

# RIT

RYMD FÖR INNOVATION OCH TILLVÄXT

## Space Innovation Forum 6

8-9 May 2018

Johanna Bergström-Roos, Project Manager

[www.ritspace.se](http://www.ritspace.se)

# Inauguration for ACS North Node

AEROSPACE  
CLUSTER  
SWEDEN



**Göran Berlema**  
CEO ACS  
(East)



**Leif Johansson**  
Cluster Coordinator  
West



**Olle Persson**  
Cluster Coordinator  
North



[www.ritspace.se](http://www.ritspace.se)



#### Medfinansieras av



Norrbotten

#### Projektpartners



KIRUNA KOMMUN

NANOSPACE



#### Projektet drivs av





# Purpose & Goal

## Purpose

The space sector will contribute to increase growth in the region on a much broader scale than it does today.

Strong links local-regional-  
national-international

## Project Goal

The space sector in the region has increased its capacity in R&D collaboration between academia, industry and stakeholders in the innovation support system.



# RIT by Numbers

A project to increase innovations and to collaborate with the growing space industry

- 1 new Center of Excellence for Space Technology
- 6 + 6 research subjects at LTU that are related to the space industry
- 7+ new Master Thesis with Omnisys, N66, GKN Aerospace, SSC
- 7 PhD students (7 new products/services to be identified, verified and validated)
- 3+ new interdisciplinary constellations (Onboard space systems + Product Innovation, Materials Engineering + Product Innovation (AM) and Machine Elements + Atmospheric Sciences)
- 1 new national space conference "Space Innovation Forum"
- 1 new matchmaking event "Lift Off", where the space industry meets LTU space students
- 4 successful collaborations with innovative SMEs and subcontractors (N66, Conex, VTT, Open Cosmos)
- 4 new regional start-ups launches within the ESA Bic Sweden (Widefind, TLIGHT, SOL-Ionics, Wilda Tracking)
- 1 new regional start-up in satellite communications (N66)
- 2 national space launches conduct development work in the region (SALLY R and FlyPulse)
- 20 regional SME:s interested to collaborate with the Aerospace business have been identified
- 1 new nod for Big Science Sweden (Northern Nodes)
- 1 new node for Aerospace Cluster Sweden (Northern Nodes)
- LTU has become a major player and is invited to important space venues: Paris Airshow, ESA-PAC, open invitation to the Parliament Space Group, Space Innovation Forum, Space Forum, KTH Round Table, ESA-BIC events, Almedalen etc.

# What shall we deliver?

WP 1	WP 2	WP 3
Establish a Centre of Excellence	8 PhD students will be half way through their education  We have identified 8 products or services for commercialisation	Initiate an innovation support system  Involve 15 regional SME:s in the space business

# Programme day 1

- Matchmaking within the Aerospace Ecosystem
- The common thread – the Supplier Chain
  - Needs within Aerospace
  - Competence among Suppliers
- Visit to Estring Space Centre
- Bus back to town (around 22.00)

When people meet  
things happen!





# Programme day 2

- Bus pick-up at Camp Ripan 08.00 and Ferrum 08.05
- Aerospace Cluster Sweden – Inauguration
- Workshop – ACS North Node
- Conclusion and thoughts about the next step  
Space Innovation Forum on 30-31 August

When people meet  
things happen!



# # spaceinnovation

# Why aerospace?

## The big picture and future possibilities

Olle Norberg, Rymdstyrelsen  
Anders Blom, Innovair  
Stefan Gustafsson, SSC



# Why aerospace? The big picture and future possibilities

Anders Blom, Innovair



*Anders Blom, Kiruna 8/5-2018*

### **Synergies between Aeronautics and Astronautics through a third node in Aerospace Cluster Sweden (ACS) in Kiruna**

- Except from space physics, many technology areas exist with possible synergies at low TRL
- These include materials science, production technology, sensors, communication systems, cyber security, computer systems, digitalization, autonomy, decision support and others
- Our joint credibility increases with SME activities in all of Sweden
- Previously ACS existed in Västra Götalandsregionen and in Region Östergötland. A third node in Kiruna is regionally needed and will create political goodwill nationally
- This node connects to LTU and the three Swedish ESA-incubators led by Arctic Business Incubator Luleå and also including Uppsala Innovation Centre and Innovatum in Trollhättan
- Synergies exist between NFFP (Innovair via Vinnova/Ministry of Enterprise and Innovation and Ministry of Defence) and NFRP (The National Swedish Space Board via Ministry of Education and Research)
- Synergies also exist within the educational area, where Innovair is establishing SARC (Swedish Aeronautics Research Centre) in Linköping on June 18-19.
- Synergies exist within international cooperation (Brazil, UK, Germany, EU, etc)
- Space will become a dual use JTI in FP9. Need for common Swedish position space/aeronautics

# Why aerospace? The big picture and future possibilities

Stefan Gustafsson, SSC



# A Global Game Change Through Space



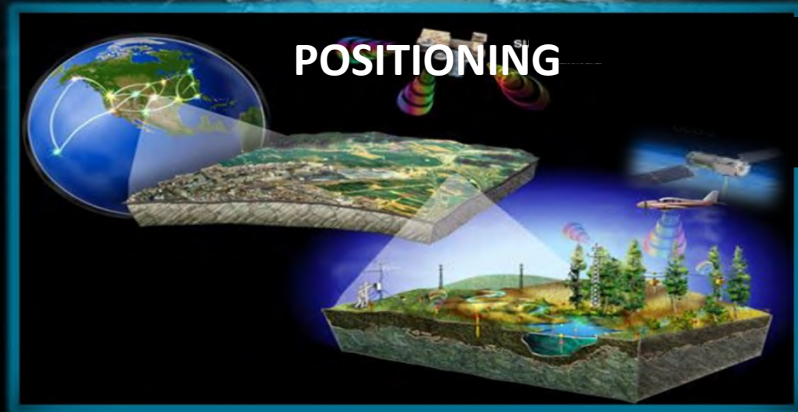
Satellite constellations and “Supersats” provide Global Transparency, Connectivity and Positioning -

## An enabling force for a sustainable planet



### EARTH OBSERVATION

Multisensor constellations provide close to real time information of the planet, including land, oceans and the atmosphere.



### COMMUNICATION

Communication constellations provide global access to internet, enabling the prospect of a sustainable development of the big world on our small planet.

# GLOBAL SHIFT – ENORMOUS OPPORTUNITIES



Digitalization  
Miniaturization  
Applications  
Commercialization  
New actors  
Globalization

- Lower costs
- Better efficiency
- Enormous opportunities

# Synergies in aerospace

Stas Barabash, IRF





# Synergies in aerospace: Kiruna space cluster

*Prof. Stas Barabash*  
*IRF Director (on-leave)*

- Aerospace is the human effort in science, engineering and business to fly in the atmosphere of Earth and surrounding space.
- Aerospace organizations research, design, manufacture, operate, or maintain aircraft and/or spacecraft.



“Since I took over as minister responsible for space policy, I have been impressed by the knowledge that Swedish players in the space sector possesses. This impression was strengthened during my visit to Kiruna area this week. Industry, government and academia have created an aerospace cluster in the region with great potential” *Helene Hellmark Knutsson, June, 2015*

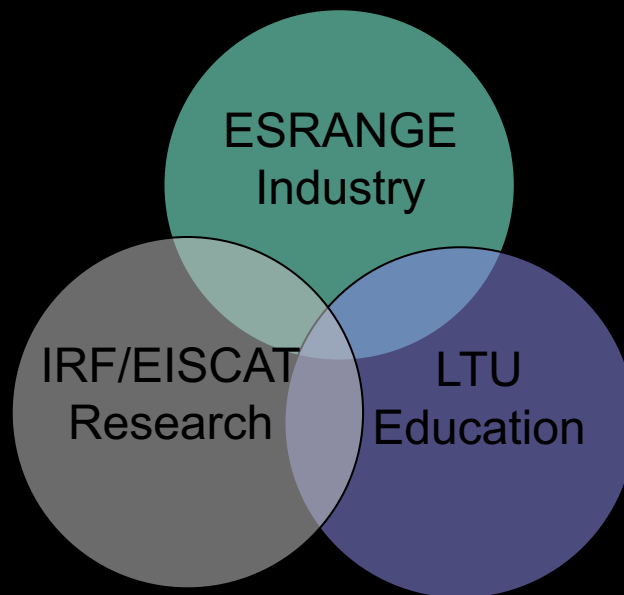
- Institutet för rymdfysik (IRF). Since 1957
  - Fundamental science:
    - Planetology, space plasma physics, atmospheric physics
  - Applied research
- Ground based long-term observations for geophysics and atmospheric physics
- SSC/ESRANGE. Since 1967
  - Launch services for balloons and sounding rockets
  - Satellite communication and control
  - Space system development



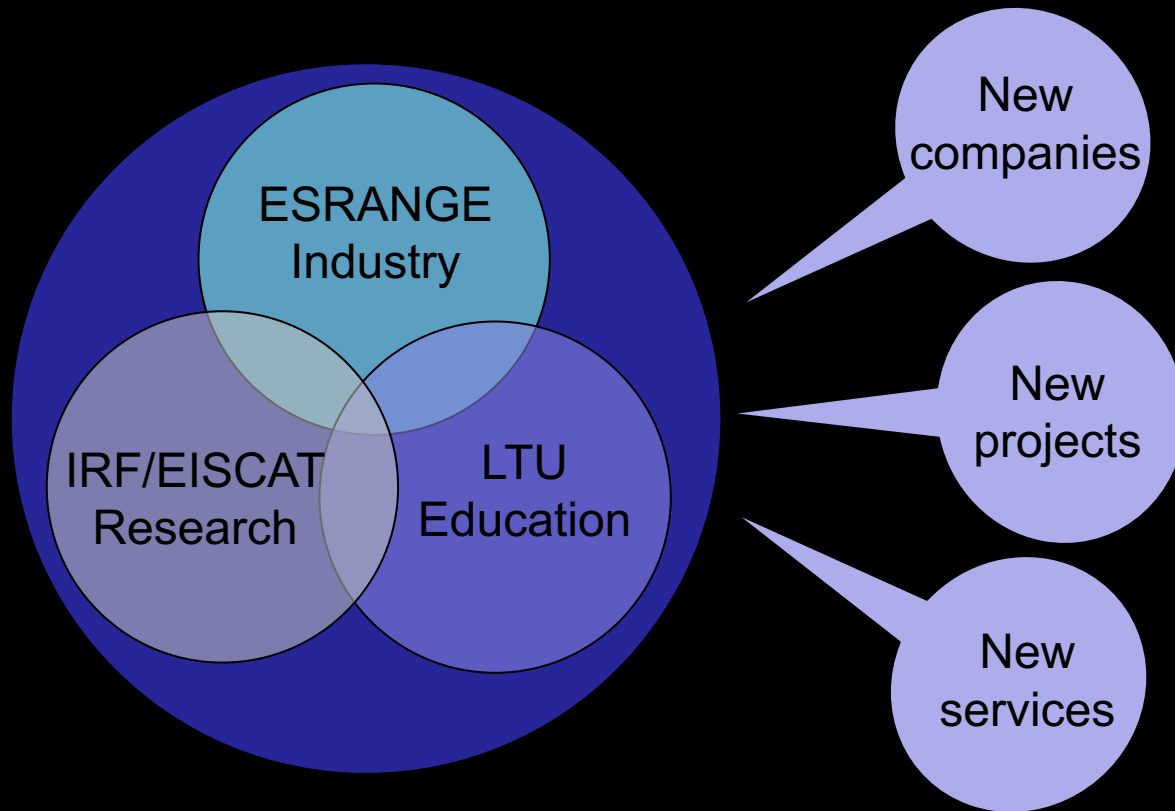
- European Incoherent SCATter Scientific Association (EISCAT). Since 1981
  - International organization
  - Ionospheric and atmospheric physics
- LTU. Since 1998
  - Education in space technology
  - Nanosatellites
  - Atmosphere science







Unique combination!



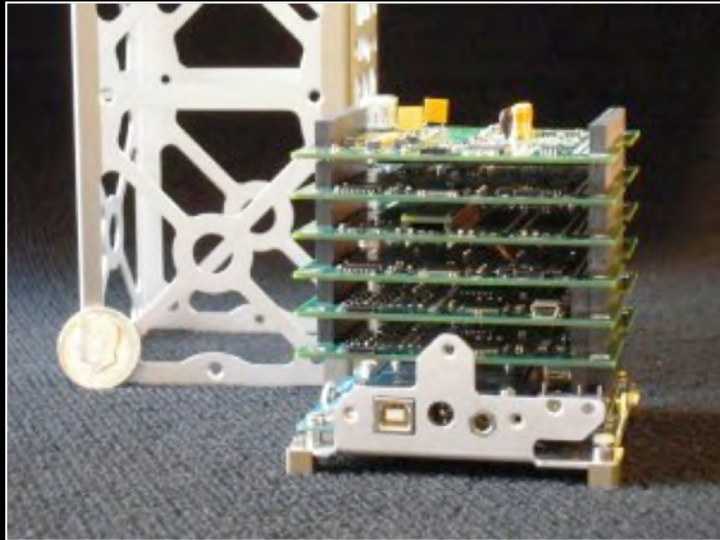
- To create test, calibration, and mechanical production facilities and equipment at the European level to provide services for:
  - Space actors in Norrbotten both industry, research, and education
  - Other Swedish and International customers
- To fill the niche for space environment simulations
- To create an environment integrating manufacturing and test/calibration of space systems at the same place



- New balloon and CubeSat projects with potential launch from Esrange
- CubeSats to test innovative measurements techniques
  - LTU: platform
  - IRF: payload
  - Esrange: launch

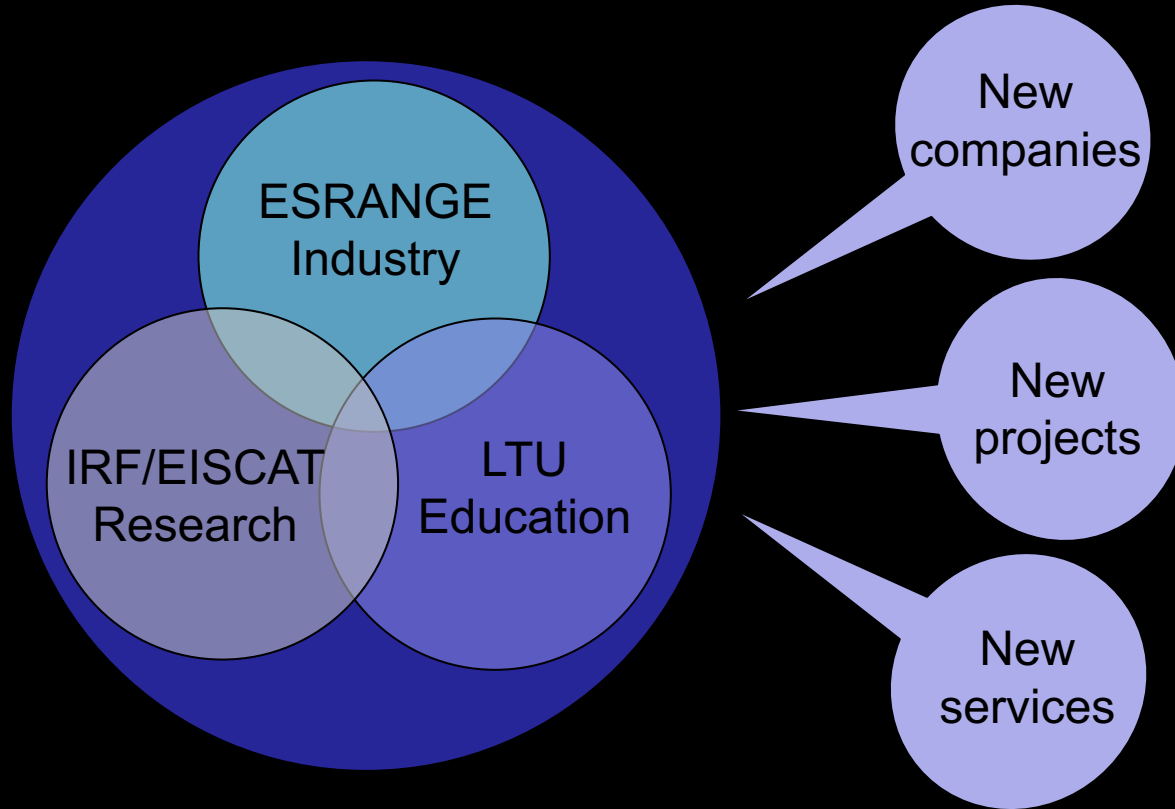


- Electronics subsystems for balloons, sounding rockets, satellites and payloads
- Electronics for ground based systems
- CubeSat manufacturing



