material are kept, and the weakest are discarded.

This process is accelerated by **symade.ai**, EmTDLab's patented AI platform.

- ❑ **Symade.ai** digitally simulates billions of new materials, and for each material, it digitally runs experiments through its natural selection process
- ❑ For each material, the system repeats the process by interchanging attributes or adding new attributes until an optimal solution is found. The result is the fittest material, built by a certified AI algorithm, digitally tested billions of times and verifiable by space agencies.

# Our development roadmap includes advanced shields for microchips, satellites, and spacecraft

Our technology is lightweight, flexible, and affordable. It can be applied to any type of system, regardless of its size or shape. Our technology can protect any space system from radiation damage and extend its lifespan and functionality.

## 1. Product development roadmap:

1. Manufacture a first “on the chip” shield for customized circuits and processors
  - Status: quotation stage with sample manufacturer (CRM Group Belgium)
2. Evolve the “on the chip” shield towards a radiation shielding box, ready for installation in any satellite
  - Status: quotation for own space computing system architecture (IMEC Semicon. R&D Belgium)
3. Evolve the “on the chip” shield towards larger scale panels for spacecraft & terrestrial application
  - Status: design prototype for 3 terrestrial applications in progress (Refer to next page).

### SMART On-the-chip shield



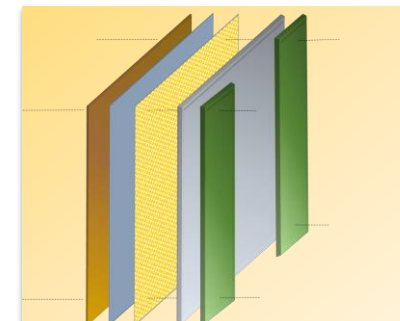
The most advanced shield for microchip radiation dose reduction

### Radiation shield box



The most powerful combination of shielding and on-board satellite computing power

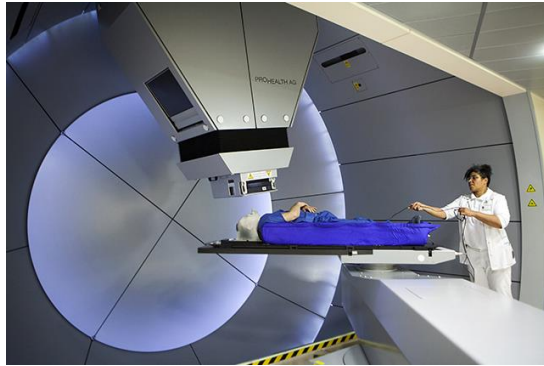
### Structural shield panels



The first effective radiation shielding material with large range of industrial applications



# Custom shielding solutions extend to healthcare, energy, and defense sectors



**HEALTHCARE**  
**Cancer Treatment Facilities**  
**Ion beam / Proton Beam**  
**X-Rays – Gamma Rays**



Develop a lightweight and structurally resistant panel for a cancer therapy treatment room.  
Saving from Steel and concrete > to 30%

Customer traction: world leader in proton therapy centres

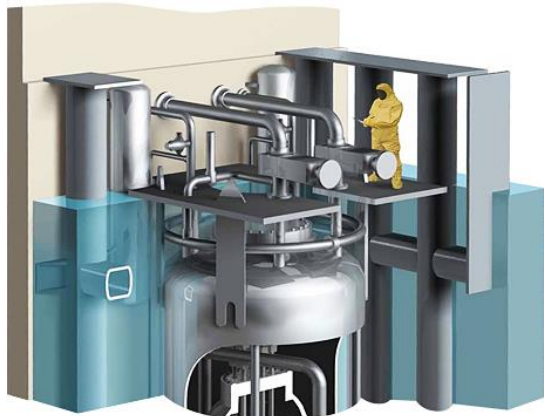


**ENERGY & DEFENSE**  
**Protection of Critical Power**  
**Infrastructure:**  
**Electro-Magnetic &**  
**Corrosion resistance**



Develop an electromagnetic pulse shield for power grid managers and drone manufacturers.  
Greenfield market offering, no current solutions

