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OPPORTUNITIES IN THE **NORTHERN SWEDISH SPACE INDUSTRY**

Welcome

Presenters



Mox Murugan
Investment Manager
Invest In Norrbotten



Niklas Grönberg
Management Consultant
LTU Business



Lisa Ek
Management Consultant
LTU Business

Agenda

INTRO – WHY IS OUR REGION OF INTEREST TO INVESTORS

INVESTMENT MEMORANDUM OF SPACE SECTOR – AIM AND OVERVIEW

BRIEF VIEW – OPPORTUNITIES IN NORTHERN SWEDISH SPACE SECTOR

NEXT STEPS

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NEXT STEPS

Northern Sweden Green Investments

US\$ 120 Billion



3 Gorges Dam \$37 Billion



Tokyo Olympics \$15 Billion x 2



Crossrail London \$23 Billion



New Suez Canal \$9 Billion



Burj Khalifa
\$1.5 Billion
X 10



Apollo 11 \$1.5 Billion



OneWTC \$4 Billion

RECORD INVESTMENT INFLOWS

10 years ago
Ground level focus



10 years from now
Eyes to the sky!



100 years ago
Underground focus

EVOLVING INVESTMENT FOCUS

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NEXT STEPS

Aim and overview of space sector IM

Aim of effort

- Overall aim is to generate new establishments and more investment in the northern Swedish space sector
- Create an overview packaging of current status and offerings, trends and future opportunities in the northern Swedish space sector
- Analyze and identify key strengths and USP:s of the northern Swedish space sector

Process

- Work conducted April – November by LTU Business and PRIME
 - Representatives from different part of space sector involved



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NEXT STEPS

The background of the slide is a light gray map of Northern Sweden. Overlaid on the map are several thin, yellow contour lines that follow the topography of the region, particularly concentrated in the southern and eastern parts of the frame. The text is positioned on the left side of the map.

OPPORTUNITIES IN THE **NORTHERN SWEDISH SPACE SECTOR**

EXECUTIVE SUMMARY

New space: The beginning of a 1 Trillion USD space economy

- New space is characterized by the transition from governmental to commercial investments.
- The commercial share is already dominant and growing – driven by reduced cost of space access, increased need for connectivity and data, space exploration missions and overall demand for small satellites.
- Overall CAGR (compound annual growth rate) of over 5%.
- Satellite sector is the key driver in both upstream and downstream activities.
- While the U.S. is still leading the commercial space race, Europe has opportunity for rapid space growth.
- Transferring tech leadership into space opportunities offers great potential for investors.

The northern Swedish space sector: A diverse eco-system on the top of Europe

- Established already in the 1950s and now building Europe's first major land-based satellite launch site, attracting historic investments and mid-cap company establishments.
- Extensive eco-system and knowledge hub:
 - Highly regarded academic system that supplies space critical competences.
 - A very collaborative environment between industry, government and academia, an environment described by NASA as "The No Problem People".
- Northern Swedish space sector is at a turning point – from a dominant public sector into a rapid growth arena for commercial businesses.
- Benchmark of similar clusters show great potential and a potential doubling of the cluster.

Northern Sweden: Uniquely well-positioned to capture growth

- Superior geographic conditions in politically stable region.
- Closeness to the north pole, an impact area twice the size of Luxembourg and the only land-based satellite launch site in Europe.
- Space critical infrastructure:
 - Easily accessible region
 - Leading test and demo possibilities
 - Small satellite launch site
 - Access to green energy at lowest prices in Europe
 - Cold climate perfect for major data centers.

Lift-off is now: Accelerating opportunities

- 13 space startups founded only since 2014.
- The region offers access to startup financing and business support.
- Recent drastic increase in company establishments due to the construction of satellite launch site, the test and demo infrastructure and the space engineers graduating in the region.

AGENDA

- Outlook and key trends in the Space sector
- What is the Northern Swedish Space Sector
- Why invest in Northern Swedish Space Sector
- How to invest in Northern Swedish Space Sector

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WHY THE SPACE SECTOR?



Exploring the unknown

Some of the most incredible technological advancements of mankind have been the serendipitous outcome of frontier research in vastly unrelated fields.

To continue to make discoveries that bring us new and revolutionary technologies, we must never stop exploring the unknown and trying to push the boundaries of the previously impossible.

Space research is one of the areas where applied science is taken to its limits, and where we stand the best chance of making the technological advancements to continue to develop our society.



Understanding our world

Throughout our brief history in space, people are mostly mesmerized by pictures of the Moon and other galaxies. While highly impressive – these images are actually just a representation of something far more important.

The single most important outcome from spaceflight is what we have come to learn about our own world. Data from satellites and sensors has given us a better understanding and insight into how our climate works, what affects it and how climate change may come to alter the world we live in.

This information is crucial to mitigate climate change, and new learning continues to improve our sustainability work every single day.

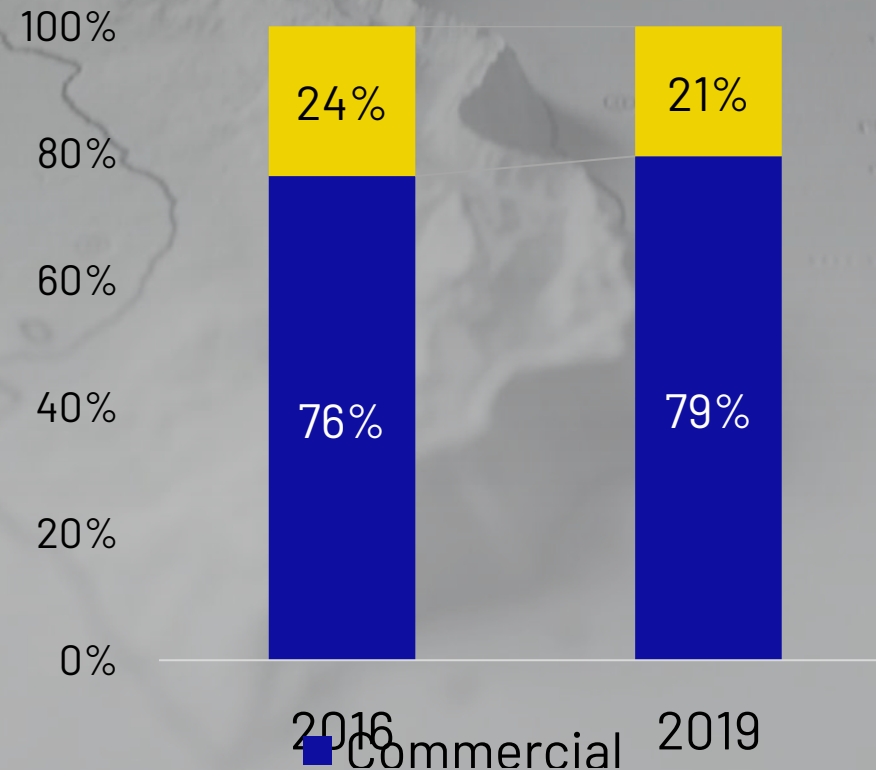
COMMERCIAL SHARE OF THE SPACE ECONOMY IS ALREADY DOMINANT – THE TREND IS CONTINUING