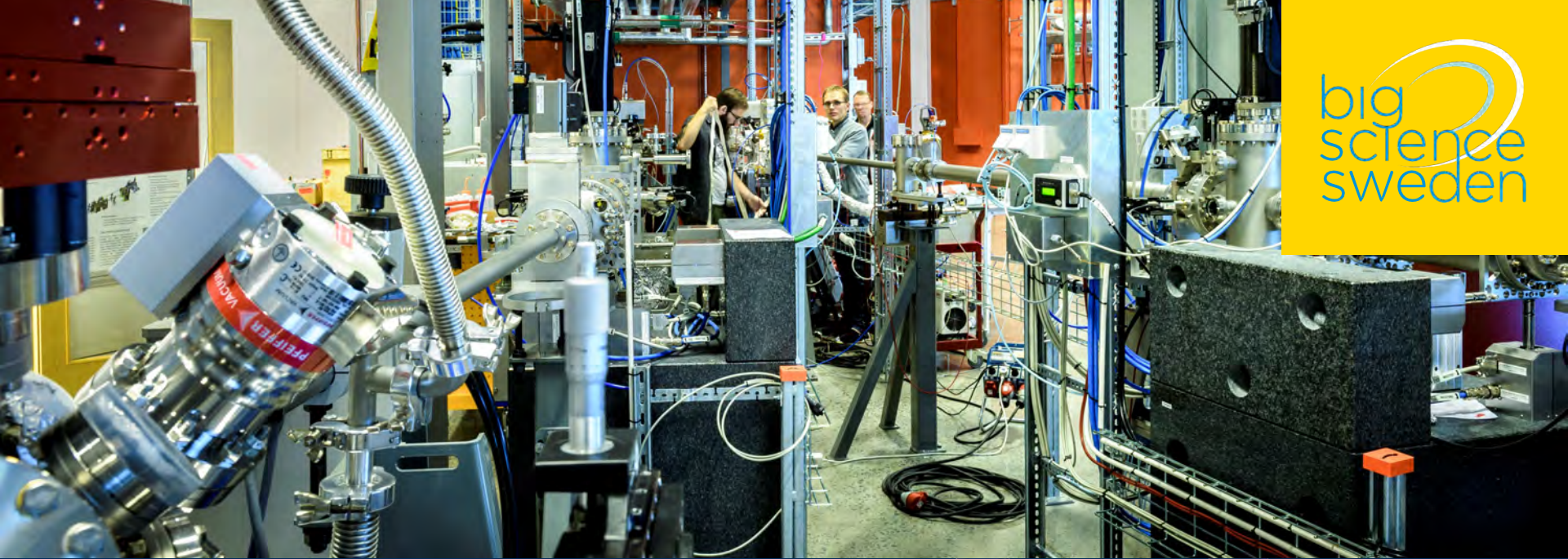
With support from:  
Regional: Tillväxtfonden, Länsstyrelsen  
National: Rymdstyrelsen, VINOVA  
International: EU, ESA





# Big business with Big Science Sweden

Anna Hall, Big Science Sweden



# Big business with Big Science

Anna Hall, Program Director Big Science Sweden

Space Innovation Forum 8 MAY 2018



Big Science facilities in  
which Sweden is investing





ESS and Max IV beeing built in Sweden





# Big Science Facilities in which Sweden is investing



EUROPEAN  
SPALLATION  
SOURCE



NEUTRONS  
FOR SOCIETY



Science & Technology Facilities Ctr  
ISIS

MAX IV



# Space Industry, Areospace and Big Science

# Big Science Business Forum 2018

big  
science  
sweden



- Johann-Dietrich Wörner, ESA Director General
- BSBF 2018 – Organizers
  - CERN, EMBL, ESA, ESO, ESRF, ESS, XFEL, F4E, ILL

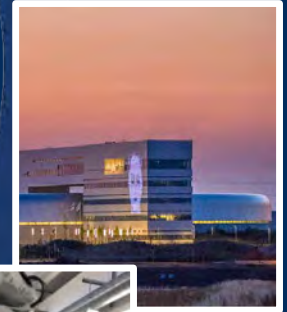
**Big Science  
Business  
Forum  
2018**





# A range of competences needed

- Construction and Civil Engineering
- Coating, Joining and Casting
- Electronics, RF and Microwave Technologies
- Magnets
- Materials Processing
- Mechanical Engineering
- Optics, Sensors and Diagnostics
- Power Supply
- Big Data
- Remote Handling
- Robotics
- Software and Control Technologies
- Support Services
- Utilities and Instrumentation
- Vacuum and Low Temperature Technologies
- Others



BIG SCIENCE SWEDEN – OFFICIAL INDUSTRIAL LIAISON OFFICE (ILO)

**SUPPORTS SWEDISH COMPANIES IN DOING  
BUSINESS ON BIG SCIENCE MARKET**



Big Science Sweden is operated by a consortium



Teknikföretagen



RI  
SE



UPPSALA  
UNIVERSITET



LUND  
UNIVERSITY



Financed by:



## The ILO team in Sweden



big  
science  
sweden



**National operation,  
with offices in four  
locations**

# Expertise Arenas and Areas of Advance

– Cooperation with Universities and Institutes



# Space Industry, Areospace and Big Science

Thank You for Your Attention!

**[www.BigScienceSweden.se](http://www.BigScienceSweden.se)**

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Program Director Big Science Sweden  
[Anna.hall@bigsciencesweden.se](mailto:Anna.hall@bigsciencesweden.se)  
+46-725544865

# New opportunities with EISCAT 3D

Johan Svensson, Eiscat 3D





# EISCAT 3D

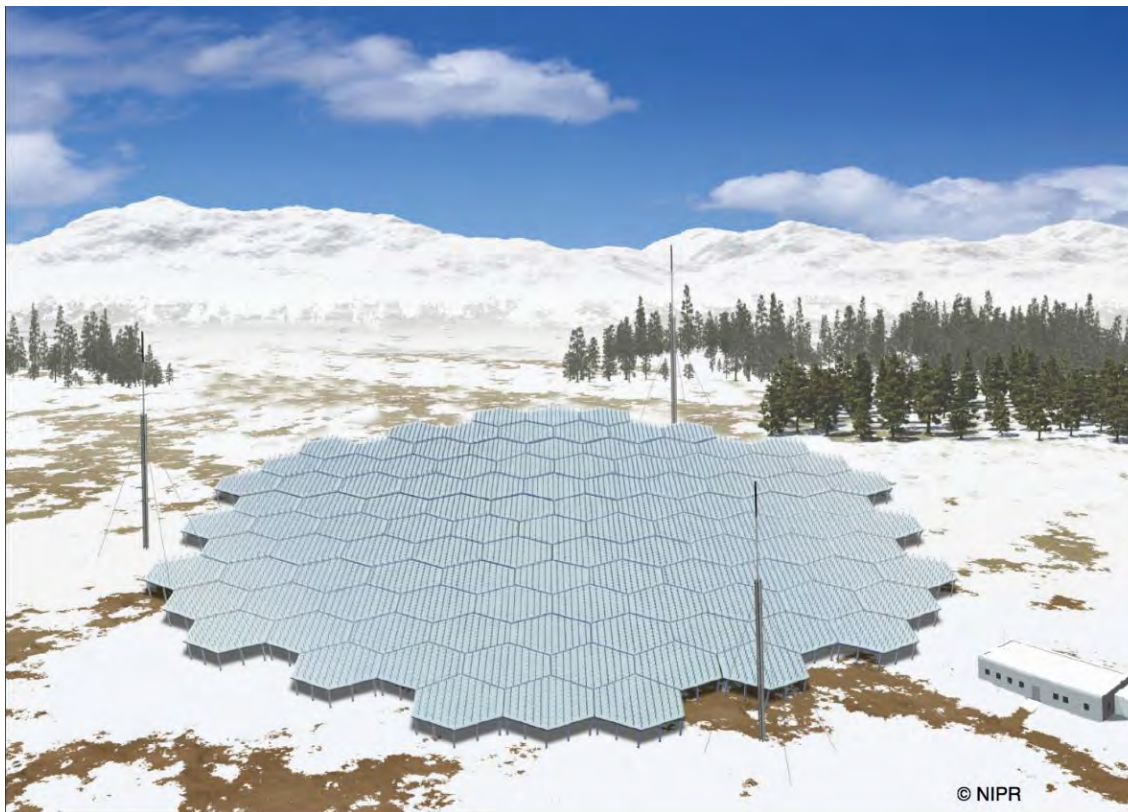
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A New Research Infrastructure for Geospace  
Studies in the Nordic Region



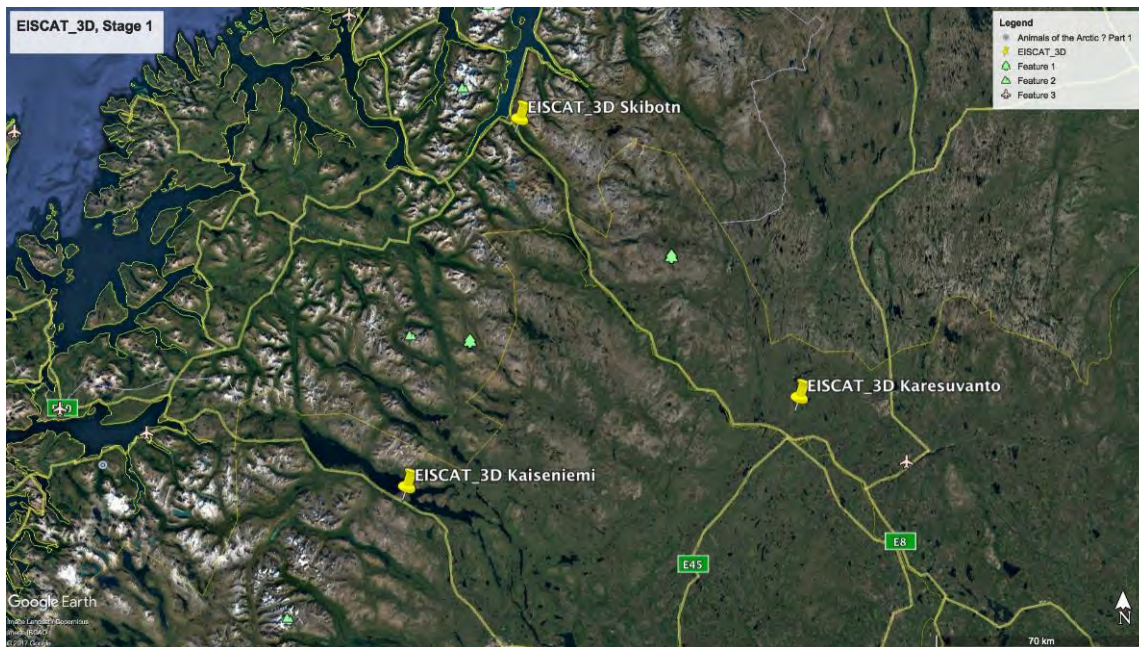
# EISCAT 3D RADAR FOR GEOSPACE RESEARCH

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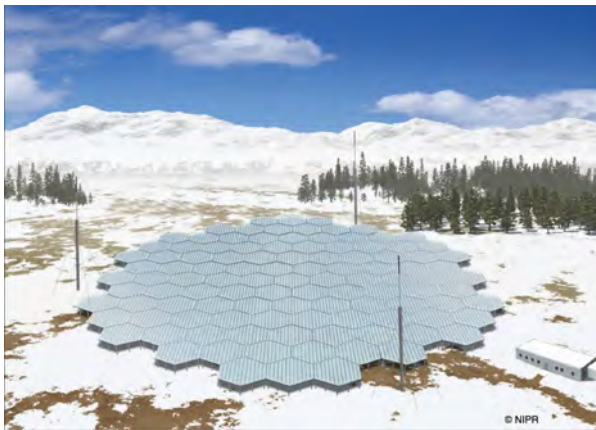


# EISCAT 3D – STAGE 1





# ANTENNA SITE OVERVIEW



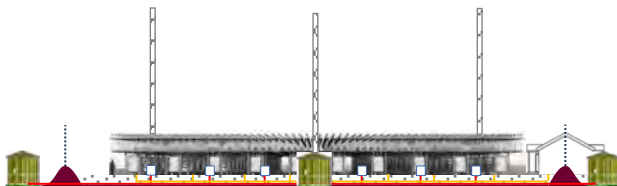
9919 dipole antenna elements

7,5MW for the transmitting site

0,7MW for receiving sites

House with appx. 75 TFlops computing capacity (appx. 50kW)

100Gb fiber

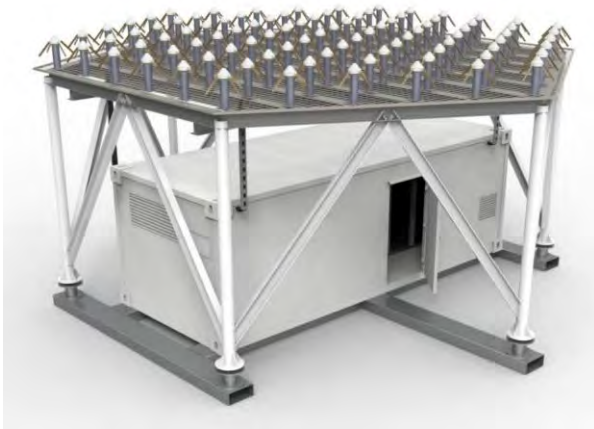


Air-termination masts  
(for lightning protection and calibration)

RF-Fence (100x100m)



# SUB ARRAY



91 dipole antenna elements

Ground plane

Appx. 4m in both height and diameter

Environmental controlled container  
for electronics (7pc 19" racks)



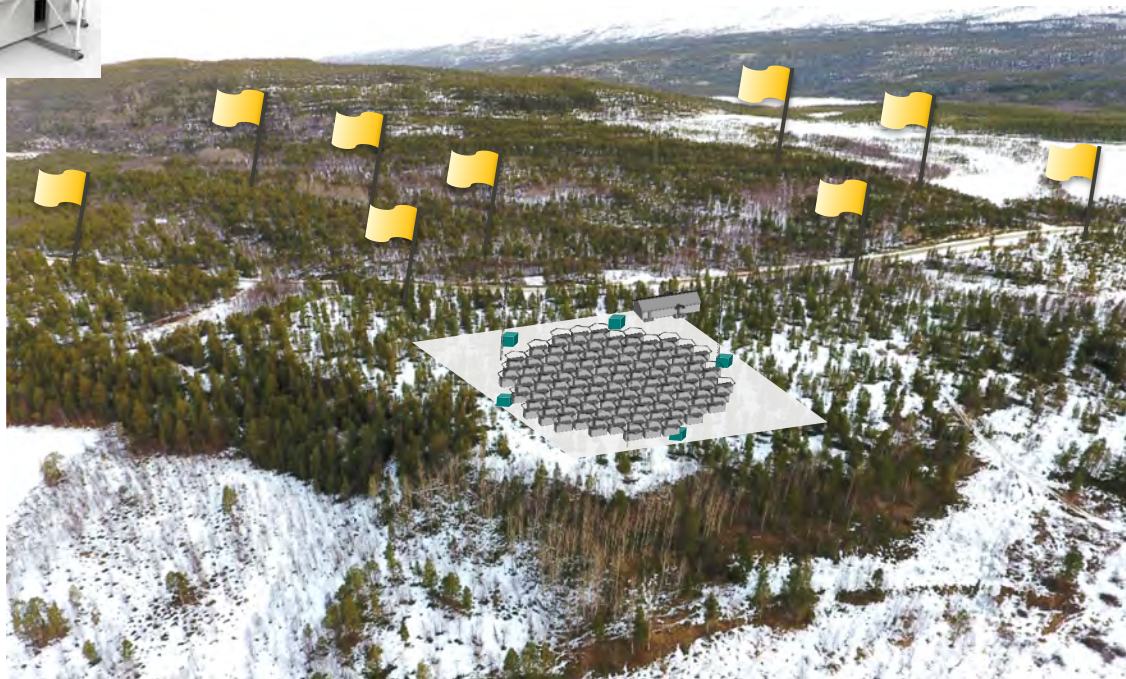
Manufacturer:

East China Research Institute of  
Electronic Engineering (ECRIEE)





# SKIBOTN SITE (TX)

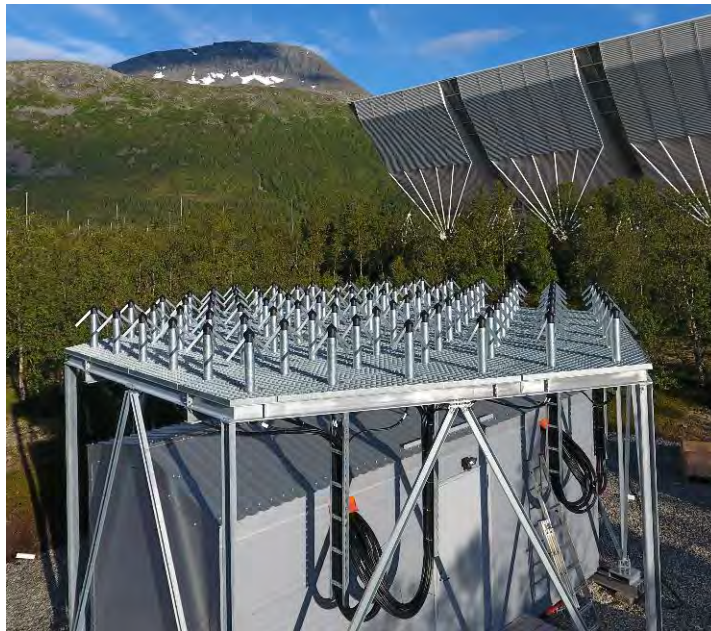


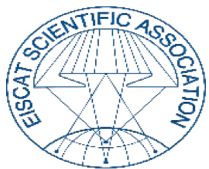




# EISCAT 3D PROTOTYPES

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# ANTICIPATED OPPORTUNITIES (2018-2021)

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Antenna Units (AUs) – Contract Signed

First Stage Receive Units (FSRUs)

20.000 channels per site, Tendering in progress

Solid State Power Amplifiers (SSPAs)

500W amplifiers, 233 MHz, appx. 10.000 units (stage 1)

Future tender opportunity



# ANTICIPATED OPPORTUNITIES (2018-2021)

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Pulse and Steering Control Units (PSCUs)

Fully flexible, phase controlled signal sources. One unit/TX sub-array. **Future tender opportunity**

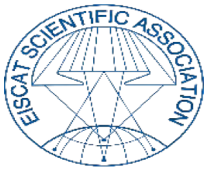
**Future tender opportunities:**

Site Preparation (ground leveling, gravel pads, trenches, access roads, etc.)