Customer traction: large drone manufacturer



**ENERGY**  
**Nuclear Energy Generation**  
**Miniaturized Reactors**  
**Gamma rays, neutrons**



Develop combined electro-magnetic and particle shielding solutions for a small modular fast reactor with lead coolant  
Greenfield market offering, no current solutions

Customer traction: governmental nuclear research centre

# Substantial market opportunities exist in space and related industries for our innovative solutions

[Global market size forecast by 2030]

		Growth	Available Market	Market share	Obtainable market	Drivers	Customer examples
<b>Structural radiation shielding Spacecraft panels</b>	<b>Greenfield opportunities</b>						
	Advanced structural & functional space materials <sup>1</sup>	12%	<b>2.9 bn</b>	4% <sup>4</sup>	<b>116 M</b>	Escalating demand for lightweight and high-strength materials	SpaceX, Blue Origin, Northrop Grumman, Sierra Nevada Corporation
<b>Shielding enclosures with commercial components</b>	Radiation shielded system-on-module for space applications <sup>2</sup>	12%	<b>2.4 bn</b>	1% <sup>5</sup>	<b>24 M</b>	The rise of commercial satellite constellations	Blackjack (Raytheon), Lightspeed (Telesat), Kuiper (Amazon), Starlink (SpaceX), OneWeb (Airbus-Oneweb)
<b>Spot shielding for commercial components</b>	<b>Replacement market</b>						
	Radiation-hardened components for space <sup>3</sup>	7%	<b>4.0 bn</b>	2% <sup>6</sup>	<b>79 M</b>	Increasing demand for reconfigurable rad-hard devices	Airbus, Boeing, Thales, Leonardo, Lockheed Martin, Raytheon

1 - Based on space advanced composite materials market value

2 - Based on space on board computing platform market value

3 - Including rad hard by design by process and by software mitigation

4 – Comparable: Carbice Carbon

5 – Comparable: Aitech systems system on module

6 – Comparable: DDC, Data Device Corporation RadPack

Additional opportunities in adjacent markets: Medical Shielding (2.0bn, CAGR 7%), Electromagnetic Interference shielding – including Defence applications (10.1bn, CAGR 5%),

# EMTDLab's revenue model leverages custom engineering solutions with high gross margins, tailored to specific market needs, ensuring profitability and scalability

Revenue Streams	Pricing	Cost base	Gross margins	Revenue economics	Business Case
<b>Structural radiation shielding panels for spacecrafts &amp; vehicles</b>	$\left( \frac{\$}{\text{Project}} \right) \times \left( \# \text{ units project} \right)$	Engineer time Raw materials Consumables 3D printer ops.	> 30%	Spacecraft structural panels are custom-made and sold based on the unique requirements of each individual space project	Comparable: NASA thermal protection shield contract to Boeing for Orion Spacecraft, valued @ 14M\$ / 1unit; 6 units were manufactured in total.
<b>Smart shields Spot radiation shielding for commercial components</b>	$\left( \frac{\$}{\text{Unit}} \right) \times \left( \text{Total \# of Chips} \right)$	Engineer time Raw materials 3D printer ops.	> 50%	Spot shielding is used at chip level, applied to several chips on a single circuit board. These are further optimized by shielding multiple circuit boards	Example: 100kg satellite with 7 key electronic boards, 10 chips to be shielded / board @ 750\$ / shield, plus 100 hours radiation simulation services @1500\$ / hour
<b>System-on-Module Radiation shielding enclosures with commercial components</b>	$\left( \frac{\$}{\text{Unit}} \right) \times \left( \# \text{ Units} \right)$	Engineer time Raw materials Electronics 3D printer ops.	> 45%	The choice of a System-on-Module hinges on mission requirements, including processing power, power consumption, environmental conditions, and task specifics.	Example: 4 System-on-module units installed in a 250kg satellite priced at 5,500\$/unit. Optional radiation simulation services*.

\*Radiation simulation services are sold as engineering services for each custom project in combination with the shields and materials. Pricing is based on #engineers billable hours and the related cost is the engineer salary cost, overheads and computing time to run the simulations.