As the total space economy grew at CAGR 8,8% between 2016 and 2019, the growth was mainly driven by increase in the commercial sector [CAGR 10,1%].

New space transformation is driven by private funding:

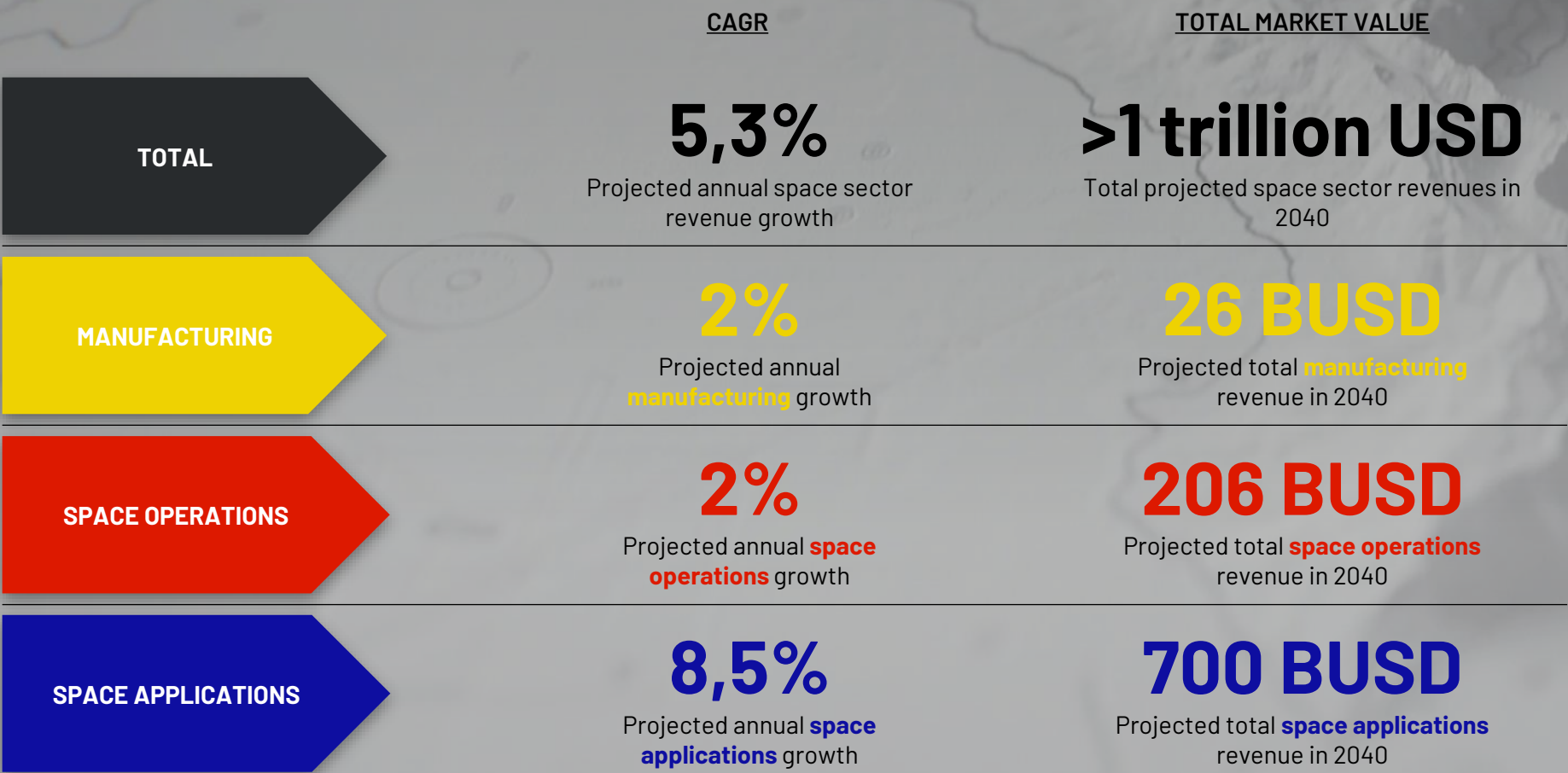
- Over 18 BUSD investment in space companies since 2000.
- Investments are picking up – grew by a factor of 3,5 2012-2017 compared to previous six years.
- Since year 2000 over 180 angel- and venture-backed companies have been founded.
- Venture capital firms constitute the largest investor segment – almost 50% of overall investments.

Share of global space economy 2016-2019

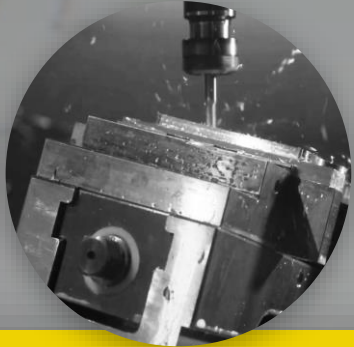


TOTAL SPACE REVENUES PROJECTED TO BE OVER USD 1 TRILLION IN 2040

Overall CAGR of over 5% where satellite sector is key space economy driver



KEY OVERALL TRENDS THAT WILL IMPACT THE SPACE SECTOR GOING FORWARD



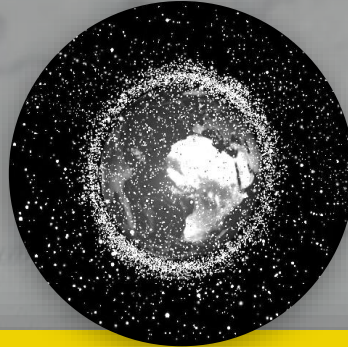
Reducing the cost of access to space

- Competition, manufacturing methods and technological advancements are lowering the cost of accessing space.