Site Infrastructure (Building, Fence, Power Distribution, etc.)

Site Computing

Various Consultancies



# PROCUREMENT PROCESS

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EISCAT\_3D is publically funded and, as a result, all opportunities will be available through competitive bidding processes

Additional information and news are available at  
[www.eiscat.se](http://www.eiscat.se) and [www.eiscat3d.se](http://www.eiscat3d.se)



EISCAT SCIENTIFIC ASSOCIATION



Fika + fruit

# Presentations by the Aerospace Industry

Anna Rathsmann, SSC



SSC

<place>

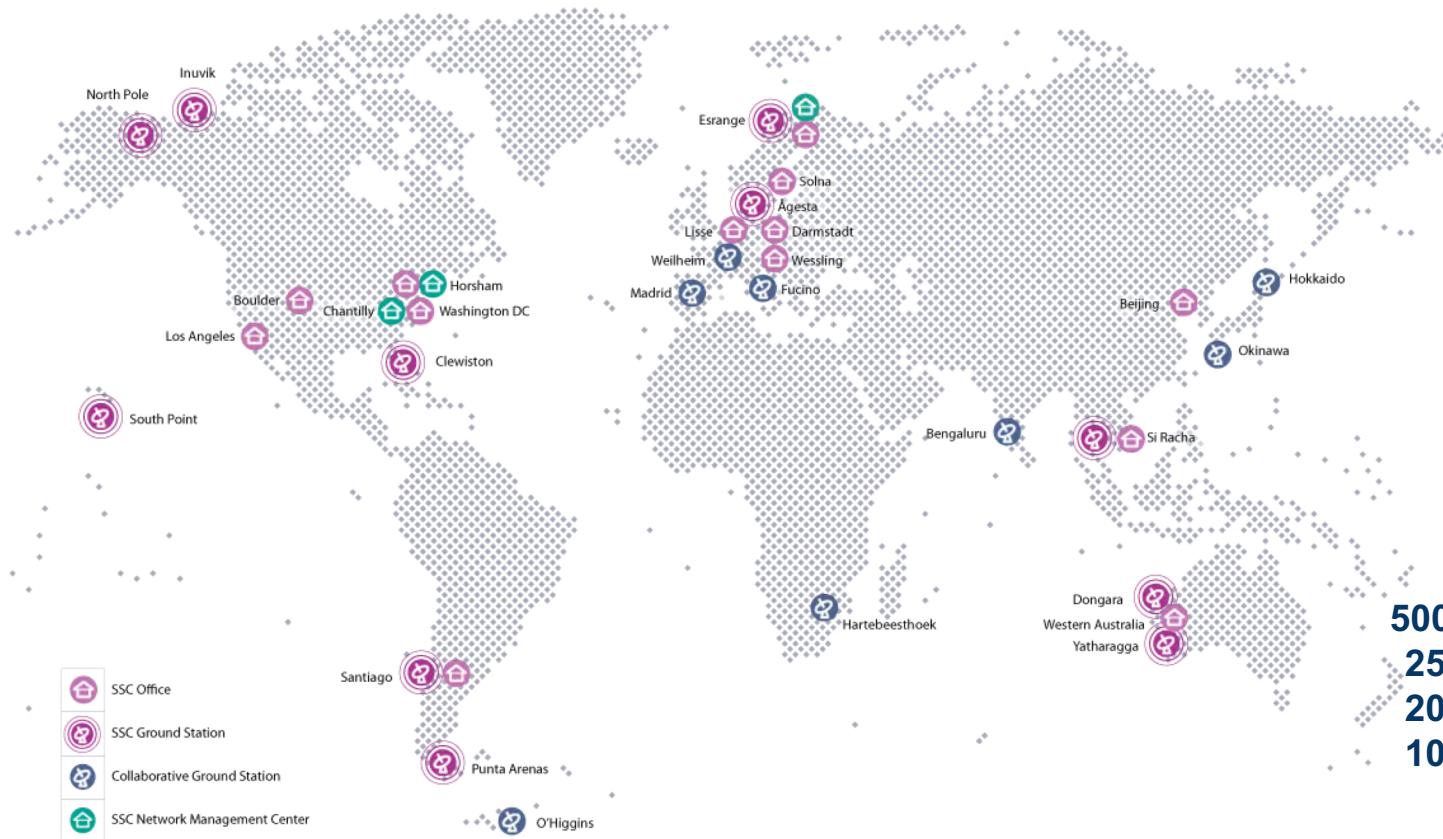
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# GLOBAL PRESENCE

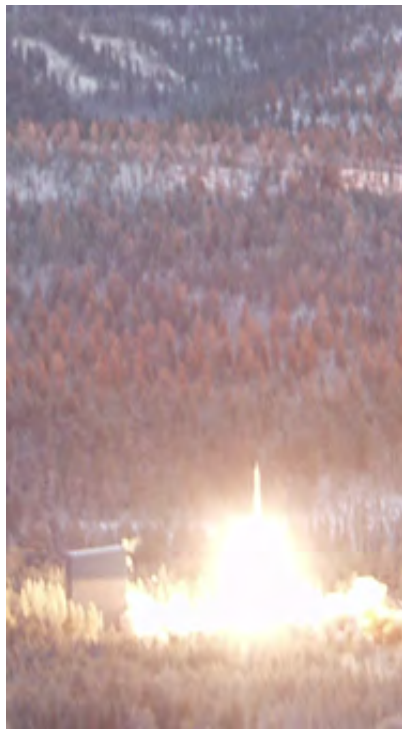
## CUSTOMER PROXIMITY



**500 employees**  
**25 nationalities**  
**20 locations**  
**10 countries**



# BUSINESS AREAS



**Science  
Services**



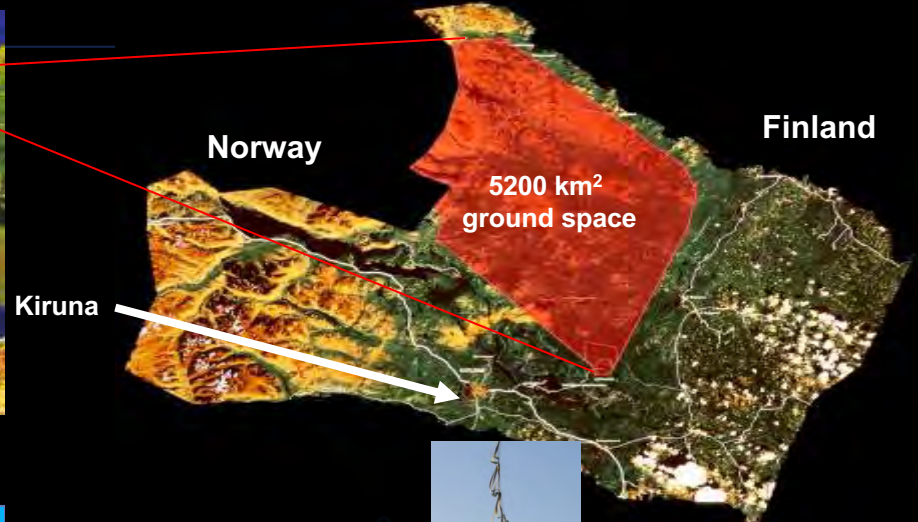
**Satellite Management  
Services**



**Engineering  
Services**

# ESRANGE SPACE CENTER

Sounding rockets



Satellite Ground Network



Technology Demonstrations



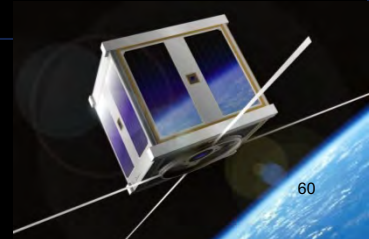
Stratospheric Balloons



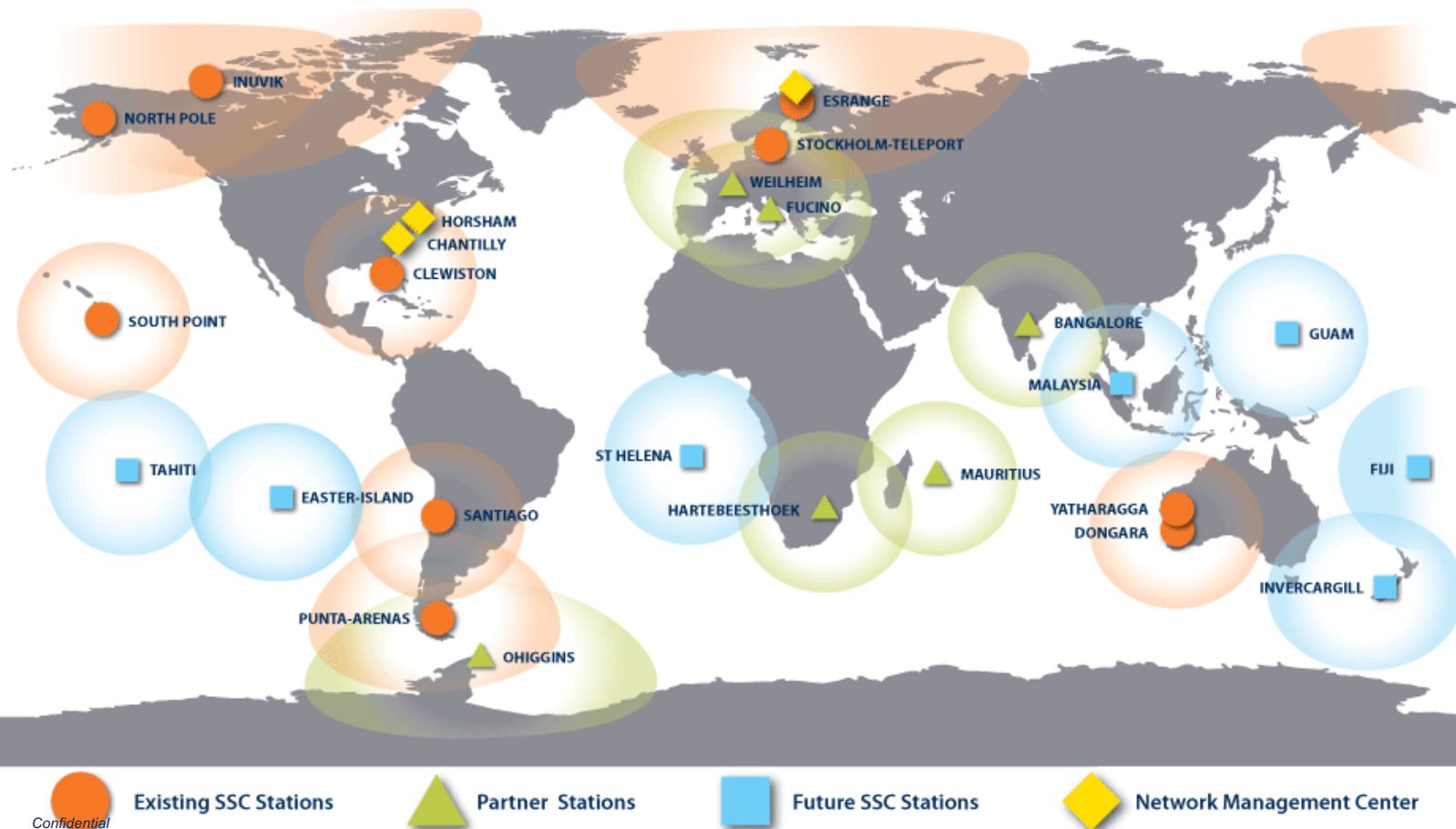
Reusability



SmallSat Express...



# LAUNCH & LIFETIME OPERATION SERVICES



Confidential



# ENGINEERING SERVICES



# WE HELP EARTH BENEFIT FROM SPACE

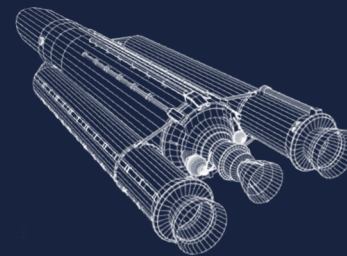
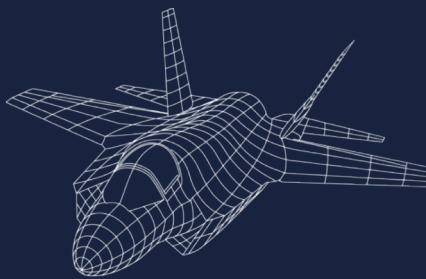
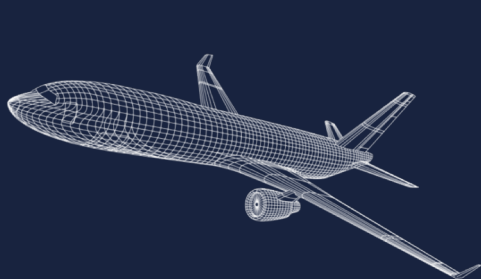


[www.sscspace.com](http://www.sscspace.com)



# Presentations by the Aerospace Industry

Sébastien Aknouche, GKN Aerospace



**GKN AEROSPACE**

**ENGINES**

**The global technology partner to the aerospace industry**





# Servicing 3 main Aerospace markets



## > COMMERCIAL

- **Partner in 70% of all active aircraft engines on the market**
- Independent **Partner** with all major OEM's
- Customers first choice on core products

**\$52bn Market incl Aero derivate**



## > MILITARY

- **OEM** for full engine (RM12) world wide supplier of product support (technical and MRO)
- **Partner/Supplier** in sub-systems and components
- Significant content on F135

**\$8bn Annual Market**



## > SPACE

- Long term **Partner** in the European space community
- Focus on Nozzles and Turbines – Design and Make