## EmTDLab wins with diversified, multi-layered shielding solutions, quick production at moderate cost

Features	EmTDLab	Commercial-off-the-shelf chips	Radiation hardened and tolerant chips	Radiation error mitigation devices	Computational materials discovery	Spacecraft & human shielding
Shielding optimisation	Chip, board, sat. level	Chip or board level	Chip level design	Board level design	-	Single application
Multi-layer	3-layers	Single layer	-	-	-	-
Custom materials	Software simulation + Manufacturing	-	-	-	Software simulation	-
Mechanical properties	Software simulation & production	-	-	-	Software simulation	Low
Total cost	Intermediary	High to very high	Very high	Not disclosed	Intermediary	Not disclosed
Product range	Diversified	Limited	Single choice	Few choices	-	Limited
Production lead-time	Short	Medium	Very long	Medium to long	-	Short to Medium
Ease of integration	Standardisation	Case-by-case	Case-by-case	Case-by-case	-	Case-by-case
Obsolescence	Low risk	Very high risk	High risk	Medium Risk	-	Medium risk



# Our go-to-market strategy targets space agencies and commercial electronics manufacturers



## Target Markets

### Structural Radiation Shielding Segment:

- Space Agencies
- Private (Aero-)space Companies

### Space Electronics Segment:

- Satellite and spacecraft integrators
- Commercial-off-the-shelf electronics manufacturers
- Radiation-hardened electronics manufacturers



## Initial Penetration Strategy

### Customer Discovery Centricity: focusing on problem-solving:

- **Deep-Dive:** researching deep needs & challenges
- **Discovery Sessions:** customer meetings to capture pain points
- **Pilot Projects:** co-fund pilot projects
- **Relationships:** formulating partnerships to create recurring customers



