

Global market presence

-

strategy for innovation and growth

Aerospace Technology Congress 2016
Folke Brundin
RUAG Space AB



Together
ahead. **RUAG**

The challenge

Sweden is small.

- Sweden at 2% of European government space investment.
- Europe is at 10-15% of US level.
- Russia, China, Japan, etc.



RUAG Space

We have succeeded to become global supplier to system integrators



- Earth Observation
- Navigation
- Meteorology
- Telecom
- Science
- Launchers



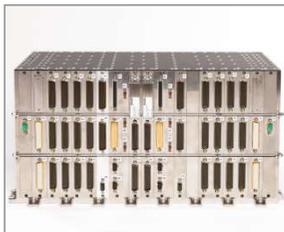
RUAG Space Sweden



Gothenburg



Linköping



RUAG Space, Operations in Sweden

Sales (2015): 775 MSEK (~92 MUSD)

Employees (2015): 400 (Gothenburg 325, Linköping 75)

Our Customers

North America

Boeing
International Launch Services
Jet Propulsion Laboratory
Lockheed Martin
MDA
NASA
Northrop Grumman
Orbital Sciences
Sea Launch
Space Systems/Loral
SpaceX
United Launch Alliance

Europe

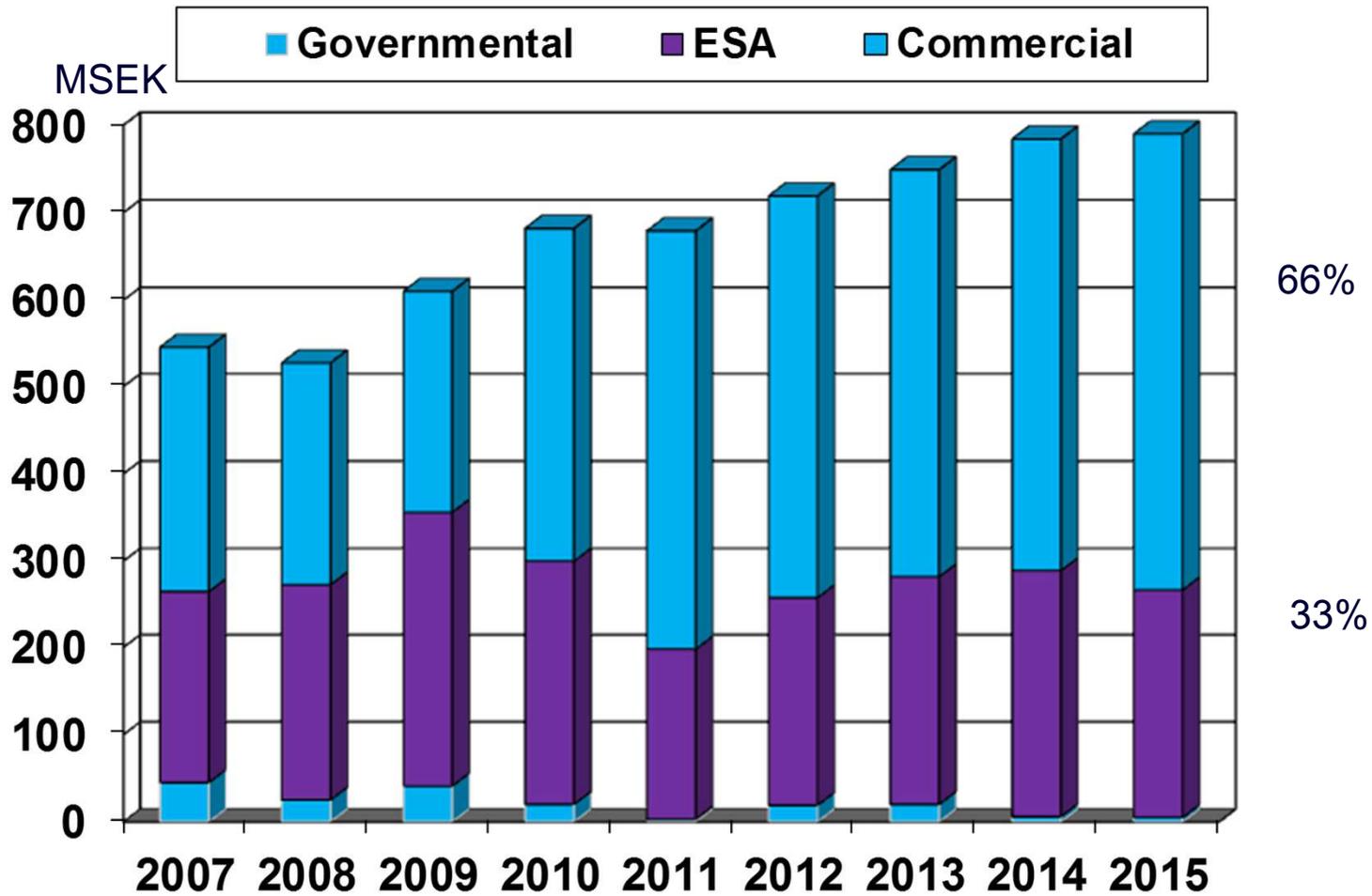
Airbus
Arianespace
Dutch Space
ESA/Estec
Khrunichev
Mier
Norspace
OHB
RSC Energia
SSTL
SIS/Land Launch
TESAT
Thales Alenia Space