Increased demand for small satellites

- A large volume of small satellites [below 500 kg] is projected to be launched by commercial players, driven by the demand for Earth observation and communication.



Space sustainability

- Active work to ensure a sustainable space sector going forward even with increased traffic, monitoring debris, traffic management, situational awareness and end-of-life protocols.
- Development of sustainable production methods and fuels to minimize climate impact of the space sectors operations.



The need for data and connectivity

- Demand for data is growing exponentially, driven by:
 - growth of new market segments growing (5G applications, mobility, autonomy, IoT, surveillance/ tracking etc.)
 - ambition to provide internet access in under- or unserved parts of the world

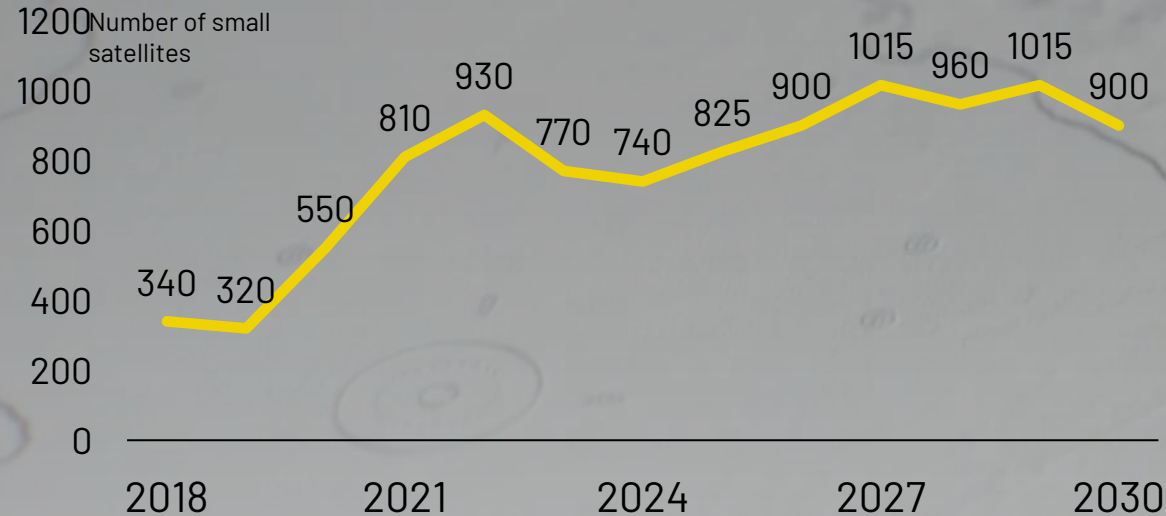


Space exploration and planetary missions

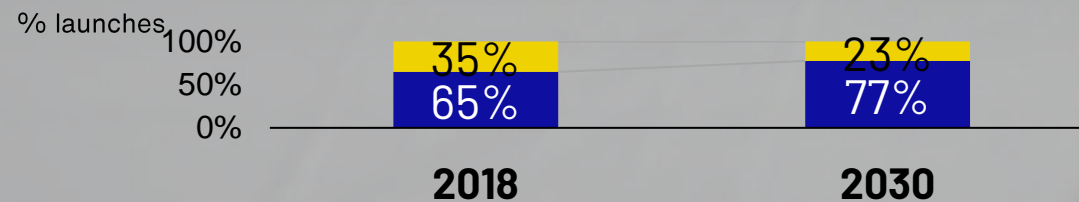
- Numerous new actors within both governmental and commercial sector show interest in crewed missions focusing on Space tourism, Interplanetary transportations and Space Resource Utilization.

DEEP DIVE: THE SMALL SATELLITE TREND IS ALREADY HERE

Almost 10 000 small satellites launches 2020-2030 – growth of approximately 10% per annum



Commercial sector is the key driver of small satellite demand



■ Governmental/Academic

Demand driven by commercial sector

- Mainly driven by demand for earth observation and broadband capacity.

Broadband mega constellations a new reality

- Absolute majority of small satellites are part of larger constellations.

Wanted: New and flexible launch sites

- For smaller payloads (less than 500 kg), satellite operators need cost efficient and flexible launch solutions.

THE TRANSITION OF THE SPACE SECTOR IS EVIDENT EVERYWHERE

Space industry in midst of transformation following record private and public investments

by Jason Rainbow — April 30, 2021

Spacenews - 2021

The pandemic couldn't keep the space industry down

2020 was a big year for space, despite the turmoil on Earth

By Loren Grush | @lorengrush | Dec 14, 2020, 11:00am EST

The Verge - 2020

Bank of America expects the space industry to triple to a \$1.4 trillion market within a decade

CNBC - 2021

SpaceX: Over 500,000 orders for Starlink satellite internet service received to date

CNBC - 2021

The Commercial Space Age Is Here



Harvard Business Review - 2021

Space infrastructure is the next investment frontier and Spacs are a launchpad

Financial News - 2021

An Investment Gold Rush Is Underway In The NewSpace Sector

Forbes - 2021

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CLOSE TO AND ABOVE THE ARCTIC CIRCLE, NORTHERN SWEDISH SPACE SECTOR IS ON THE TOP OF EUROPE