## Channels & Partners

### Direct Sales:

Engage targets directly with proof-of-concept projects

### Partnerships:

Form strategic alliances with complementary companies like Dupont

### Online Marketplaces:

List products on global marketplaces, like SatSearch

### Industry Events:

Participate in space technology expos, trade shows, and conferences

# An experienced leadership team drives EmTDLab's innovation and growth



Stephane Bordas, PhD  
Computational  
Mechanics Advisor

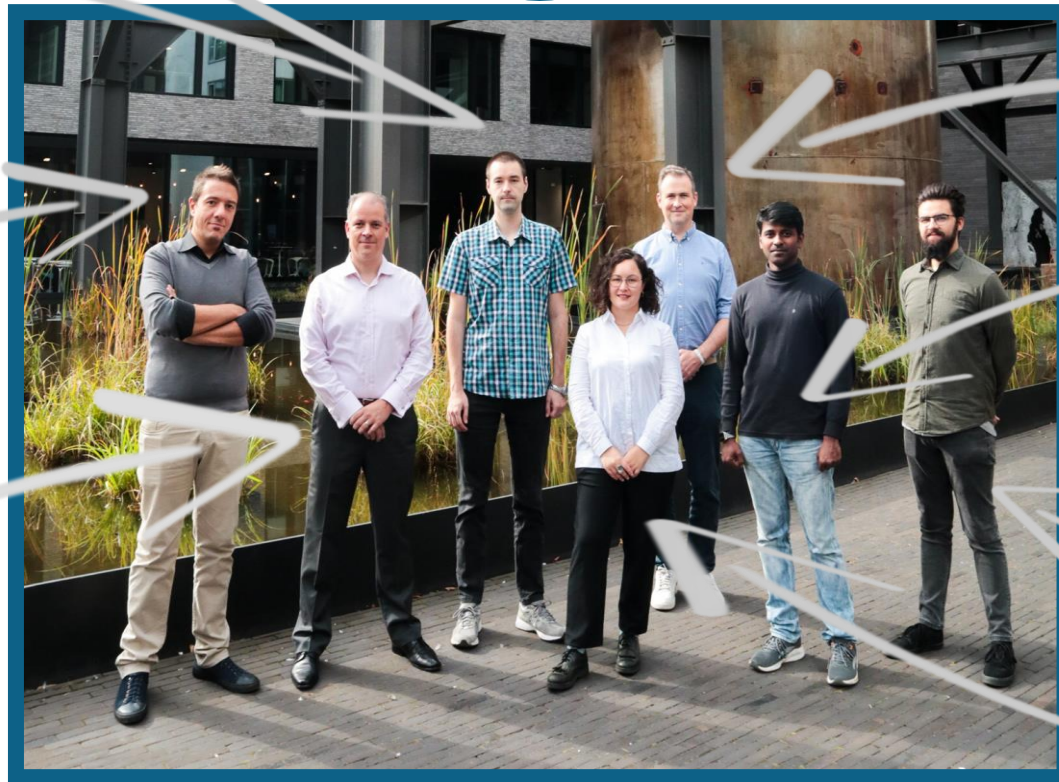


Vincent Ryckaert, PhD  
Business IP  
R&D Collaborations



Lars Beex, PhD  
Mechanical Properties  
Prediction Advisor

Matus Lach, PhD  
Computational Physicist  
and Software Developer



Yannick de Harlez, PhD  
CFO & COO

Surendran Murugesan, PhD  
Microstructure Modelling

Gabriele Saleh, PhD  
Computational Materials  
Chemistry

Jarno Canu, BSc  
CAD designer

Cedric Thiry, Jr.  
CEO & CTO

Sofia Colombi, PhD  
Radiation Effects & Simulation  
Engineer

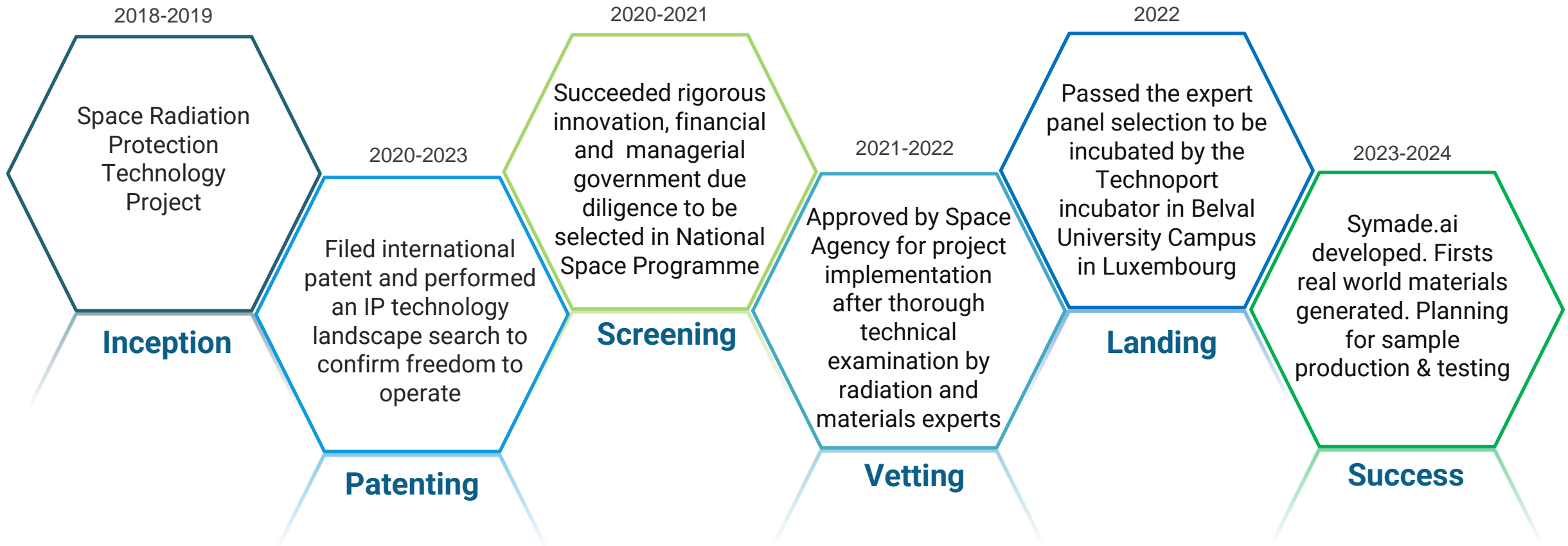


Simon Challinor  
Software Architect  
Full Stack Developer



Eefje Van Damme, Jr.  
Technology Landscaping  
Freedom-to-Operate

## Key milestones and achievements underscore our progress and capabilities



# Secured funding, accreditations, and strategic collaborations enhance our market position

## Funding



Secured a **National Space program** grant by the Luxembourg Space Agency

EU Government **Investment** project upon successful fundraising