**\$1.5bn Annual Market**

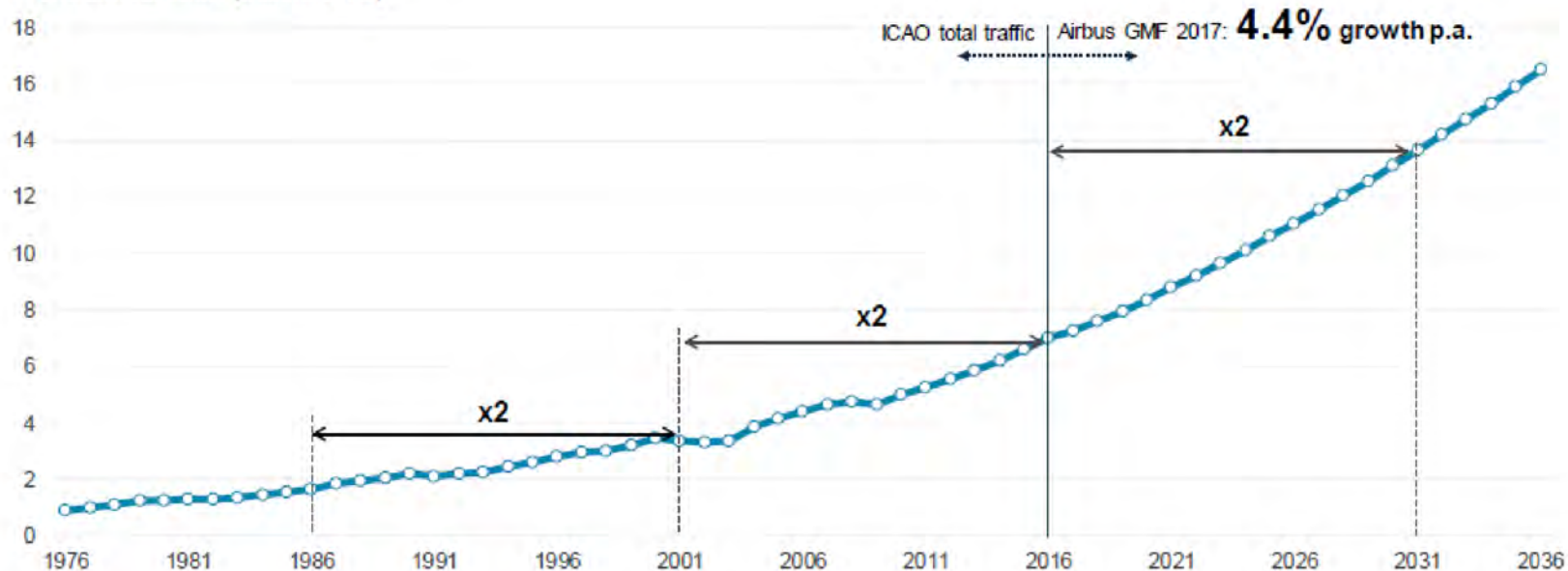




# Commercial Market - Bright Future

Traffic doubles every 15 years

World annual traffic (trillion RPKs)





# Strong footprint in growing markets

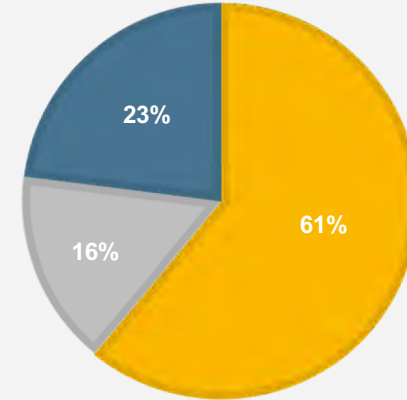


- 4.5% combined CAGR in all three segments to 2020
- Current backlog for commercial aircraft will ensure strong demands for the next 5+ years
- Strong future development in global air traffic, especially in Asia, provides long term growth
- Military spending is increasing globally
- Increased privatization and spending in the space industry opens up more available content for GKN

**GKN's balanced portfolio provides stability and positioning for growth across all segments**

## 2017 - CURRENT PORTFOLIO

■ OE   ■ Military / Space   ■ Aftermarket



- \$1.5bn balanced sales portfolio
- Well positioned to outperform market growth in all segments



# Engines invests logic in research and innovation

Product Application

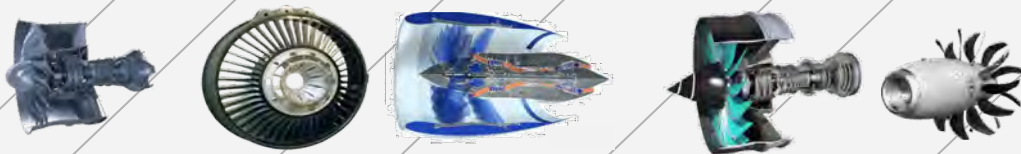


Development Programs



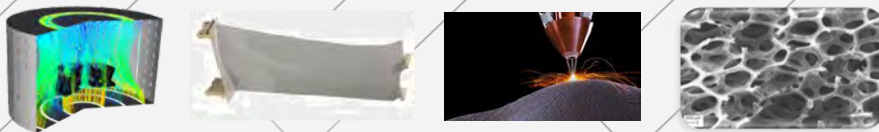
TRL 9  
VERIFIED  
TECHNOLOGY

International Collaborative Programs



TRL 6  
DEMONSTRATOR

Seeding Projects



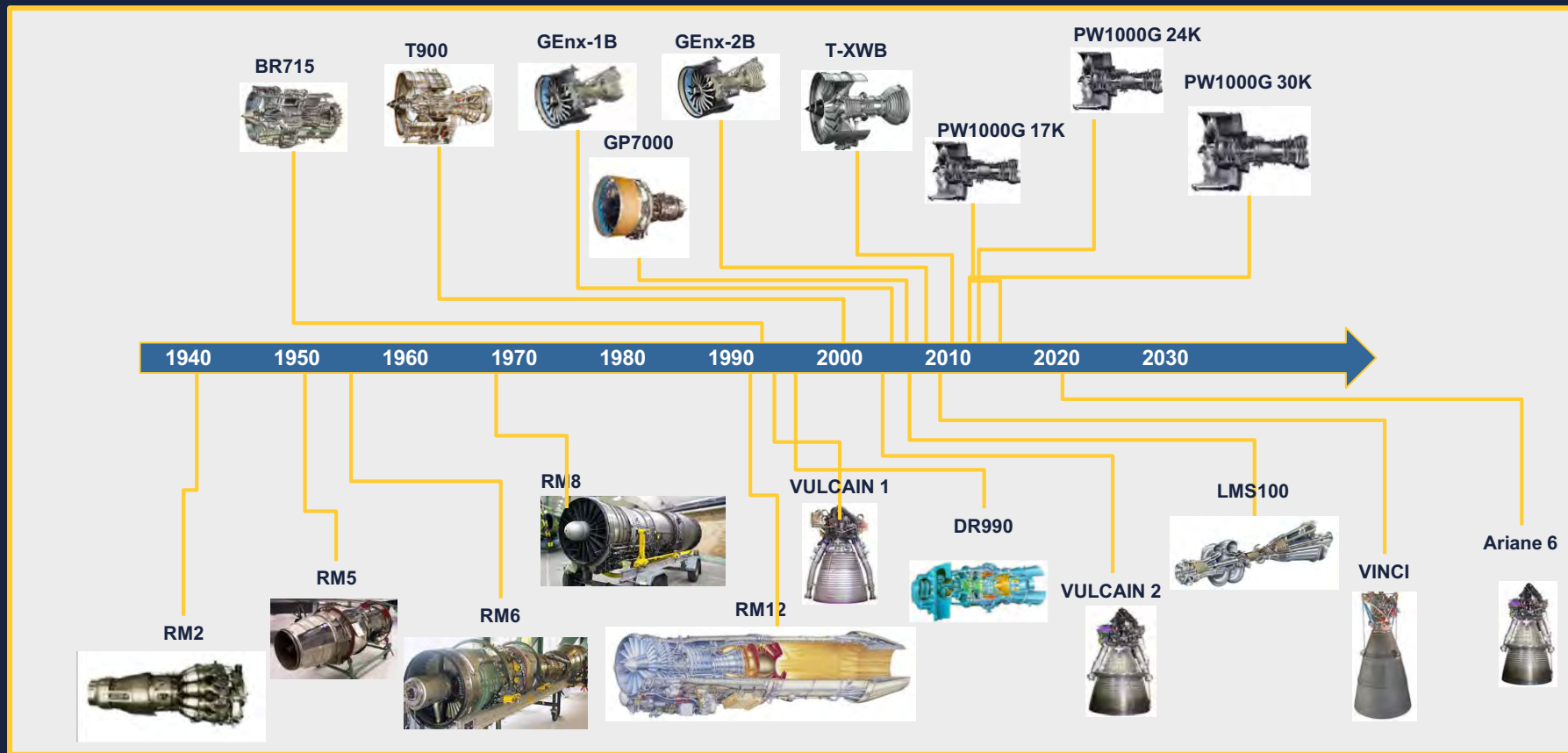
TRL 3  
TECHNOLOGY

Time





# Continued success based on significant experience





- Engines is strongly contributing to solving global challenges
- Delivering competitiveness
- Safety first!

Safety first!		Environment			Competitiveness			Safety	
ACARE Vision 2050		CO2 -75%	NOx -90%	Noise -65%	Development	Manufacturing	Repair	People	Flight operation
an tics  bine tics  an atives  ressor LPC		+++	+	++	+++	+++	+++	+++	
		+++	+	++	+++	+++	+++		
		+	+	N/A	+	+++	+++		
		+	+	N/A	+	+++	+++		
		Engines influence +++ HIGH    ++ MEDIUM    + LOW							



# Using Process Technologies to drive business value

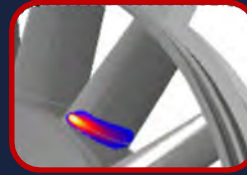
## Engines core manufacturing process technologies

### Additive Manufacturing - Key enabler for augmented product offer

- Provide increased value to GKN product offer and opportunities to expand CRO business
- Provide opportunities for reduced product cost on legacy products



Additive Manufacturing



Fabrication and Joining

### Fabrication and joining - A significant competition differentiator

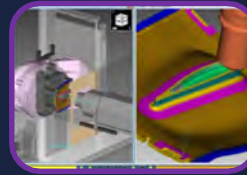
- Advanced welding- and inspection technologies to support GKN Product Strategy
- Differentiates product offer from the competition

### Automation and process control - Drive operational excellence

- FMS solutions for robust production and increased operational efficiency
- Automated and optimized manual work



Automation and Process Control



Advanced and Robust Machining

### Advanced and robust machining - Key process to drive economy of scale

- The main process used across sites and provide opportunities for cost reduction
- Improved robustness to drive automation

# A well managed industrial structure provides advantage

Engines industrial strategy for key technologies

## Centers of Excellence



### > High-Tech & New Products/Processes

- Complicated parts and production processes
- Development and start-up of new parts and production technologies

## Operational Performance Centers



### > Mid/Low-Tech & Mature Products/Processes

- Adopting established parts and productions
- Second source risk mitigation
- Bulk capacity at low cost

## Supplier network



### > Mid/Low-Tech Products/Processes & Mtrl

- Raw material; castings, forgings etc.
- Attaching parts
- Surge capacity
- Non-core processes to reduce capital investment

Always 100% GKN

GKN or Joint Ventures

External





# Presentations by the Aerospace Industry

Per Bodin, OHB Sweden

Per Bodin  
2018-05-08



SATELLITE SYSTEMS

## Space Innovation Forum 6

### *OHB Sweden Presentation*

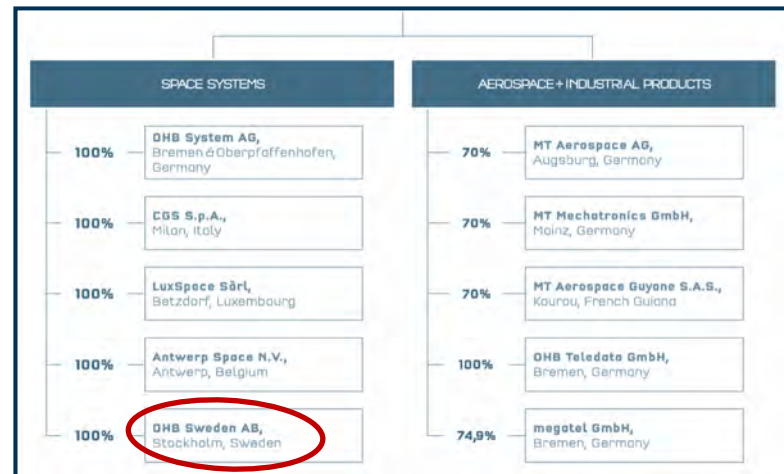
## OHB Group

- European space flight and technology group
- Among the top 3 European "Large System Integrators"
- Involved in major European space and infrastructure programmes
- One of the most important independent forces in European aviation/aerospace
- Strong historical total revenue growth with stable EBITDA-margins



## OHBSweden AB

- Founded in 2011 by acquisition of the Space Division of the Swedish Space Corporation
- Swedish center of competence for space systems and satellites
- Currently 75 employees, highly educated and with and long experience working with space systems
- Self-supporting company within the OHB SE Group



## OHB Sweden company profile

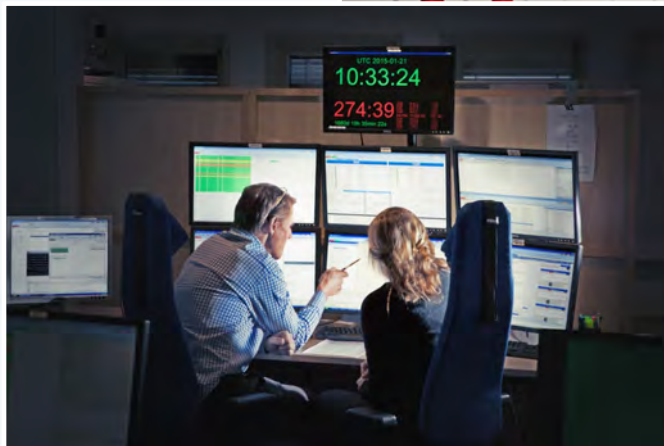
- Experienced Small Satellite Prime and System Integrator of satellites up to 400 kg
- Subsystem supplier to larger satellites
  - AOCS
  - Propulsion
- Core competence areas
  - *Mission Architecture and Analysis*
  - *Spacecraft System Engineering and Integration*
  - AOCS
  - Propulsion
  - Check-out and Ground Control Systems





## OHBSweden Facilities

- New facilities in Kista (Stockholm) since beginning of 2014
- Development, process and manufacturing area including cleanroom integration and testing capabilities
  - *Cleanroom is ISO class 8, upgradable to class 5*
- Satellite control centre for in-house developed satellite systems