Kiruna, the space capital of the Nordics

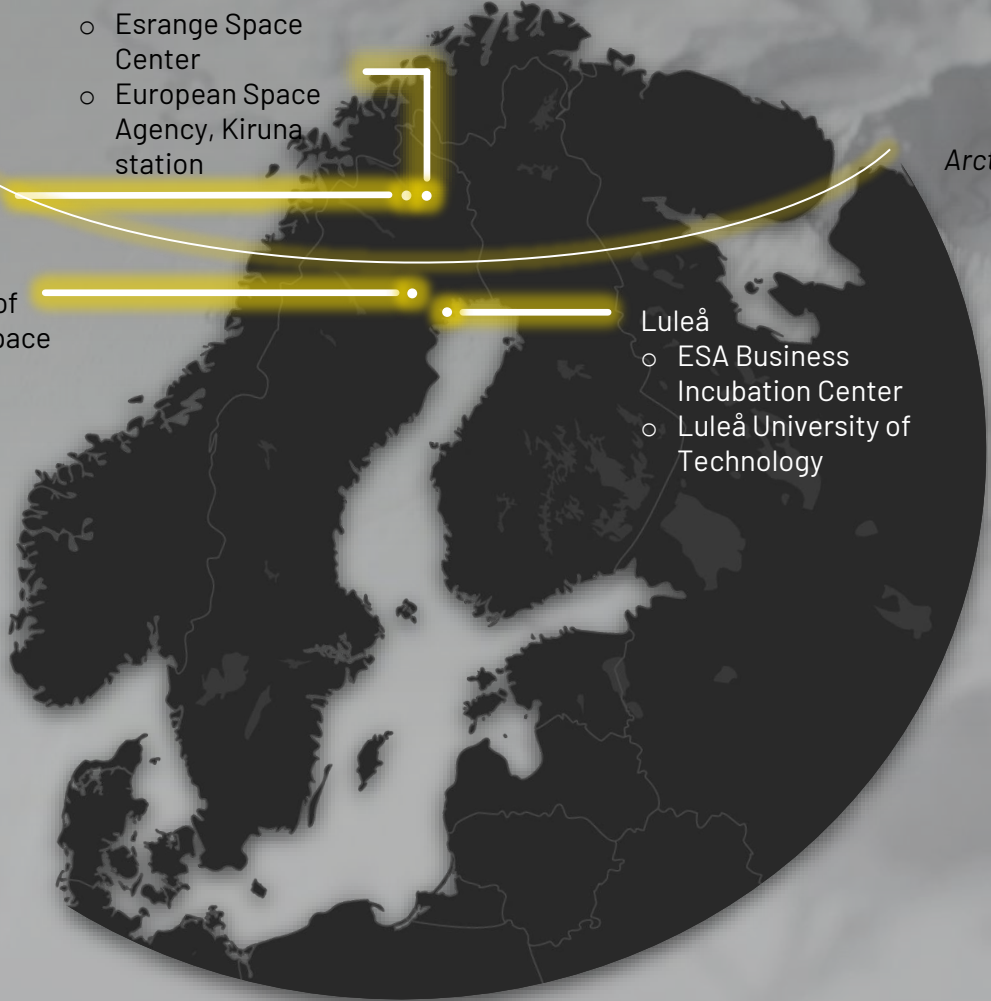
- Luleå university of technology space campus
- Swedish Institute of Space Physics
- European Incoherent Scatter Scientific Association
- Space high school

- Esrange Space Center
- European Space Agency, Kiruna station

Vidsel test range, part of North European Aerospace Test range

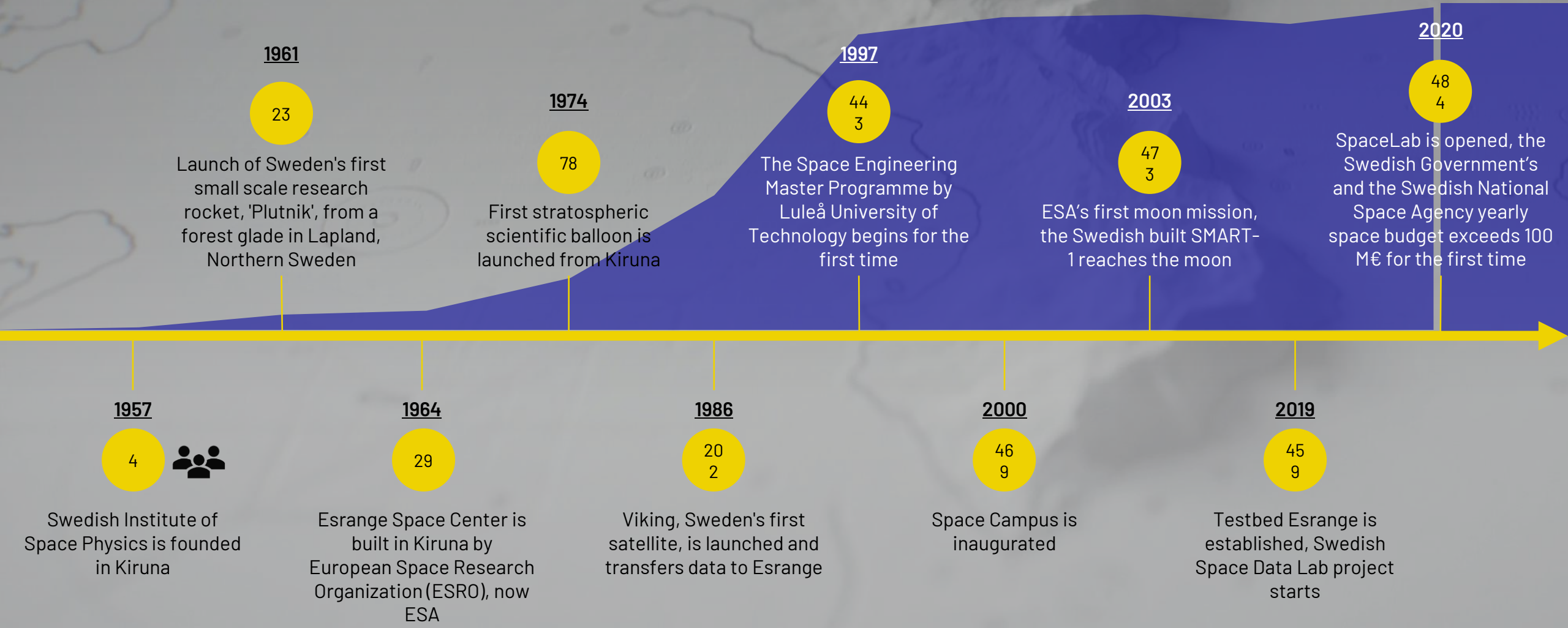
- Luleå
- ESA Business Incubation Center
 - Luleå University of Technology

Arctic circle



The image features a map of Northern Europe, specifically focusing on Sweden and Finland. A thick yellow line represents the Arctic Circle, curving across the top of the landmasses. Several locations are marked with yellow dots and connected to text labels by yellow lines. In the north, near Kiruna, are the Esrange Space Center and the European Space Agency station. To the west of Kiruna, a group of locations is listed, including the Luleå university of technology space campus, the Swedish Institute of Space Physics, the European Incoherent Scatter Scientific Association, and a Space high school. Further south, near Vidsel, is the Vidsel test range, part of the North European Aerospace Test range. In the south, near Luleå, are the ESA Business Incubation Center and the Luleå University of Technology. The map is set against a light gray background with faint outlines of other European landmasses.