## Accreditations



Singapore Space & Technology Ltd

**Accredited supplier** with **ESA** the European Space Agency

Member of the **Singapore Space & Technology Limited**

Part of the **NVIDIA** Inception and **AWS** programmes

## Projects & Collaborations



Tendering for lightweight Cubesat radiation shielding project with **ESA**

Strategic collaborations in an APAC **Government Space Program** in negotiation

Part of **Yet2/NASA** scouting for technology needs

## Milestones



**ESA validation**

**Q3 2022 - Q1 2023**

- Use case & market

**Q4 2023:**

- Symade Proof-of-concept

**Q2 2024**

- 50% sumade.ai delivered

**Q3 2024**

- First novel materials found



# Recent advancements demonstrate the effectiveness of our AI platform in material discovery

August 2024

EmTDLab's SYMADE A.I software has reached an important milestone – the first radiation shielding materials discovery campaign. After defining the chemical space consisting of chosen chemical elements of the periodic table, the software can generate a population of simulated materials, more specifically alloys, and evolve this population over time.

For each alloy, it can accurately estimate its density, stability and predict its radiation shielding properties.

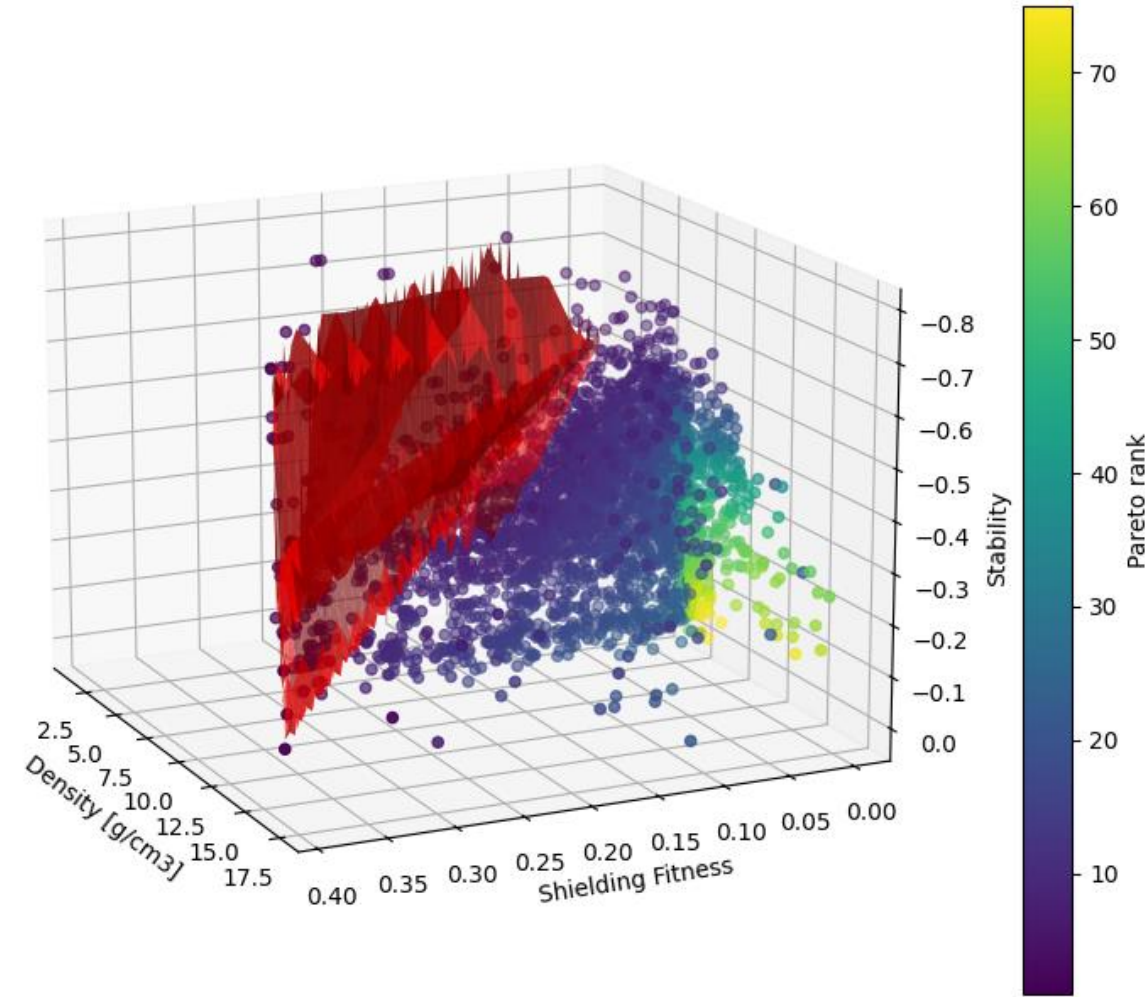
We observe that the software can independently explore the predefined chemical space and that the evolved materials are getting better over time with respect to their shielding performance.