Asia

ISRO
Mitsubishi
NEC Space Systems
Hanwha Thales

Sales development over time

RUAG Space AB



Innovation and growth - Our strategies

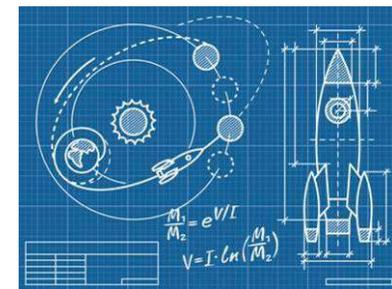
- Niche supplier, portfolio in relation to R&D resources on home market
- Broad customer base – high market share in selected niches
- Partnership with customers- strategy in line with their

- Strategy in line with Swedish space objectives
User and societal benefits, European cooperation



Leverage developments in ESA user driven missions to commercial market
Leverage commercial sales to efficient supply for ESA/EC/Eumetsat missions

- Strategy for innovation making best use of technological strengths
Cooperation with world-class universities in Sweden
Continuous innovation of our existing technological strengths, "all" TRL levels

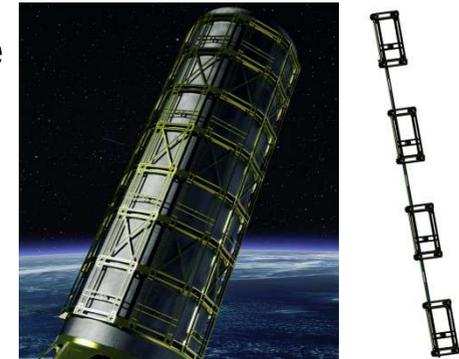


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OneWeb Dispenser

Megaconstellation of 900 satellites

- Supplier of Dispensers to Arianespace, 500 MSEK
- Launch from French Guyana or Baikonour
- System to accommodate and separate 32 satellites
- Cylinder Structure in CFRP
- Success factors
 - Innovative rail solution to solve logistics at satellite factory and launch base – customer partnership
 - Heritage – separation sequence of 32 S/C
 - New CFRP, cost efficient, developed in ESA satellite program

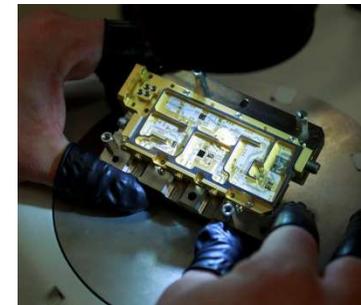


Supply of Microwave electronics

Preferred supplier of frequency receivers to world largest telecom satellite prime contractor, SSL in Palo Alto.