A NORTHERN SWEDEN SPACE HISTORY: FROM THE 60'S LAUNCH OF MINI ROCKET PLUTNIK TO THE EMERGENCE OF AN INTERNATIONAL SPACE REGION



NORTHERN SWEDISH SPACE SECTOR TODAY: BUILDING EUROPE'S FIRST LAND-BASED SATELLITE LAUNCH SITE

Esrangle SmallSat Express is being built

In Sweden's Far North, a Space Complex Takes Shape

New York Times, 2021

Sweden Is Building Europe's First Major Satellite Launch Site

Surface Magazine, 2021

Esrangle will become Europe's leading space base

Warp News, 2020

Historic governmental investments

Minister of Space: This is why Sweden invests over one billion per year in space

NyTeknik, 2019

Major investment in the space sector

Published September 18, 2019

The Government is investing in the space sector in the budget bill for 2020. The Swedish Space Agency will receive an increase of SEK 150 million annually for space research and space activities.

The government is investing in Norrbotten as a space region

Social Democrats Norrbotten, 2020

Swedish spaceport development will double size of space sector in country's north

Engineering News, 2021

First space mid-cap tech company establishments

Germany's Isar Aerospace raises \$91M to get its satellite launch vehicle off the ground

TechCrunch, 2020

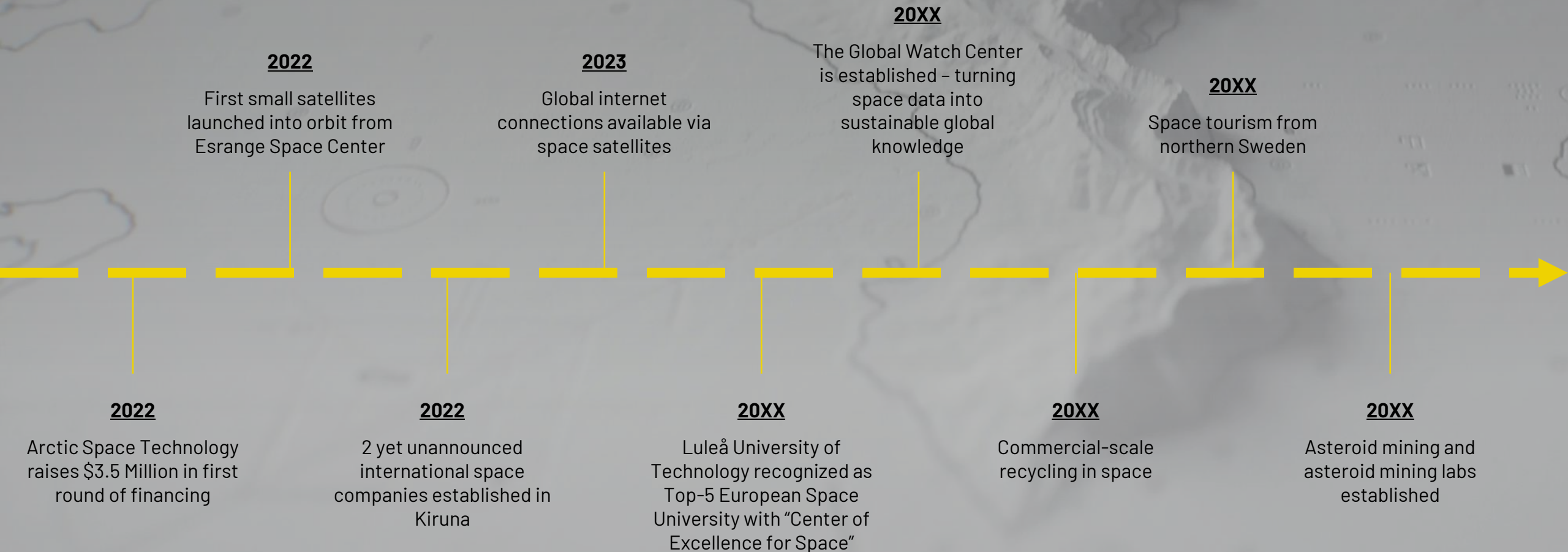
RFA's Team in Sweden Ready to Meet First Milestone with Hot Fire Test

Satnews, 2020

Isar Aerospace raises over \$90 mln in biggest European spacetechnology funding

Reuters, 2020

A NORTHERN SWEDEN SPACE FUTURE: FIRST SMALL SATELLITES LAUNCHED INTO ORBIT, DOUBLING THE SECTOR AND TAPPING INTO GLOBAL TRENDS



FROM EDUCATION AND RESEARCH TO INDUSTRY – THE REGIONAL ECOSYSTEM IS INTERNATIONALLY CONNECTED AND COMPETITIVE

1: Space Center



2: Test and demo infrastructure



3: Research



4: Education



5: Space Business Incubator



6: Space Startups



7: Industry



8: International networks



9: Governmental support system



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NORTHERN SWEDEN IS UNIQUELY WELL POSITIONED TO CAPTURE GROWTH IN THE SPACE SECTOR

1



**Superior geographic
conditions**

2



**Space critical
infrastructure in place**

3



**Extensive eco-system
and knowledge hub**

4



**New space growth
potential**

1

THE GEOGRAPHIC LOCATION CREATES GLOBAL ADVANTAGES

Europe's only land-based launch and test site - near the north pole



Key attributes of geographical location

1. The only land-based launch site in Europe.
2. Over-land impact area of 5200 square km – twice the size of Luxembourg.
 - Access to airspace for testing
 - Restricted air space even larger than impact area – 6600 square km
 - Clear benefits to sea-based launch areas – Significantly more stable and controlled environment for launch, recovery and diagnostics
3. Closeness to the North Pole.
 - Offers key benefits in both launching polar satellites and collecting data from polar orbit satellites
4. Located in one of the most politically stable countries in the world.
5. No light pollutions and low air traffic
 - Key conditions for both industry and research