We've already managed to discover a set of metal alloys candidates.

EmTDLab is currently planning the metal alloys sample specimen production for material characterization and testing.

Manufacturing and testing third parties have been identified whilst European Space Agency oversees the verification and validation process.

Shielding Fitness vs Density vs Stability for First Fifty Pareto Fronts

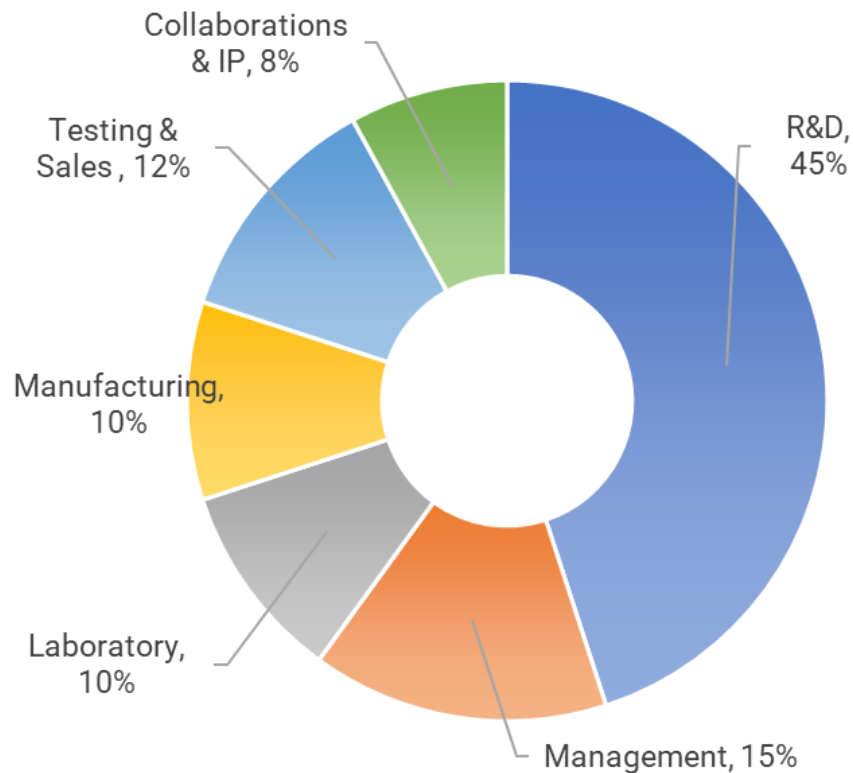




# Raising capital to complete development and capitalize on current market opportunities

We are raising € 7M in equity  
to complete the development of our AI platform,  
manufacture our first novel material and launch our first  
product – ANCILE chiplet shield

## Funds Allocation



## A.I. Software Platform 1.2 million €

- Hire key people in computational chemistry, radiation engineering, scientific programming, system engineering & materials science
- Acquire computing hardware for data security – GPU server
- Develop full AI software platform working pilot
- Identify & simulate novel shielding materials
- File at least one patent for novel materials