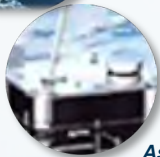
### Early Scientific Satellites



*Freja (1992)*

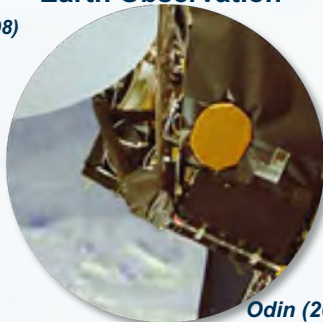


*Astrid 1 (1995)*



*Astrid 2 (1998)*

### Astronomy and Earth Observation



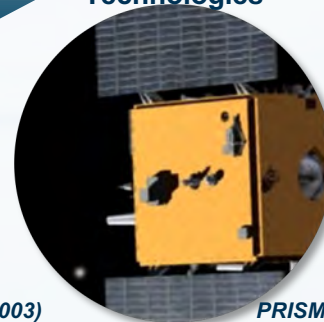
*Odin (2001)*

### Lunar Science



*SMART-1 (2003)*

### Formation Flying Technologies



*PRISMA (2010)*

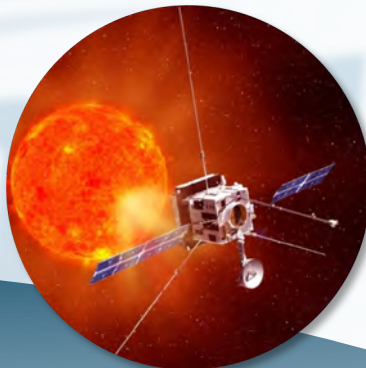
## OHBSWEDEN Heritage

Provider of Complete Satellite Systems

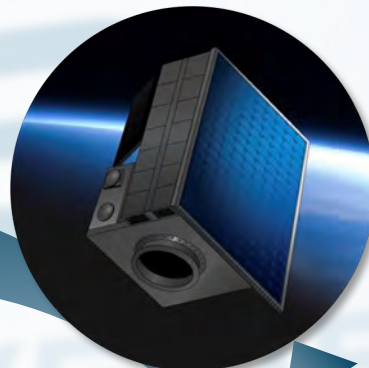
**Telecom Satellites**



**ESA Scientific Satellites**



**Swedish National Programme**

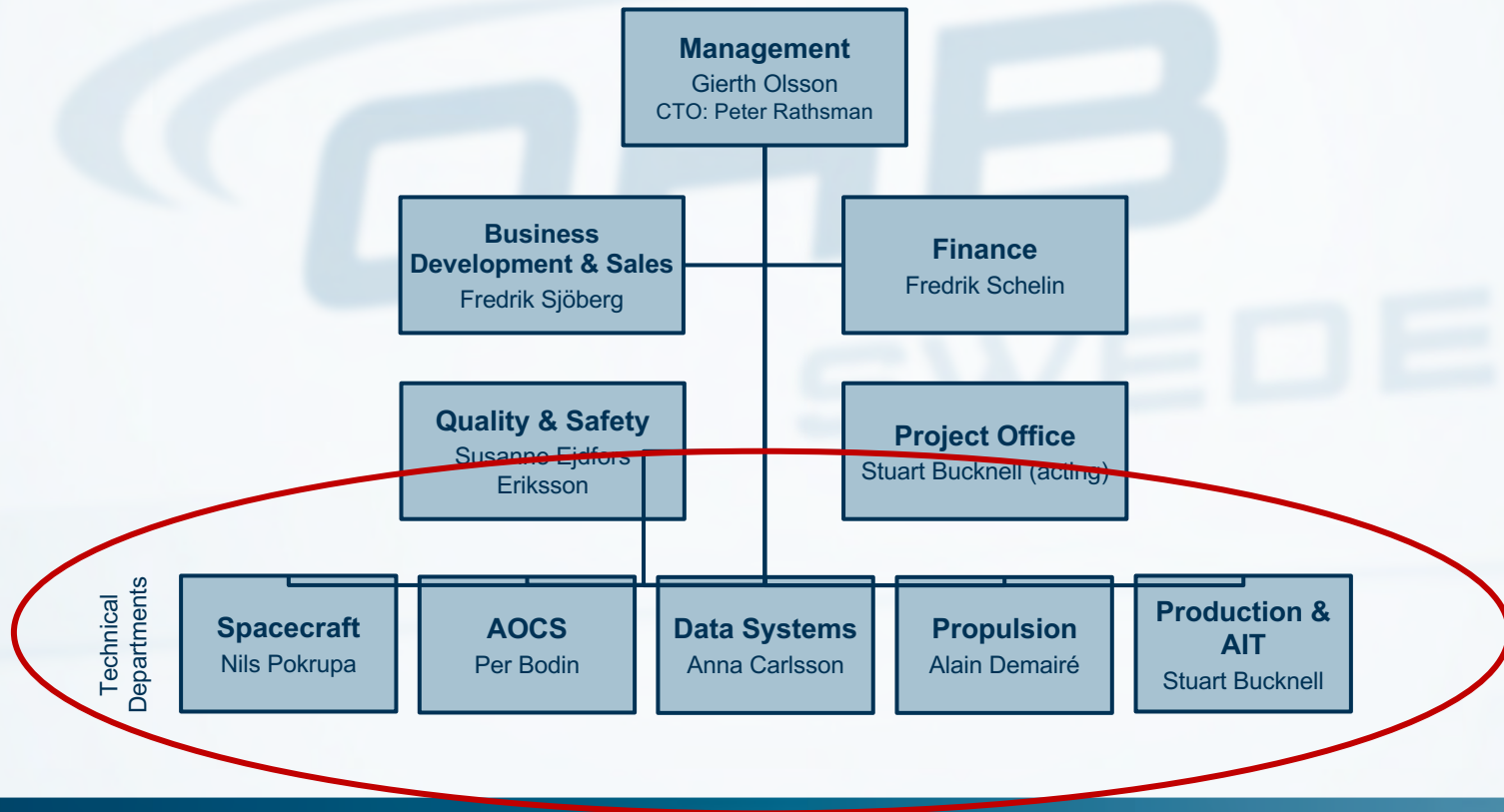


**OHB Sweden today provides:**

- *Attitude Control Subsystems*
- *Propulsion Subsystems*
- *Small Satellite Systems*

**within Telecom, ESA and National Programmes**

## OHBSweden Organization



## Technical Departments

- **Spacecraft**
  - *Spacecraft System Engineering for Complete Satellites*
- **Attitude and Orbit Control Systems (AOCS)**
  - *AOCS Design, Development and Verification*
- **Space Data Systems**
  - *Over-all responsibility for the complete Software and Data Handling chain*
- **Propulsion**
- **Production & AIT**
  - *Spacecraft Production and Test*





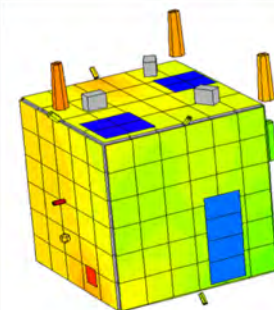
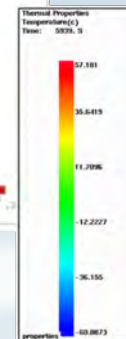
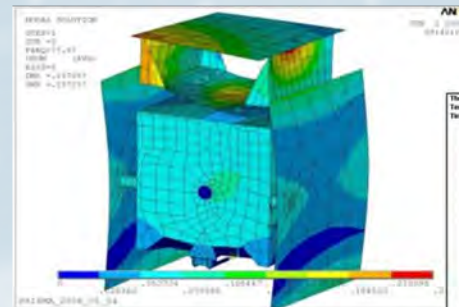
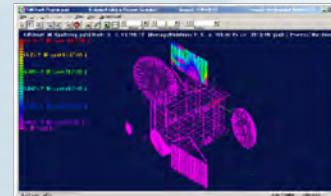
A large, complex spacecraft is being assembled in a cleanroom. The spacecraft is mounted on a white support structure. Several large, rectangular solar panel arrays are visible, some of which are covered in a blue protective material. The background shows various pieces of equipment and a clean, industrial environment.

# Spacecraft

## Spacecraft

### *Spacecraft System Engineering for Complete Satellites*

- Experienced within
  - *Requirements engineering, System and subsystem specifications, Equipment procurement specifications, System interface engineering, System budgets, Specialized Analyses*
- Specialized Analyses
  - *Mission Analysis, Venting, Plume Impingement, Spacecraft Charging, FMEA and FDIR, Thermal and Radiation*
- Design Capabilities
  - *CAD and Thermal Design*
- On-going projects
  - *Innosaf/MATS over-all prime responsibility*
  - *Sentinel 9 (PolarIce) Phase A/B1*
  - *System engineering in on-going AOCS and Propulsion projects*



A satellite with a large rectangular solar panel array is shown in space, oriented vertically against a background of Earth's clouds.

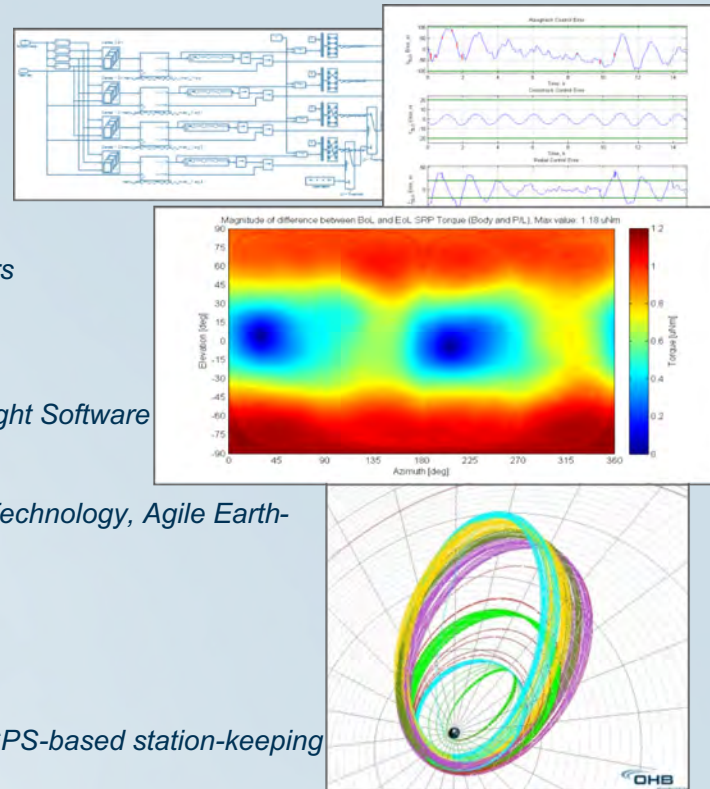
**AOCS**

2COA

# Attitude and Orbit Control Systems (AOCS)

## AOCS Design, Development and Verification

- Experienced within
  - AOCS Design, Development and Verification for all kinds of AOCS
  - Mission Analysis, Specification and procurement of AOCS Sensors and Actuators
  - Hardware-in-the-loop testing, support to AIT, Flight Dynamics
- Techniques
  - More than 20 years of experience with Model Based Design for Autocoding of flight Software
- We look for innovation and cooperation in the field of
  - Further development of formation flying and rendezvous, Vision Based Sensor Technology, Agile Earth-observation, high-altitude GPS navigation, learning systems
- On-going/recent projects include
  - AOCS Detailed Design for OHb Group telecom satellites
  - AOCS for InnoSat/MATS
  - Participation in studies such as Space Debris Removal, Asteroid Rendezvous, GPS-based station-keeping algorithms for geostationary satellites





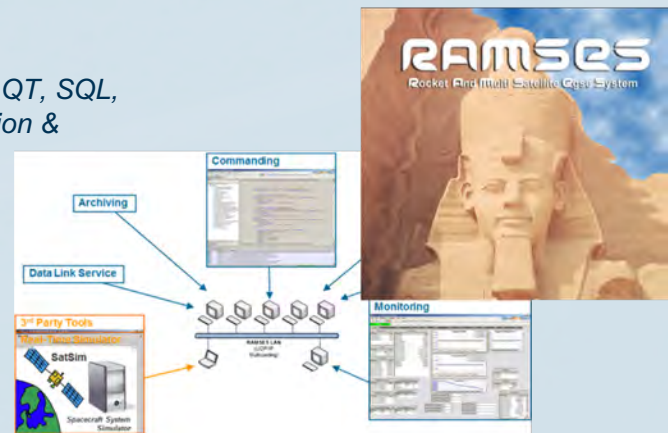
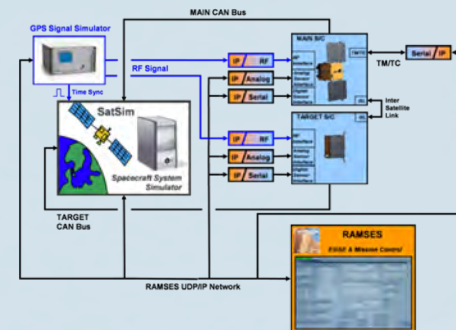
# Space Data Systems



## Space Data Systems

*Over-all responsibility for the complete Software and Data Handling chain*

- Experienced within
  - *On-board Software, Model Based Design and Autocoding of AOCS Software, Simulators, Ground Control and Checkout Software*
- Used standards
  - *ECSS, CCSDS, PUS, MISRA*
- Used technologies
  - *Model based design and autocoding, Matlab/Simulink, C/C++, Python, XML, .NET, QT, SQL, GCC (RTEMS), Windows and Linux, Realtime embedded SW, Continuous Integration & Delivery*
- We look for innovation in the field of
  - *Automation of verification & validation, documentation, process modeling*
- Ongoing projects include
  - *AOCS Software and Simulators for OHb Group telecom satellites*
  - *On-board software, Simulators, Checkout and Control Software for InnoSat/MATS*



A large, blue-tinted background image of a rocket engine, showing its complex internal components and structure.

# Propulsion

## Propulsion

## Propulsion

***Provision of the best suited propulsion technique assembled and tested on the spacecraft***

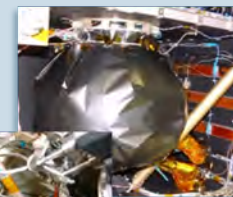
- We look for high tech companies capable in the areas of
  - *Welding, Cleaning, Inspection (X-ray, US)*
- We look for innovation in the field of
  - *Thermal sensors, fluid management, hydrazine storage, open source thermal and fluid simulation software*
- We want to explore all ideas which could benefit propulsion, mainly
  - *High temperature handling materials, 100% NDT techniques for carbon fiber wrapped tanks, new techniques to form and passivate Aluminum to allow for manufacturing of Al-tanks*
- Ongoing projects include
  - *Electric propulsion for OHb Group telecom satellites*
  - *Bipropellant, monopropellant, micropulsion for ESA scientific satellites (Solar Orbiter, Euclid, Biomass)*
  - *Tech development within cryofits, manual valves, innovative electric propulsion techniques*



Assembly on jig



Xenon tank installation



Thermal Installation

A blue-tinted photograph of an industrial facility, likely a space station or large-scale manufacturing plant, with complex scaffolding, walkways, and large cylindrical structures. The image is semi-transparent, allowing the text to be overlaid.

# Production & AIT



## Production & AIT

### *Spacecraft Production and Test*

OHB Sweden specialises in producing spacecraft and spacecraft sub-assemblies

Spacecraft assembly requires precision components and supporting processes to ensure that the high standard of quality is maintained for our products



**Kista Production Facility Capabilities:**  
Full capability to manufacture all types of propulsion systems and spacecraft systems integration





## Production & AIT

*OHB Sweden relies of partners to supply the following technologies and processes*

- Jig manufacture
- Surface treatment
  - *Paint, Coatings, Chemical treatment*
- Precision fastenings
  - *Screws, Rivets, Nuts, Washers, Safety Wire*
- Non-destructive Testing
- Vibration and shock testing
- Thermal testing
- Metrology
  - *3 axis measurement of assemblies and jigs*
- Calibration services
- Precision component machining
  - *Titanium pipe fittings, Spacecraft brackets in plastic or metal*
- 3D printing
  - *Plastics, Metals*
- Precision welding
  - *Automatic TIG, EB welding*
- Lab supplies
- Thermal hardware
  - *Heaters, Multi-layer insulation, Mylar sheets, Kevlar, Metal tapes*
- Adhesives
  - *2-part epoxy suppliers, Adhesive tapes*
- Electrical components
- Connectors
  - *Flight grade wire, Crimps and pins, Soldering supplies, Precision cleaning chemicals, Cleanroom supplies*



# Presentations by the Aerospace Industry

Peter Engberg, SAAB

# THINKING EDGE IN DEFENCE AND SECURITY

Presentations by the Aerospace Industry  
Saab AB

Peter Engberg, Vice President  
Head of Traffic Management  
Saab AB

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consent.