THE REGION HAS KEY INFRASTRUCTURE FOR SPACE SECTOR GROWTH – AND IS EASILY ACCESSIBLE DESPITE REMOTENESS

World leading test and demo infrastructure

- No other place in the world hosts as many areas of demo and testing as Norrbotten.
- Space sector test infrastructure include extensive possibilities:
 - Tests and validations of systems and equipment – launch, rockets, satellite technology, operations, software and demonstration of space applications (**Esrang Space Center**)
 - Instruments and data for space missions
 - Processing and collection of data for applications
 - Robotic systems (**Vidsel test range**)
 - Nano satellite, space propulsion, atmospheric physics, spacecraft avionics and several more lab infrastructures relevant to space development

Satellite launch infrastructure

- **SmallSat Express:** The European launch facility for small satellites at the Esrange space center from 2022 will provide:
 - Unique capabilities to meet the increasing demand for small satellites
 - A multitude of services supporting both the scientific community and commercial actors
 - Sustainable solutions – SmallSat Express will be a green site, banning Hydrazine.

TOGETHER SINCE THE 50'S: STRONG COLLABORATION IN THE EXTENSIVE NORTHERN SWEDISH SPACE NETWORK, A KEY TO INNOVATION AND DEVELOPMENT

Triple helix actors

Industry



Academia



Government



Resulted triple helix projects



ESA Business Incubation Center



Graduate school of Space Technology



Space Innovation summer



RIT project - Space for innovation and growth



Space SME-network



Space test bed-network



"Our strength is not only that we have leading key resources within academia, research institutes and industry - it's that collaboration is very easy and flexible, enabling efficient joint efforts"

- Jonas Ekman,
Head of Department Computer science,
electrical and space engineering LTU



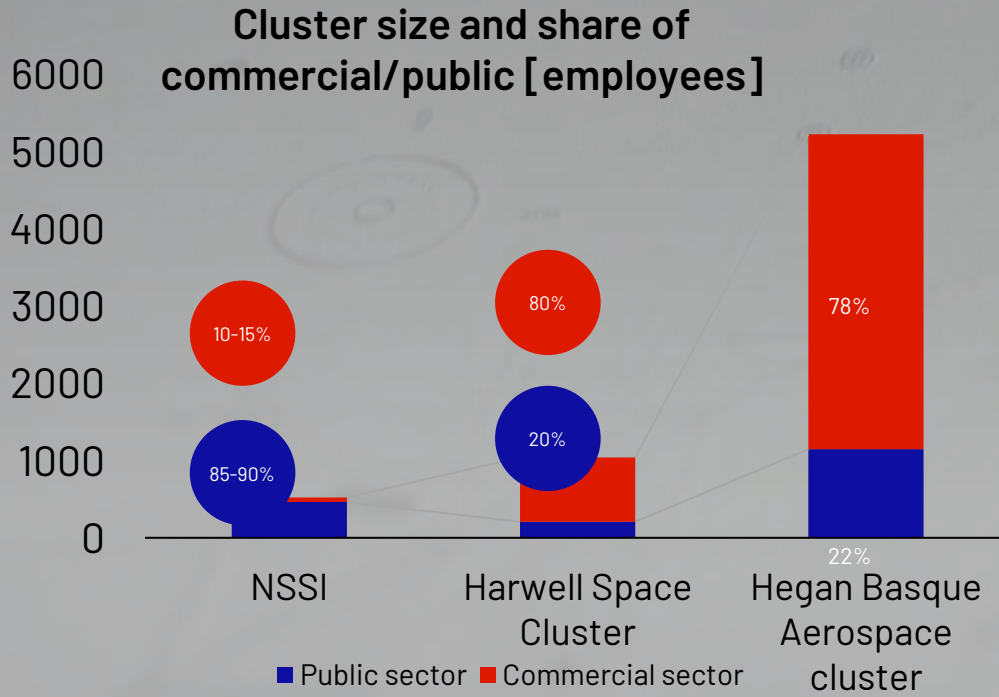
"Together we are writing European history in the field of commercial aerospace"

- Stefan Brieschenk,
Chief Operations Officer at Rocket
Factory Augsburg

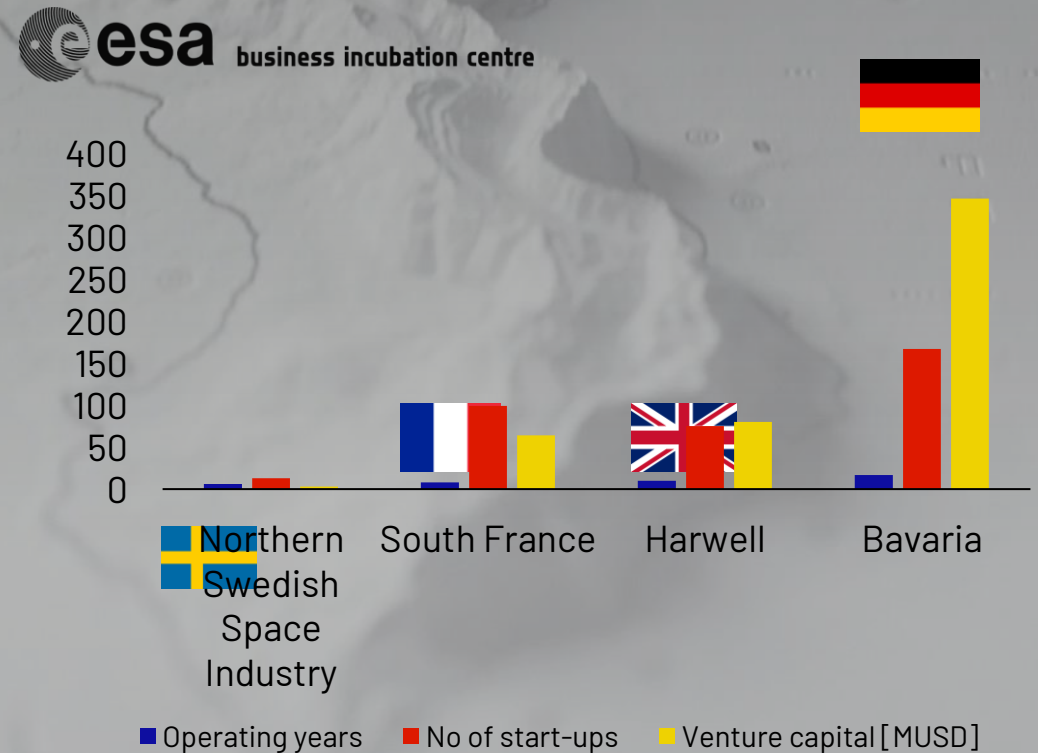
"
The No Problem People
- NASA

GREAT GROWTH POTENTIAL – ESPECIALLY IN THE COMMERCIAL SECTOR

Growth in space regions driven by commercial sector –
Northern Sweden has great potential