10-50 equipment per satellite, depending on service offered, 1-5 MUSD value

- Success factors
 - Use of technology developed at/with Chalmers University
 - World-class MMIC chips – GaAs, GaN
 - Product development and qualification in ESA programs
 - Niche product – broad customer base - high market share



Supply to Iridium Next

Supplier of Payload Interface Unit to Iridium Next,
10 kg electronics.

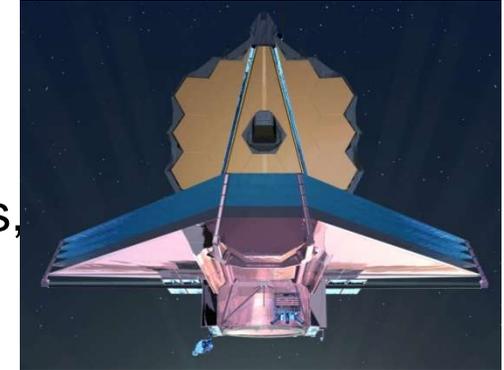
Constellation of 80 satellites, mobile communication.
Customer Thales Alenia Space, France.

- Success factors
 - Use of COTS technology, innovative design choices
 - COTS technology proven in ESA feasibility study
 - Fault-tolerance state-of-the-art heritage, based on 40 years of cooperation with Chalmers
 - Industrialisation for series production



Antennas to James Webb Telescope

- Successor to Hubble, 9 BUSD budget
- RUAG antennas downlink all measurement data to ground
- RUAG selected as supplier on pure commercial basis, Northrop Grumman, LA
- Success factors
 - Heritage from ESA programs (eg Rosetta)
 - CFRP Technology for Hi frequency communication
 - Cooperation with universities



CHALMERS

Multipaction, Corona

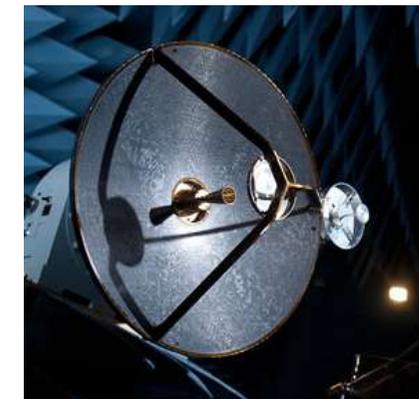


Accoustical noise



LUNDS
UNIVERSITET

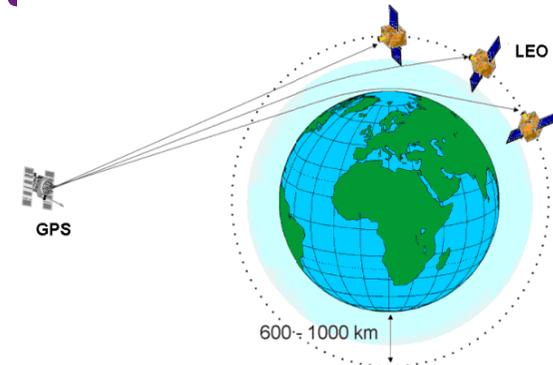
Electromagnetics



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Radio Occultation instrument

Atmospheric sounder probing the atmosphere with GNSS signals. Temperature and humidity profiles.



- Numerical Weather Prediction (NWP), (RO has in a few years made a major impact)
- Climate research (accuracy to within a decade detect global warming)
- Space weather monitoring (power grids, communication ...)

RUAG Supplier of complete instrument, GRAS

To MetOp, the present operational polar system of Eumetsat

To MetOp Second Generation, 6 satellites, service until 2035; contract of >300 MSEK

Success factors:

- Studies over many years with Meteorology institutes, Eumetsat, ESA
- Pre-developments in ESA studies
- Cooperation with Chalmers and Blekinge Högskola: atmospheric models
- Technologies based on our equipment strengths (computer, RF receivers, antennas)

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Summary - Innovation and growth

- **European cooperation**
 - Synergies of funding between user/society benefit and product developments
 - Develop customer trust
 - R&D together with customers
- **Use technological strengths – university cooperations**
 - State-of-the-art technology giving competitiveness
 - Focus R&D investments in strength areas with commercial market potential
- **Broad customer base – high market share in selected niches**



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