## Materials Manufacturing 1.8 million €

- Hire key people in 3D materials production, laboratory operation, materials workshop operation and process engineering
- Acquire key laboratory equipment for process secrecy
- Synthesise novel materials samples
- Manufacture 3D printed units
- Test radiation shielding and mechanical properties
- File at least one patent for production process

## ANCILE Shield for Space Computing 4.0 million €

- Hire key people in design, prototype engineering, sales, supply chain, production engineering, test engineering and quality control
- Acquire key electronics laboratory equipment and electronics workshop equipment
- Design & assemble satellite computing components
- Develop production upscaling process
- Manufacture 3D printed prototype, pre-production units
- Test radiation shielding and mechanical properties
- File at least one patent for the novel multi-layer shield

Activities

## Summary – Market, Product & Use of funds

Core product development	Cash use (Capital) €	Cash Runway Start 2025	Total available market 2030, €	Market obtainable by EMTD lab 2030, €	Products	Product Readiness	Priorities	Sales Revenue Y1 (2025) €	Sales Revenue Y2 (2026) €	Sales Revenue Y3 (2027) €	Identified clients
(1)	(2)	(2)	(3)	(3)	(1)	(1) + (2)		(4)	(4)	(4)	(1) + (3)
SMART shield (Protective <b>box</b> ) <u>Core Technology</u>	1.1 M	12 months	4.0 billion	2% Market Share  79 million Revenue	Simulation Services Component Shielding Circuit Board Shielding	12 months	1	-	10 k	800 k	Thales NewSpace SME's
Structural radiation shielding <b>panel</b> (Large panels)	1.8 M	18 months	2.9 billion	4% Market Share  116 million Revenue	Satellite & Payload Lightweight Shield	24 months	2	250 k	250 k	500 k	ESA Nokia
					Nuclear Energy Shielding (Reactors Tech Challenge)	6 months	3	100 k	200 k	300 k	SCK
					Drone or Transformer Electro-Magnetic Shielding	6 months	4	250 k	1.7 M	2.0 M	ANAVIA & SKYY
					Nuclear Medicine Shielding	6 months	5	-	3.0 M	3.0 M	IBA
					Space station & Moon rover vehicles shielding	24 months	6	-	-	1.2 M	NASA SpaceX Toyota
ANCILE <b>high performance space computing</b>	4.9 M  (incl. IMEC)	36 months	2.4 billion	1% Share  24 million Revenue	Radiation proof high performance space (HPSC) computing system	36 months	1	Under Devpt.	Under Devpt.	Under Devpt.	Space Nuclear Healthcare

**Market geography:** Asia-Pacific largest and fastest growing market, followed by North America, Europe and Rest of the World

**Product development:** Next to priorities two products can be developed in parallel, excluding ANCILE as separate track (IMEC collaboration project)

**Capital fundraising plan:** aiming for 7M EUR in one investment tranche for the next 36 months, with on-going subsidies and grants applications

(1) Ref: Product Development plan

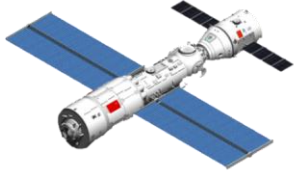
(2) Ref: Use of Funds

(3) Ref: Market analysis

(4) Ref: Revenue

+ read Competition overview

# Strategic timing makes NOW the perfect moment to invest in EmTDLab's breakthrough solutions



## Strategic Environment Drivers

- Space is now a sovereign capability in a growing number of countries
- Increased global government funding
- Renewed and global public enthusiasm for space exploration

## Space Economy

- Value of \$564bn in 2023 – Expected to grow to \$1T by 2030
- Democratization of space
- Rise of satellite constellations: 4,850 satellites now operational on-orbit, ~1,740 satellites to be launched / year

## Future Markets – Space & Medical

- Increasing cancer treatment facilities shielding needs
- Space-based solar power, orbital logistics and mining could reach \$100bn yearly sales by 2040.



Mars 2117 City Conceptual View – Credits UAE Space Agency

## Thank You

*"In a century, our legacy as pioneers in the New Space era will stand out, distinguishing us from the incumbents who failed to recognize the potential of A.I. to craft new advanced materials"*

*Cedric Thiry, Founder*



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