Startup investments:
Benchmark in different ESA-BIC

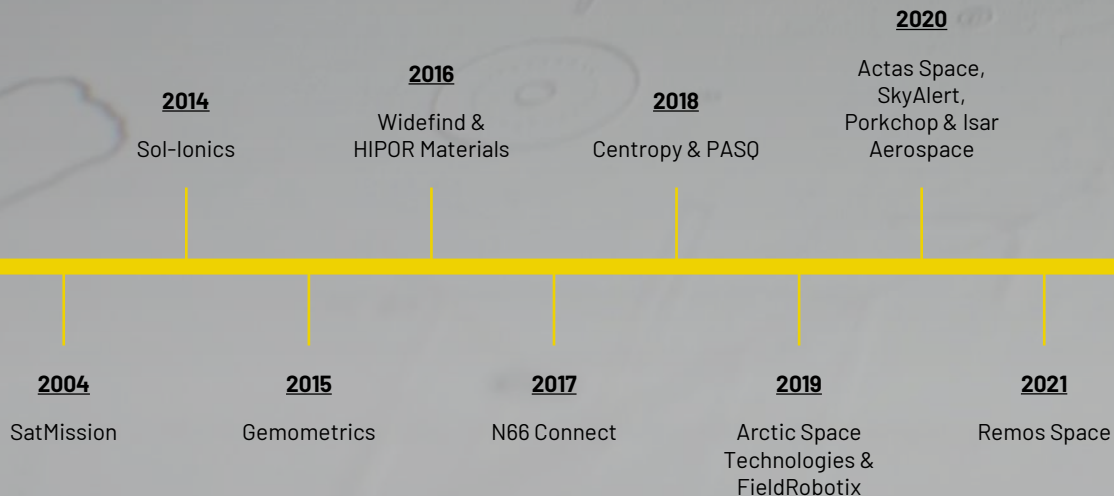


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LIFT-OFF IS NOW: THE COMMERCIAL SECTOR IS ACCELERATING NOW – THERE ARE MANY OPPORTUNITIES GOING FORWARD

Timeline up to 2021: Establishments and startups



Future opportunities

Vast opportunities within all parts of the space value chain

- Manufacturing of rockets, satellites as well as systems, sub-systems and components
- Data processing and space application development within all key areas – earth observation, communication and positioning
- Testing of equipment, systems and sub-systems for space missions will be a key area going forward
- The need for new sub-suppliers to the space sector will increase – stainless steel and other materials (composites) as well as services



"I believe that in just 10 years, there will be at least 50-70 space companies in our region"

- Johanna Bergström Roos, Project leader for RIT (regional space development project)

SPACE ESTABLISHMENTS ARE INCREASING – THANKS TO THE UNIQUE POSSIBILITIES IN NORTHERN SWEDEN

Bring your space technology development and operations to northern Sweden

By bringing your space related business to Northern Sweden, you will:

- Get support from the vast network of actors in the Northern Swedish Space Sector.
- Get access to the world-class test and demo infrastructure.

Case: Rocket Factory Augsburg

- A space technologies company offering launch solutions for satellite constellations. Founded 2018 and backed by the German satellite manufacturer OHB as a strategic investor.
- Established in the Northern Sweden Space Sector 2020 and inaugurated its test site at Esrange Space Center the same year.

"While the Esrange test site offers the perfect facilities and infrastructure for us, they also share the same hands-on spirit as RFA."

– Jörn Spurmann, Chief Commercial Officer at RFA



"The interest from the industry to bring their operations here has drastically increased recently"

Olle Norberg, Director of Swedish Institute of Space Physics, previously Director-General at Swedish National Space Agency

Case: Isar Aerospace

- The first European space company able to transport satellite constellations into the Earth's orbit on internationally competitive terms. Founded 2018 in Germany and closed the biggest investment round so far in the European SpaceTech sector, securing first launch of a German launch vehicle.
- Established in the Northern Sweden Space Sector 2020.

"We are happy that we so quickly were able to find a suitable test site for our upcoming engine and stage tests. We see this as a beginning of a long and fruitful relationship with SSC and Sweden in general."

– Josef Fleischmann, COO and co-founder of Isar Aerospace.

SPACE STARTUPS ARE THRIVING – BE PART OF THE JOURNEY BY CREATING A SPACE STARTUP

What can I do if I want to create a space startup in Northern Sweden?

- Apply to the ESA Business Incubation Center by Arctic Business.
- When accepted you get:
 - funding of 50.000 € for product development and IPR from ESA and 40.000 € from Arctic Ventures through Arctic Business Incubator
 - business development support and advice
 - effective workplaces for up to 24 months
 - technical Support up to 80 hours through Technical partners
 - access to ESA IP for Commercialization
 - access to the international ESA BIC's community and international ESA events
 - support to secure further venture capital, loans and grants as needed
 - preferred access to office facilities, experts, suppliers and investment capital
- Access startup financing through several actors in the regional innovation system and government backed funding programs – both investments, grants, convertible loans and traditional loans.

“

Funding and business advice from the regional innovation system has been critical to the development of our startup



– Sandra Nilsson,
COO Arctic Space Technologies

SPACE STARTUPS ARE THRIVING – BE PART OF THE JOURNEY BY INVESTING IN A SPACE STARTUP

What can I do if I want to invest in a space startup in Northern Sweden?

- In Northern Sweden's space sector, there are 13 space startups and counting, all in different growth stages and with different financial needs:
 - Seed capital
 - Angel investor capital
 - Venture capital financing
- All startups accepted to Arctic Business Incubator and ESA-BIC Northern Sweden are initially granted financing by Arctic Ventures, a business angel company.
- As an investor in Arctic Ventures, you will for a period of about two years become a partner in a selection of northern Sweden's best startups from different industries: space, industry, games, IT and more through convertible loans.
- You will be able to meet and follow these companies at a number of meetings, receive regular reports and information that gives you a unique relationship with them.
- All this so that you can get to know the companies, the founders and the teams and maybe later invest directly in them or work with them in another way.