# IN 1937 WE TOOK OFF

- A history from the 17th century through Alfred Nobel (Bofors) and the shipyard in Karlskrona (Kockums)
- In 1937, Saab was founded to protect Sweden's borders and its people
- Born smart – as a small country, we were forced to arm ourselves with good and cost-effective equipment
- On our journey we created Sweden's computer, missile and space industries
- Read more about our history at [history.saab.com](https://history.saab.com)

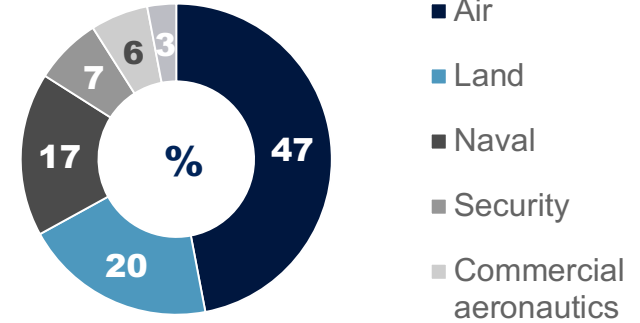




# AN **OVERVIEW** OF OUR COMPANY (2017)



**SALES**  
**31,394**  
**MSEK**



**16,427**  
**EMPLOYEES**

**100**  
**CUSTOMER COUNTRIES**

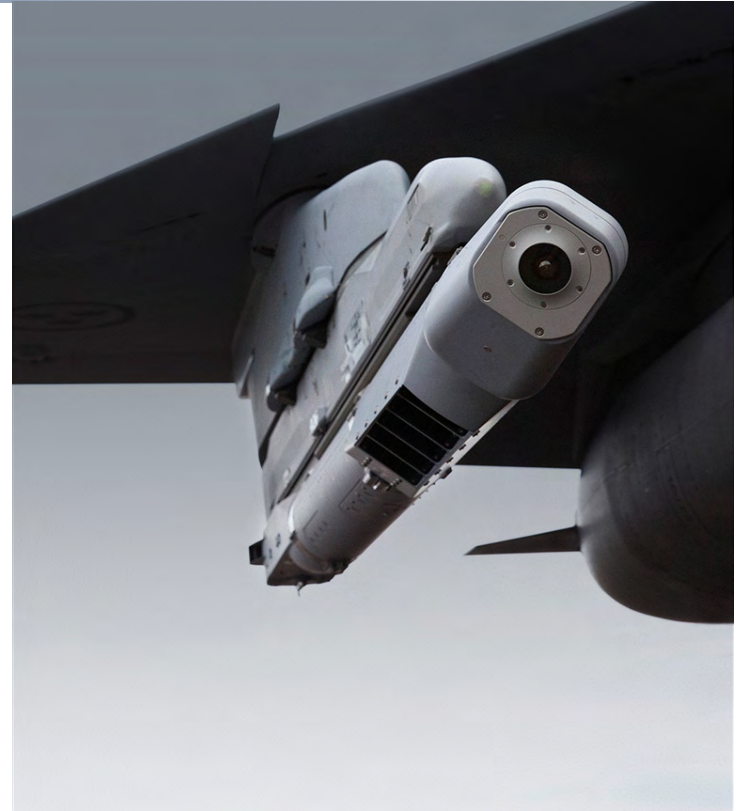
# TODAY, WE LOOK **TO THE FUTURE**

- The world's most cost effective, high-tech defence and security company
- Our history has enabled us to shape a defence and security offer with great depth and breadth
- Through acquisition, Saab has brought together a broad base of knowledge and innovative thinking
- Companies like Bofors, Sensis, Ericsson Microwave Systems and recently Kockums have added expertise



# WE **ANTICIPATE** FUTURE NEEDS

- Close cooperation with customers and industrial partners creates learning opportunities
- 23 percent of sales is invested in research and development, strengthening our competitive position
- Innovation is at the very core of our portfolio strategy
- We are reducing costs and improving efficiency through investment in new technology





# GRIPEN NG AND BRAZIL





# GLOBAL EYE







# TX





# A 26



# FIRST REMOTE TOWERS IN THE WORLD

## DELIVERED AND APPROVED FOR OPERATION

- ATS Örnsköldsvik in operation since April 2015
- ATS Sundsvall in operation since November 2016
- ATS Linköping planned for live operation in 2018
- ATC on demand – Green Field airport, LOI signed





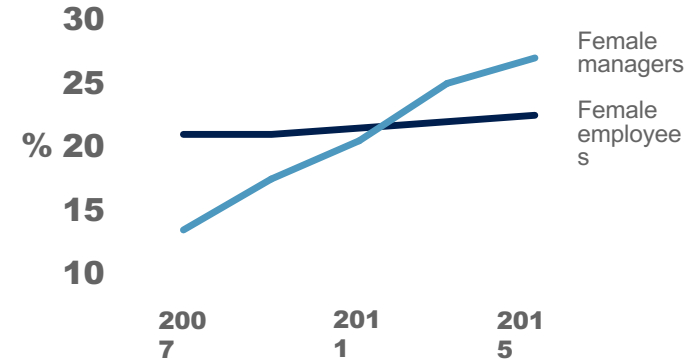
# TRANSPORT FOR LONDON – COMMAND AND CONTROL



# OUR **WORLD-CLASS** PEOPLE



Our employees are genuinely proud to work at Saab and we score highly in external employer surveys.



- A majority of us are engineers, but almost every type of job is represented amongst our employees
- We seek diversity – because we think it drives innovation and performance
- We respect the need of all employees to maintain balance between work and personal life

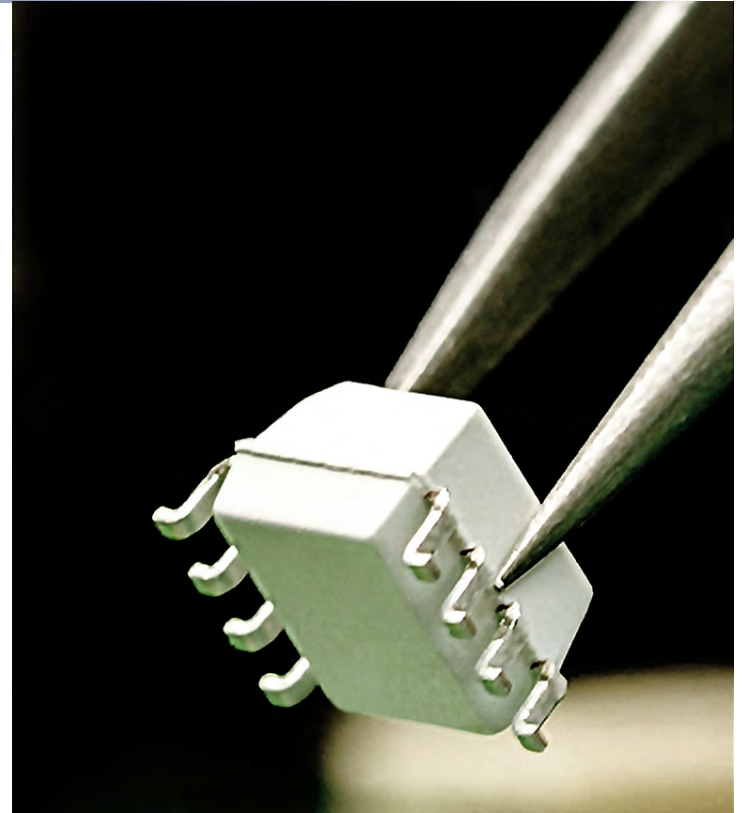
# 16,427

employees in **35** countries



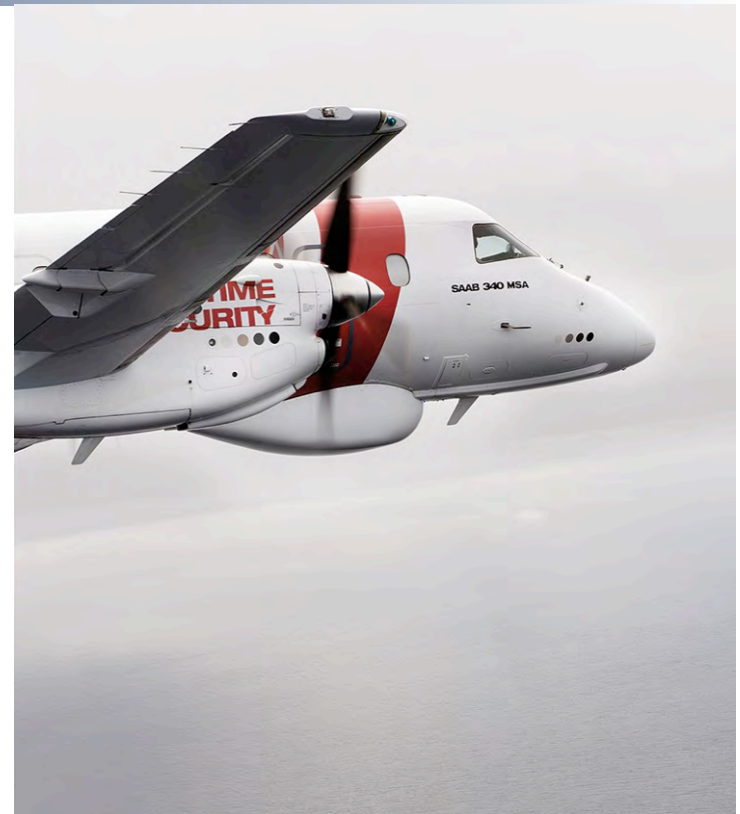
# CONTRIBUTING TO **SOCIETY**

- Products contributing to increased security
- Generating jobs, export revenues
- Innovation leads to economic growth
- Sustainability is always part of our business
- Promoting education and interest in technology



# SAAB IS GOOD FOR **SWEDEN**

- Internationally competitive company with advanced security and defence systems
- One of the world's most high-tech and research intensive companies
- Presence in 50 cities around Sweden
- Generating jobs, export revenues and large technological spill over effects
- Providing cost-effective supply defence materiel and contributing to Swedish foreign and security policies



# POSSIBLE BUSINESS OPPORTUNITIES FOR SME

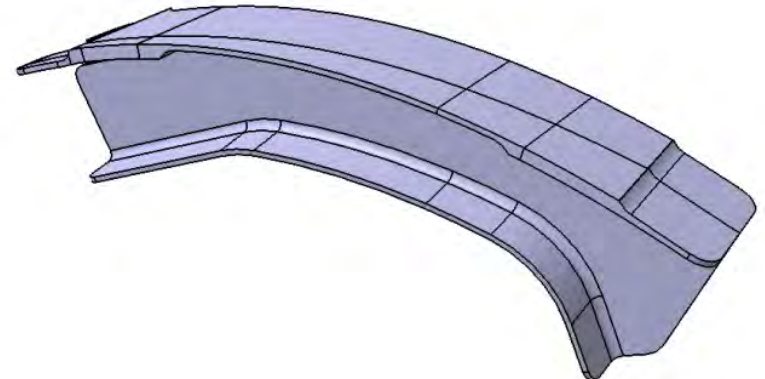
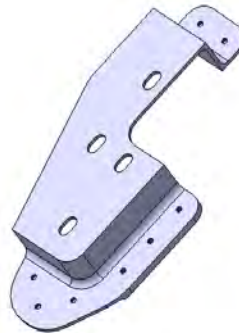
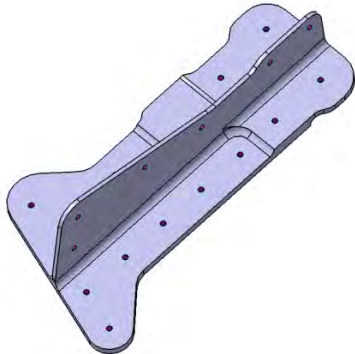
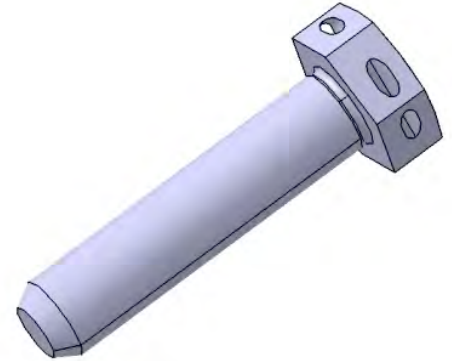
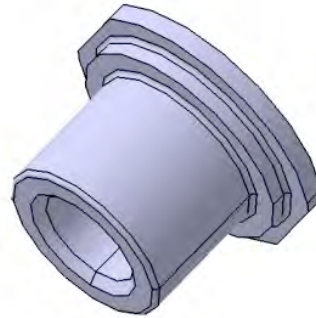
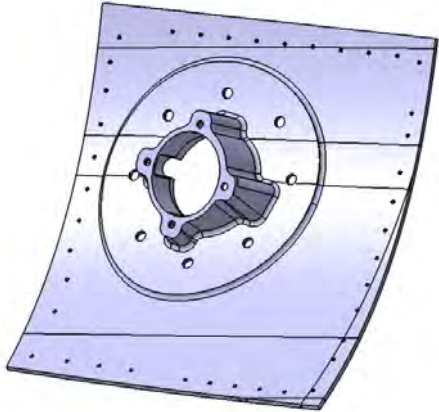
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- Parts manufacturing aluminum and composites
- Additive Manufacturing
- Emerging technologies – Internet of Things (IoT), Artificial Intelligence (AI), Virtual and Augmented Reality...
- Production capability– Automatization and digitalization, efficient assembly, Jiggs and tools
- R&D&I - NFFP (Nationella Flygtekniska Forsknings-Programmet), SWE-Demo, Clean Sky 2...



# GRIPEN EXEMPEL PARTS

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# SAAB GLOBAL INNOVATION PROGRAM

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- Build relationships and bilateral innovation open arenas for joint R&D
- Executive programs for knowledge exchange
- Joint initiatives with Swedish academia, government agencies and Swedish Industry
  - Royal Institute of Technology, Stockholm (KTH)
  - Linköping University, Linköping
  - Chalmers University, Gothenburg
  - Vinnova and other funding agencies
  - Swedish Defence University & Swedish Armed Forces
  - Swedish Global Industry (Volvo, Scanica, Ericsson, ABB etc)
  - Industry clusters (ACS, Teknikföretagen, Swedsoft, Compraser etc)



*Figure 2: Triple Helix model*

**Source: Etzkowitz (2002, 2004), Etzkowitz and Leydesdorff (1998, 2000)**





# Presentations by Suppliers

AIT i Umeå AB, BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, N66connect, nVent, Optimization,  
Swedish Composite Innovation Center

# Advanced Integration Technology i Umeå AB

Mikael Nensén

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, N66connect, nVent, Optimation,  
Swedish Composite Innovation Center

## **AIT Umeå**

### **Advanced Integration Technology**





- ❖ US subsidiary
- ❖ Founded 2007
- ❖ Turn key solutions
- ❖ Offer:
  - ❖ Design
  - ❖ Project Mgmt
  - ❖ Manufacturing
  - ❖ Installation
  - ❖ Service
- ❖ 70 Employees
- ❖ Customers:
  - ❖ Boeing, Spirit, Embraer, Xian Air, Volvo, Scania, Rolls Royce



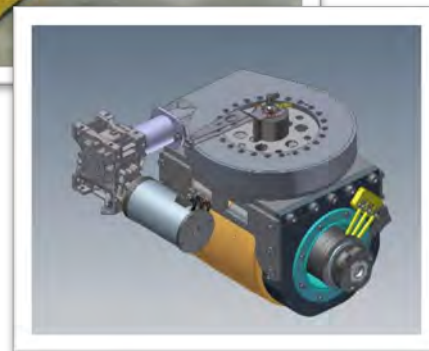


❖ Specializes in automation solutions including:

- ❖ Heavy duty material handling
- ❖ Fixtures
- ❖ AGV
- ❖ MGV
- ❖ MLT
- ❖ Telehandler
- ❖ Positioners

❖ Expertize

- ❖ Heavy duty wheels
- ❖ Mechanical Engineering
- ❖ Navigation
- ❖ Positioning
- ❖ Controls



**Passionate about innovation and solving customer problems!**

# Agio

## Jens Olovsson

AIT i Umeå AB, [Agio](#), BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, N66connect, nVent, Optimization,  
Swedish Composite Innovation Center



# agio

[100% EFFEKTIVARE PROCESSER]

# Vår affärsidé

VERKSAMHET



IT-SYSTEM



# BnearIT AB

Kent Eneris

AIT i Umeå AB, Agio, [BnearIT](#), Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, N66connect, nVent, Optimotion,  
Swedish Composite Innovation Center



# Boliden Electro AB

Jens Holmqvist

AIT i Umeå AB, BnearIT, [Boliden Electro](#), Brogren Industries, CGI, Conex,  
Data Ductus, N66connect, nVent, Optimotion,  
Swedish Composite Innovation Center

**BOLIDEN**  
**Electro**

# Vår vision

Intelligenta lösningar för  
en intelligentare värld!



# Vår mission

Genom att leverera intelligenta  
lösningar i teknikens absoluta  
framkant, erbjuder vi våra  
kunder säkerhet och stärkt  
konkurrenskraft!