ARCTIC VENTURES



"The startup scene is really hitting off up here, startups not only from other parts of Sweden but other parts of Europe are moving here so start their space company"

- Emma Hansson
Project Leader ESA BIC Sweden

HOW TO GET INVOLVED!

COMPANY ESTABLISHMENTS

invest in NORRBOTTEN

- Assistance and information to investors about business and investment opportunities
 - Invest in Norrbotten
 - Support and coordination to companies planning to establish or expand business in Norrbotten.
 - A wide network of local, regional and national business contacts
 - All our services are free of charge and with full confidentiality
 - <https://www.investinnorrbotten.se/>



- Support and advice on space related establishments inquiries
 - Center of Excellence Division of Space Technology, Luleå University of Technology
 - Olle Persson, business manager
 - <https://www.ltu.se/staff/o/ollper-1.143157>

INVEST IN A SPACE STARTUP

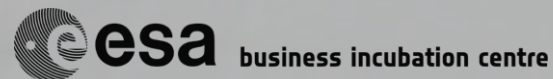


- Information on current startups
 - ESA Business Incubation Center and Arctic Business Incubator
 - Jens Lundström, MD ESA BIC and CEO ABI
 - <https://www.abi.se/en/contact-us>
 - <https://www.esa-bic.se/incubatees>



- Information on Arctic Ventures
 - Invest in Northern Sweden's best startups
 - <https://arctic-ventures.se/>

CREATE A SPACE STARTUP



- Companies ready for incubation support
 - ESA Business Incubation Center and Arctic Business Incubator
 - Jens Lundström, MD ESA BIC and CEO ABI
 - <https://www.abi.se/en/contact-us>



- Students and researchers ready for commercialisation support
 - LTU Business idea coaching
 - <https://ltubusiness.com/services/idea-coaching/>

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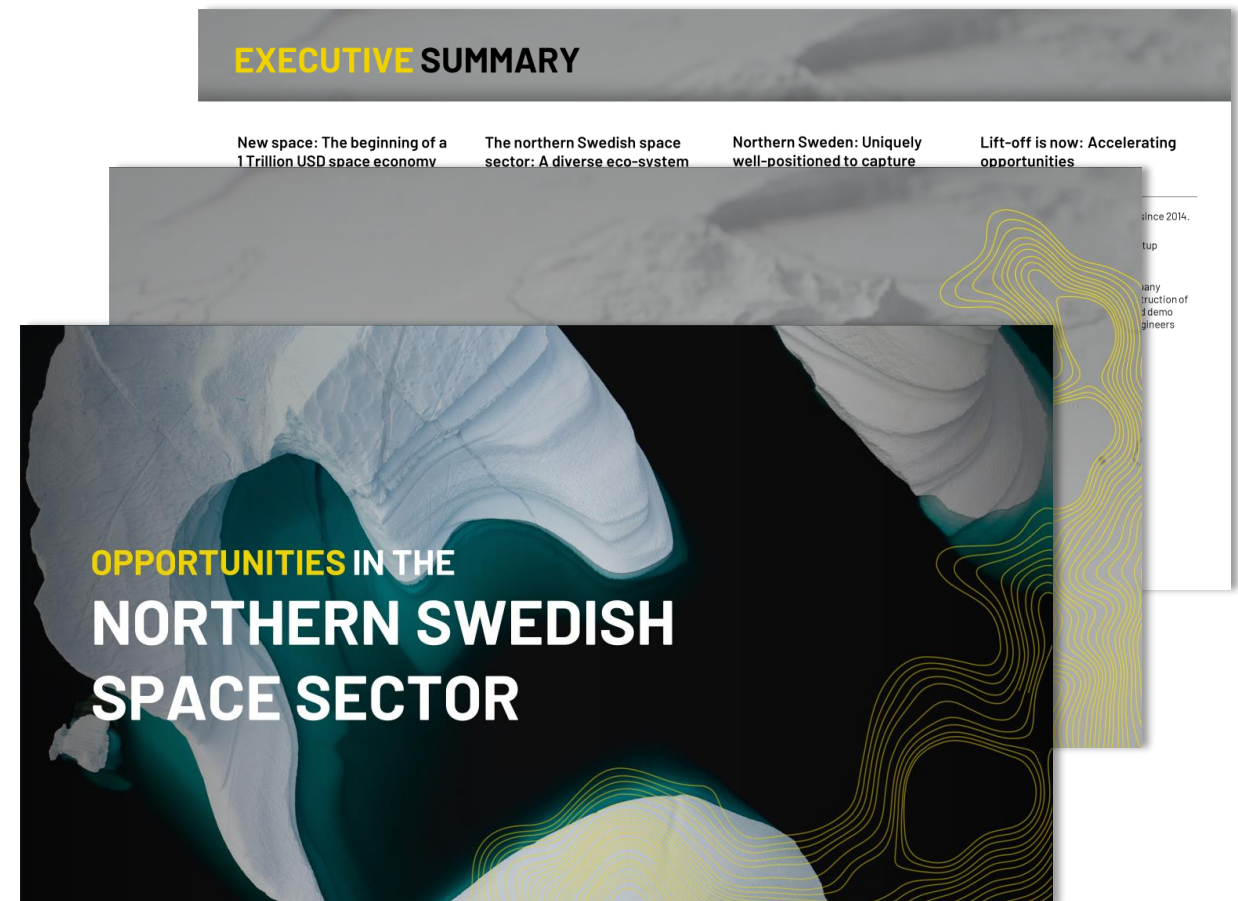
BRIEF VIEW – OPPORTUNITIES IN NORTHERN SWEDISH SPACE SECTOR

NEXT STEPS

Next step – Material is available for all stakeholders

- Minor changes are still made to the material
- Invest In Norrbotten owns the material – and can share it to any actor who needs it
- The whole IM is relatively extensive – parts and sections can be used depending on situation and need

The material should be used to stimulate and initiate investments and establishments – further detailing will be needed for specific cases





Thank you!