# Våra kärnvärden

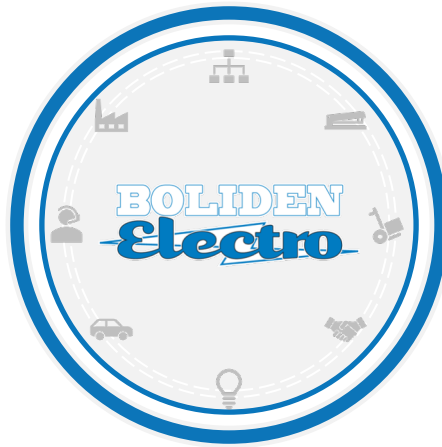
Kompetens

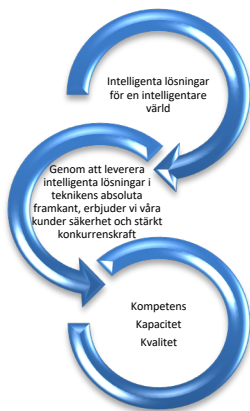
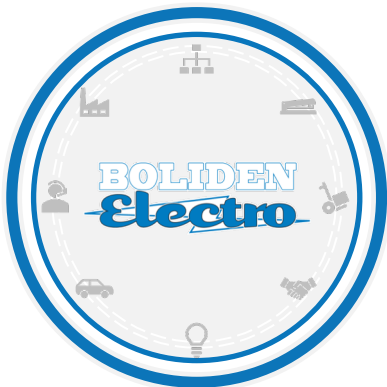
Kapacitet

Kvalitet









Installation, Drift & Underhåll



Sammansättning av produkter

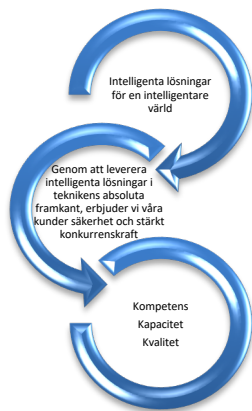
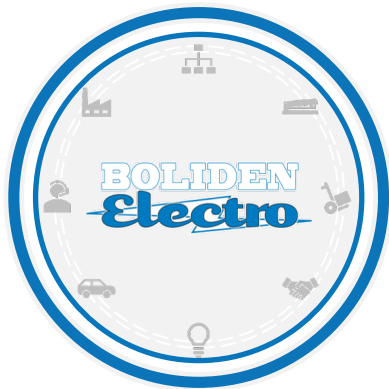


Konstruktion, Besiktning, Driftsättning

Som företag är Boliden Electro AB organiserat i tre samverkande avdelningar.

- Installationssidan är den numerärt största delen, vår expertis är framför allt tung industri.
- Sammansättning av våra produkter sker av våra montörer på vår Verkstad.
- Konstruktionsavdelningens två huvudsakliga industriella inriktningar är Elkraft & Automation, men för att klara av våra omfattande projektleveranser besitter vi även expertis inom Byggkonstruktion.

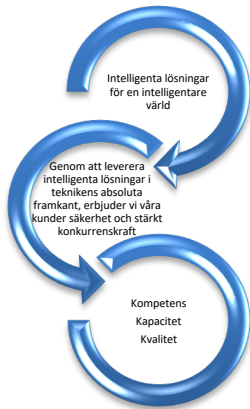
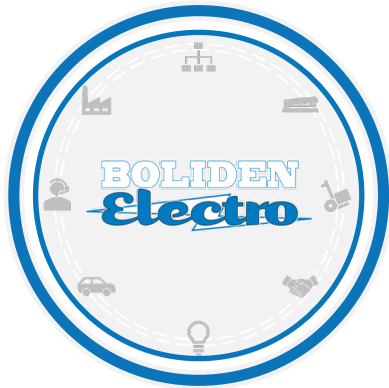
Verksamheten är i sin helhet kvalitets och miljöcertifierad, arbetsmiljöcertifiering pågår under 2018.



## Produkter

- Compact Power QS
- iQS
- iQS\_AR
- iQS Media
- X-Blast
- X-Pulp
- Teknikhus
- Switchlådor
- Kraftuttagscentraler
- Last- & arbetsfrånskiljarskåp
- Nätstationer 3-24kV/1-0,4kV
- Mobila transformatorenheter
- Pump/Ventilations styrningar





Intertek



## Referenser

- **Mandalay Resources – (IS1)**  
Inkommande ställverk  
Björkdalsgruvan
- **LKAB –**  
Etablering Mertainen  
Etablering Svappavaara  
Etablering Leveäniemi
- **Boliden Mineral – (HS3-10)**  
Inkommande ställverk  
Anriktningsverket
- **ABB Ltd –**  
Northland Resources  
Amulsar Gold

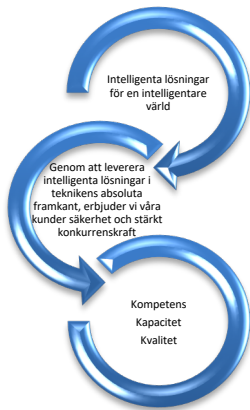
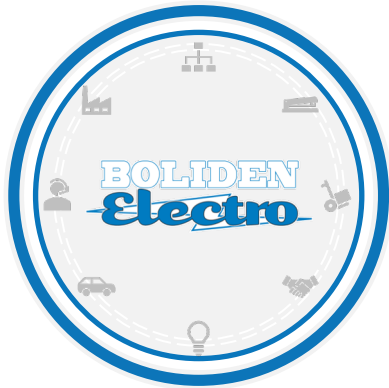


ABB Ltd – Northland Resources och Amulsar Gold  
Nya Teknikhus till nyetablering av en gruva i Pajala (Sverige) och en gruva i Armenien.

Genomförande år: 2012 & 2017  
Spänningsnivå: 20/0,72/0,4kV  
Antal Byggnader: 9+7

### Kort omfattningsbeskrivning:

*Projektering, Tillverkning av Teknikhus inrymmande allt från Driftcentral, Serverrum, Ställverk, Drivsystem, Transformatorer till Byggnader, stål-/balkkonstruktioner och Trappor*



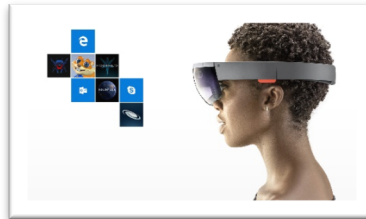
## Under utveckling



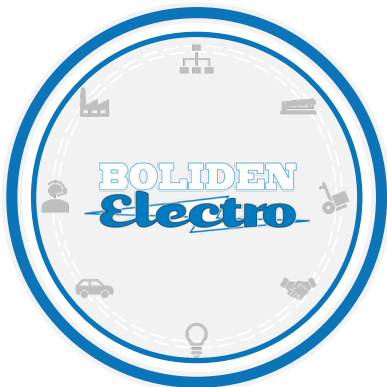
- **X-Blast**  
Skjutsystem för under- och ovanjordsgruvor
- **iQS\_AR**  
'Augmented reality' miljö för vår iQS familj

Dessa saker motiverar sin egen presentation för att göra det hela rättvisa, men lite kort avseende skjutsystemet så är det en vidareutveckling av det koncept vi levererar till Världens största underjordsgruva under innevarande år. Utvecklingen består i "gruv-layout anpassade" lösningar.

*iQS\_AR, kommer att presenteras på Euro Mine Expo, Juni 2018.*







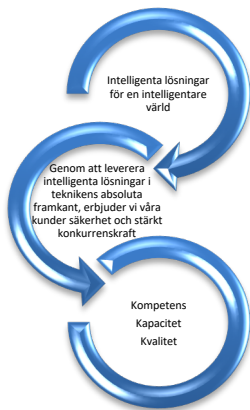
Installation, Drift & Underhåll



Sammansättning av produkter



Konstruktion, Besiktning, Driftsättning



# Tack för din uppmärksamhet!

Besök [www.bolidenelectro.se](http://www.bolidenelectro.se)

för mer information om företaget och det omfattande utbud av tjänster vi erbjuder



Intertek

**BOLIDEN  
Electro**

# Brogren Industries AB

Fredrik Olofsson

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, [Brogren Industries](#), CGI,  
Conex, Data Ductus, N66connect, nVent, Optimation,  
Swedish Composite Innovation Center



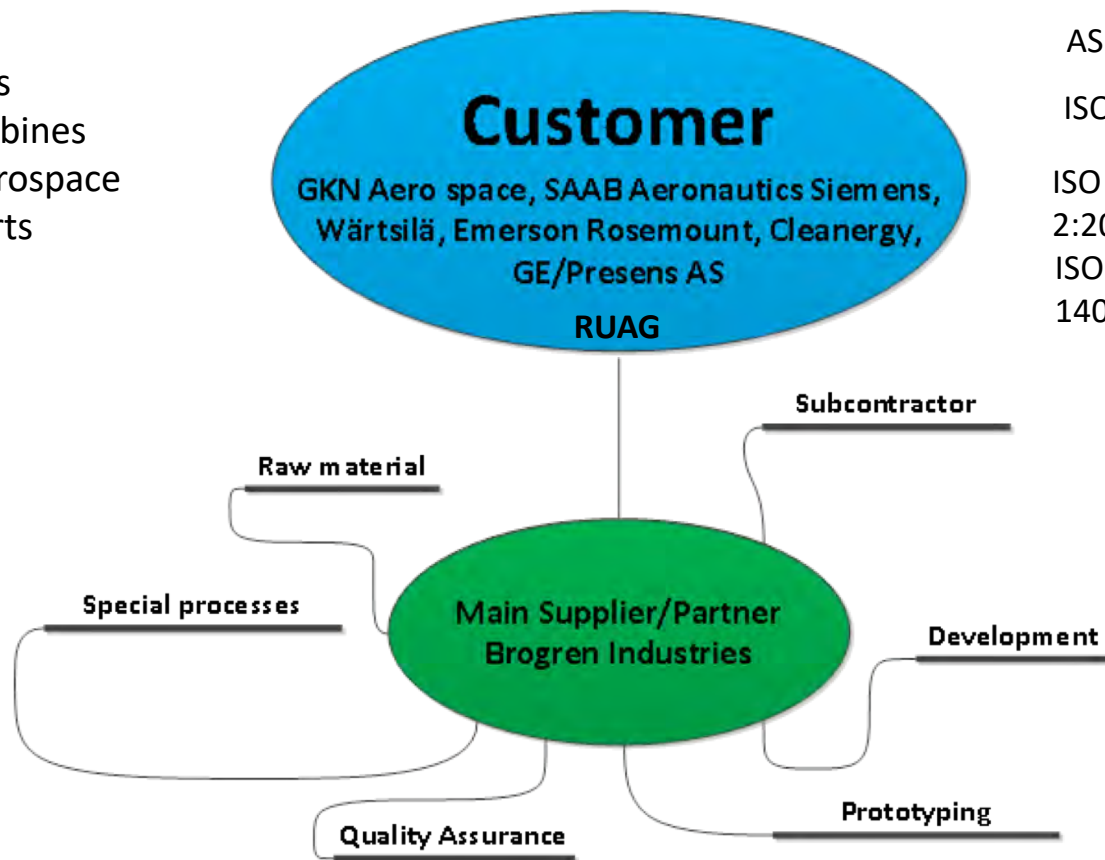
Fredrik Olofsson

# Brogren Industries

- Grundat år 1965 av Lars Brogren, ägs fortfarande av familjen
- Affärsidé sedan start är skärande bearbetning
- År 2007 tog företaget beslut om att svetsning skulle ingå i verksamheten
- Första order till flygindustrin 2012
- Verksamheten drivs idag av anställd personal
- Finns i Älvängen mellan Göteborg och Trollhättan



Gas  
turbines  
Aerospace  
Parts



AS 9100 Rev D

ISO 9001:2015

ISO 3834-

2:2005

ISO

14001:2015







# CGI

## Raimo Pesämaa

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, [CGI](#),  
Conex, Data Ductus, N66connect, nVent, Optimization,  
Swedish Composite Innovation Center

# DREAM INSPIRED CLIENT DRIVEN



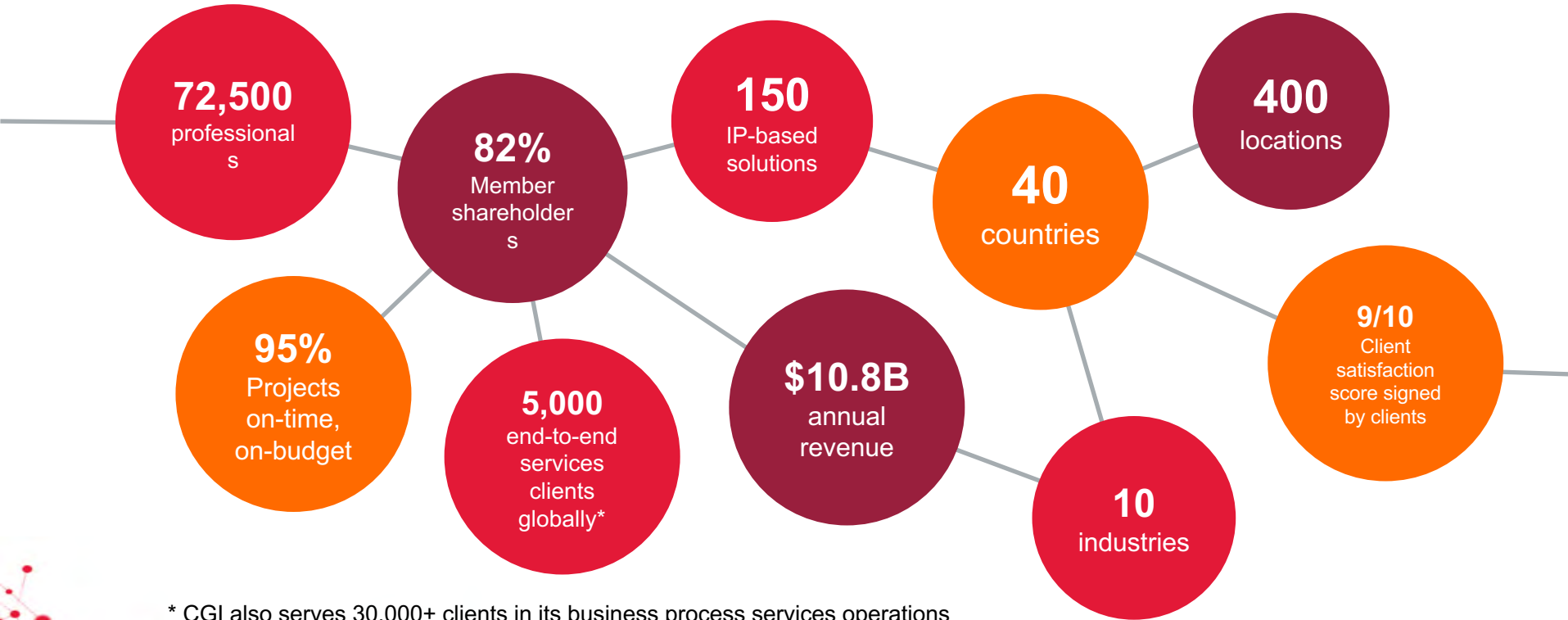
## CGI

Raimo Pesämaa – Vice President Consulting Services  
[Raimo.pesamaa@cgi.com](mailto:Raimo.pesamaa@cgi.com)

## CGI

Experience the commitment®

Founded in 1976, CGI is the 5th largest independent end-to-end IT and business consulting services firm in the world





# CGI in space



# Our range of services and differentiators

## Range of services

High-end IT  
and  
business  
consulting

Systems  
integration

IT and  
business  
process  
outsourcing

**Client-proximity model**

**Domain expertise**

**Intellectual Property**

**Global delivery network**

## Differentiators



# Conex AB

## Ola Hallergren

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, CGI,  
[Conex](#), Data Ductus, N66connect, nVent, Optimatation,  
Swedish Composite Innovation Center

# Engineering



- Founded 1996 as a spin-off from Luleå University of Technology with origin in:
  - Development of material models, sheet metal forming and fracture mechanics focus on Hot stamping
- Close cooperation with Luleå University and CHS
- Core business: Design & simulation, product and process development, project management and turn-key supply
- +15 Engineers

Swedish



English



Finnish



Chinese



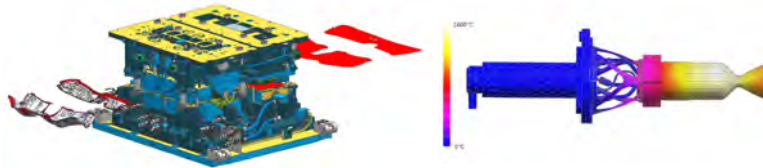
Slovak



Czech



German



## Daily Engineering software (selection):



## Selection reference customers:



swerea | MEFOS

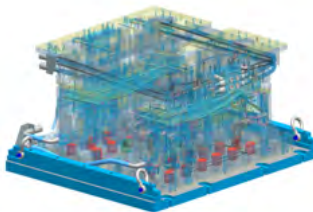


Kalix  
Luleå

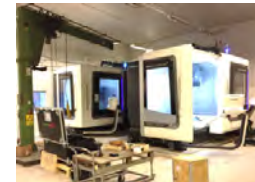
# Manufacturing



- 20+ years experience.
- Available machining >30.000h
- Workshop ~3000m<sup>2</sup>
- 3-D CMM + other quality validation tools
- Try-Out line
- In-house Product development
- 3-D Printing (Scale models or products)



Selection reference customers:



- DMU 90P DuoBlock 5ax, 2 pcs
  - 900mm x 1050 mm x 850 mm
  - Motor spindle 12000 min-1
- EMCO MMV 2000 5ax
  - X=2000 mm, Y=800 mm, Z=750 mm
  - 15000 rpm
- FIL FA 1000 Bed Milling
  - X=4000, Y=1800, Z=1500
- Correa NC Milling
  - X=3500 mm, Y=2500 mm, Z=1000 mm
  - High speed spindle= 18000 rpm
  - Heidenhain TNC 426
- Quaser MV204 IIL
  - X=1500 mm, Y=660 mm, Z=610 mm
  - Matsumoto KDH-302R
  - Heidenhain TNC 530 I





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# Data Ductus

Bengt Gunnarsson

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, [Data Ductus](#), N66connect, nVent, Optimatation,  
Swedish Composite Innovation Center

# Data Ductus in brief

38

## IT Consultancy and Professional Services

### Founded:

1989 in Stockholm, Sweden

**Ownership:** Privately held

**Number of employees:** 220+

**Offices:** Sweden, US and Singapore

### Revenue:

FY17: 23.8 MUSD

FY18 (FC): 28.6 MUSD



# Service offerings in three main areas

39

## Network Orchestration & Automation

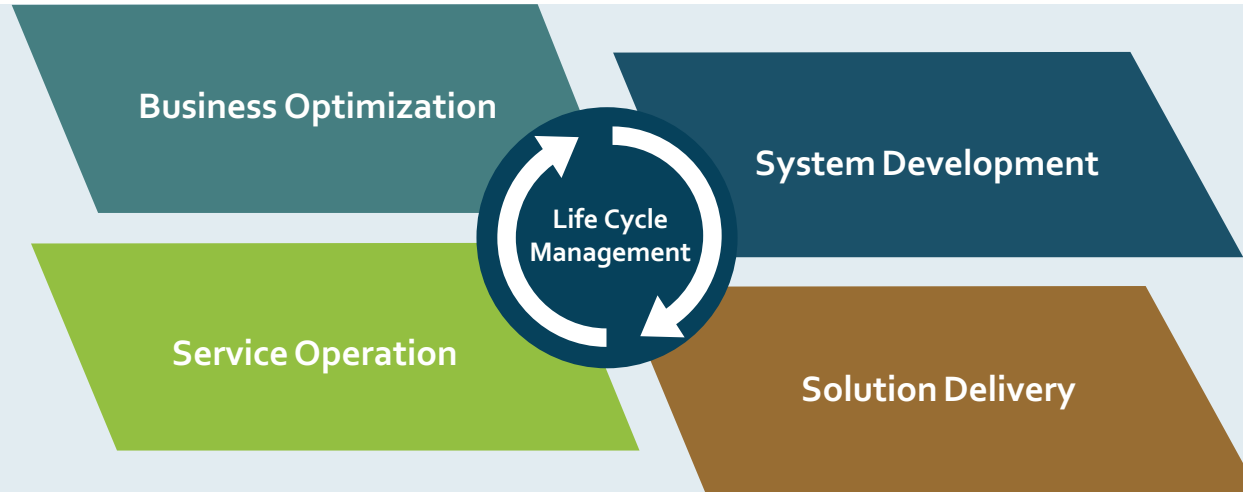
Service Provider and  
Enterprise

## IT & IoT System Development

Enterprise and Public Sector

## IT Service Management & Service Desk

On-prem & Cloud



## What we do?

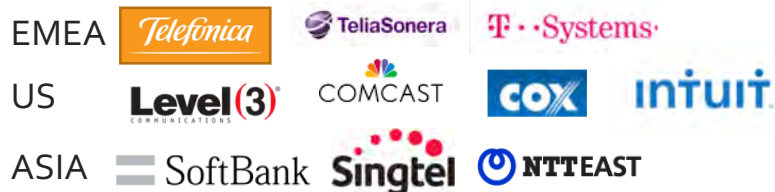
- Software R&D
- Application Life Cycle Management
- Automation
- Orchestration
- Fulfillment & Assurance
- Workflow

## For Whom?

- Equipment Providers and ISV



- Service Providers and Enterprises



## Partners





## What we do?

IoT platform solutions:

- Hybrid integration

IoT sensor-specific solutions:

- Visual analytics, machine learning
- Water & environment
- Geo-positioning

IT solution areas:

- Application Life Cycle Management
- R&D as a Service

## For Whom?

- E.ON (Europe's second largest energy company)
- LKAB (Largest iron ore mining company within EU)
- Boliden (Copper mining company)
- Public sector clients
- IKEA industries (furniture manufacturing)
- Automotive clients (Porsche, Continental, SHPG New Zealand)

## Partners



## What we do?

- Service operations in cloud/hybrid environments
- Service Desk on premises
- ITIL and ITSM implementation
- Data center and cloud migration services
- Collaboration platforms

## For Whom?

- Public organizations
- Manufacturing industry
- Service Providers

## Partners

ManageEngine

CISCO

vmware

OP5  
monitor

bmc

TDS | TRANSITIONAL  
DATA  
SERVICES





- Non-hierarchical organization
- Strong culture of cross-domain collaboration and learning
- Large portion of staff members in customer-facing roles
- Attrition rate less than 7%
- 89% Bachelors degree or higher\*
- 6 Ph. D.
- Average experience 14 years

\*Excluding admin & Service Desk

# N66connect AB

Jan-Olof Sänkelä

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, [N66connect](#), nVent, Optimatation,  
Swedish Composite Innovation Center



N66

CONNECT







N66

CONNECT

WE PROVIDE

**Reliable broadband services  
for the Arctic region**

The background of the entire advertisement is a photograph of a massive, blue-tinged ice wall or glacier face. In the lower right, a small red inflatable boat with several people is on the water. A large, thick orange arc curves across the middle of the image, passing behind the main text.

# nVent AB

## Ulf Broomé

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, N66connect, [nVent](#), Optimation,  
Swedish Composite Innovation Center

# OUR MISSION



**At nVent, we believe that safer systems ensure a more secure world. We connect and protect our customers with inventive electrical solutions.**

# ENCLOSURES OVERVIEW

We protect control equipment for critical applications and maximize our customers' design productivity & competitive advantage.

## Equipment Protection - Hoffman

### Verticals Served

Industrial, Commercial, Energy, Infrastructure, Food and Beverage

### End User Application Focused

- **Manufacturing:** Process (i.s. Oil and Gas), Discrete (i.e. Automotive), Hybrid (i.e. Food and Bev)
- **Commercial:** Office, Healthcare, Hotel, Retail, Education
- **Infrastructure:** Telecom, Railways and Roadways
- **Datacenters**

### Key Products

Enclosures, cooling, electrical boxes, accessories, HMI, Steinhauer Mod Solutions,



## Electronic Protection - Schroff

### Verticals Served

Defense and Aero, Information and Communication Technologies, General Electronics, Railway

### End User Application Focused

- **Industrial:** Test & Meas, Automation & Control, Medical
- **Infrastructure:** Railway, Defense & Aerospace, Information & Communication Technology

### Key Products

Cardlocks, cabinets, cooling, front panels, subracks and accessories, and Integrated Systems





# HIGH PERFORMANCE SOLUTIONS FOR DEMANDING APPLICATIONS

## Crate

Delivering superior infrastructure:

- AdvancedTCA up to **100 GBPS**
- MicroTCA.4 for **REAL TIME** applications
- VPX for rugged deployed applications



## Cabinets

Cabinets with integrated air/water heat exchangers:

- Room independent **COOLING** scaleable up to **40 KW**
- **EMC** shielded



## Datacenter

From cabinet to intelligent infrastructure:

- Active / Passive Cooling
- Power and environmental **MONITORING**





# Platform proven solutions for demanding applications

- Wedgeloks / cardguides



- Electronics packaging components (panels, sub-racks)
- Systems for rugged applications (VPX, CPCI, mTCA)
  - Commercial and rugged cabinet solutions



# Optimation AB

Peter Lingman

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, N66connect, nVent, [Optimation](#),  
Swedish Composite Innovation Center



**Vanliga biverkningar:**  
stora energibesparingar,  
ökad lönsamhet och en  
minskad miljöpåverkan.

# We are experts in automatic control and process virtualization

We have worked with Modelica and Dymola modelling tools since 2002

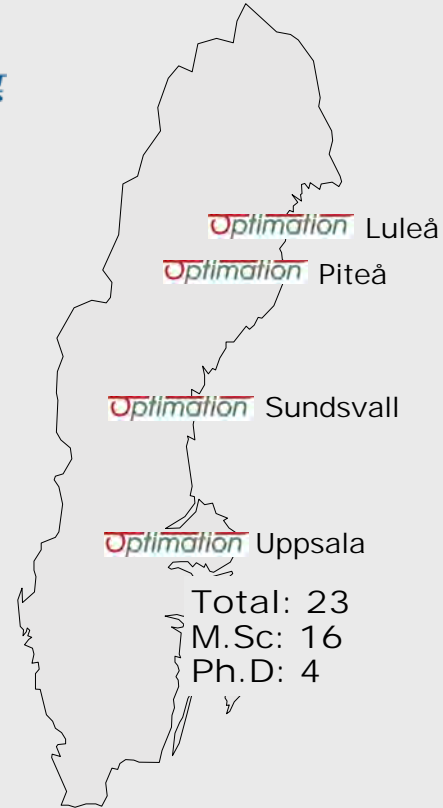


>20 complete virtual factories based on our modeling library are delivered globally

Our subsidiary company MBV Systems is specialized in measurement by vision technology



Our development process is inspired from the well known V-process and today adapted towards an agile development approach



Total: 23  
M.Sc: 16  
Ph.D: 4

# Swedish Composite Innovation Center

Ulf Westerberg

AIT i Umeå AB, Agio, BnearIT, Boliden Electro, Brogren Industries, CGI,  
Conex, Data Ductus, N66connect, nVent, Optimation,  
[Swedish Composite Innovation Center](#)





**SWE  
CIC**

SWEDISH  
COMPOSITE  
INNOVATION  
CLUSTER



**PTC**

PLASTIC TECHNOLOGY COMPOSITES



**Piteå**  
SCIENCE PARK

**swerea**|**SICOMP**

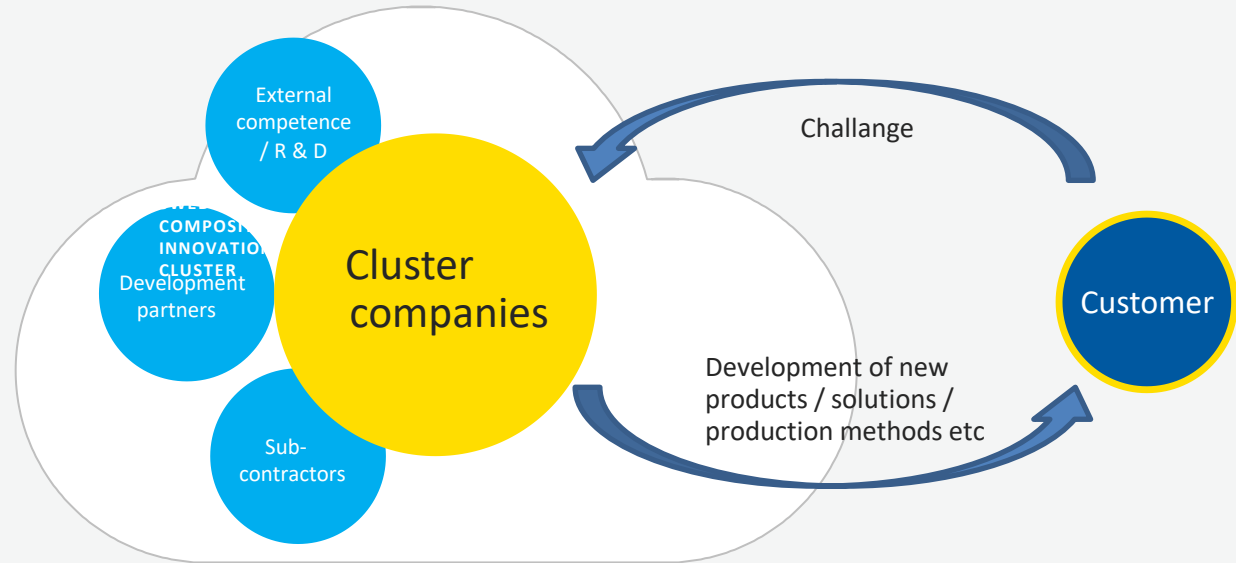


GESTAMP  
**HARDTECH**

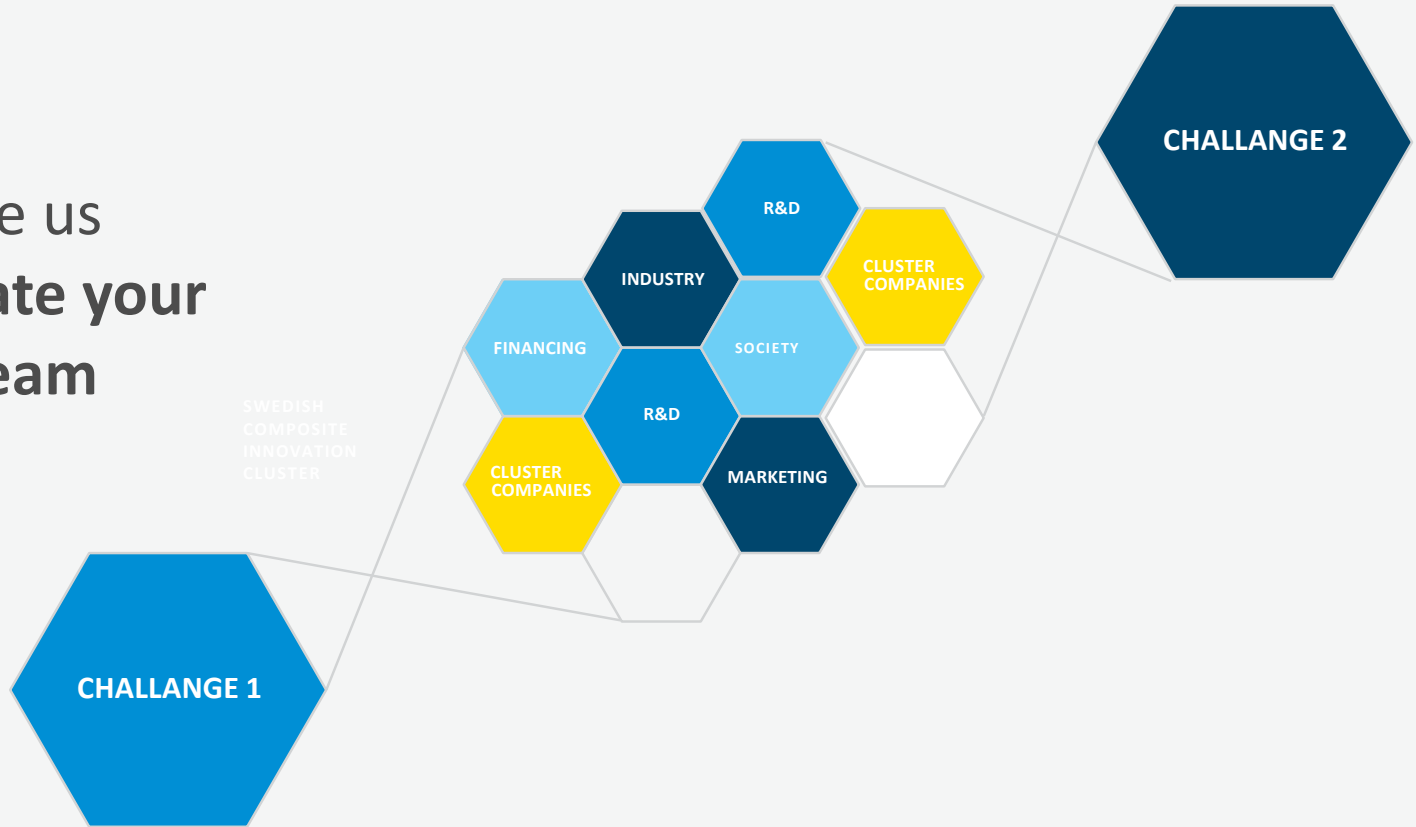


**Composite Service**  
Europe AB

# Challenge-driven innovation



Challenge us  
- we create your  
dream team



# THANK YOU FOR TODAY...

17.30	Bus to Esvinge Space Centre
18.00	Guided tour at Esvinge space Centre
20.00	Dinner at Esvinge space Centre
22.00	Bus back to Kiruna (Drop off at Ferrum and Ripan)