

What is the position of the space research in this case?

Space research has for ages been a profiled research field in Sweden, mainly to investigate visible phenomena connected to the magnetic fields and space plasma. The country also holds a leading role in the activities in connection with the use of sounding rockets and satellites in further investigation of space phenomena. Practical utilisation of satellite data has mainly been carried out within environmental monitoring through active participation the Spot-programme and within communication

as operator of private communication satellites. In addition, several industrial companies have utilised their competence, thus become leading suppliers within some fields of space qualified equipment.

The Swedish National Space Board, SNSB, is a central governmental agency under the Ministry of Industry, Employment and Communication. SNSB is responsible for national and international activities relating to space and remote sensing, primarily research and development.

SNSB has three main tasks:

- To distribute government grants for space research, technology development and remote sensing activities
- To initiate research and development in Space and Remote Sensing areas
- To act as Swedish contact for international co-operation

Basic research is financed via the Ministry of Education and Science. SNSB functions as a research council for Swedish research using equipment in space or at high altitudes in the atmosphere.

The Swedish space programme is carried out by means of extensive international co-operation, in particular through Sweden's membership of the European Space Agency, ESA.

Odin – a success story within space research.

One of Sweden's trademarks is their capability to develop, build and manage small and cheap satellites for research purpose. Today the sixth of this type is in orbit. Odin, the most complicated of them all, is still in an operational phase three years after the launch. The satellite, that is a co-operation between Sweden, Finland, Canada and France, combines two scientific disciplines on a single spacecraft. One is astronomical studies of star formation and the early solar system. The second discipline is aeronomy and here Odin addresses the mechanisms behind the depletion of the ozone layer in the Earth's atmosphere and the effects of global warming. The Swedish Space Corporation on behalf on the co-operative partners has developed the satellite and is responsible for its operation.

Odin data are being used to study the global distribution of species of key importance for understanding the physics and chemistry underlying ozone destruction and global warning. Among such species are ozone, various chlorine and nitric compounds, hydrogen compounds and aerosols. Odin has an unprecedented capability for measuring mesospheric water vapour and making very sensitive determinations of the abundance of e.g. chlorine monoxide.

Some of the reasons why Sweden can develop, build and manage their own satellites within acceptable economical frames are their ability to find cost effective technical solutions, using small and effective managing models and their ability to find the right co-operation partners.



Developing of Odin, a very large job for the space research community in Sweden.



The inside of Smart-1 during the finally tests before launch. Swedish Space Corporation's managing of this international project was based on experience build up through the Swedish national small satellite programmes.

Photo: Nordic Space Activities.

Innovation

Swedish Agency for Innovation Systems (VINNOVA) has as its main goal to promote sustainable growth through developing effective innovation systems and financing of application oriented research.

An analysis of the Swedish National Innovation System for 1970-2003 shows that the Swedish national innovation system has a relatively weak long-term competition power with regards to economical growth, new workplaces and innovation. An important reason for this is the gradually decreasing effectiveness in the Swedish model that previously contributed to growth in the R&D intensive multinational companies. Sweden has previously had little focus on private and public service sectors. These are increasing fields and countries that have had large part of the R&D in these fields will have a relatively larger growth. Like many other countries, Sweden has also experienced that an increasing part of the population is outside the working life.

In comparison with most of the OECD-countries the Swedish innovation system has a large potential. Sweden has a international strong macro economy and good public finance that gives a reliable basis for incitement structures and for investment that can promote innovation and economical growth. Sweden is also attractive for qualified R&D investments. The country has, in international relation, much knowledge intensive enterprises, and a well-developed and scientific qualified university system. Sweden has in addition a high education level and is relatively willing to take in use new technology and new services.



Electronic components for the mass market is the finally result of basis research, applied research and innovation.

Photo: Nordic Space Activities

The way forward

In a report from a panel of experts, called Technical Foresight “Teknisk Framsyn” it was pointed out that Sweden must learn to choose away some subject for the good of others. Sweden has not enough resources to participate in all areas if they are going to hold the leading position they have built up and has kept till now. In the evaluation it is pointed out that specialisation is a trend in the industry, with concentrations on special products or product areas. This has consequences for the industrial research and exchange of knowledge across subject borders. Another trend that is observed is that Sweden is not in the forefront in many of the new research areas.

In the report “Inspiration to Innovation – technology and knowledge towards 2020” the panel has identified eleven clusters of fields that they evaluate to have significant importance for Sweden in a 15-20 years’ perspective, evaluated in accordance with knowledge level, present trade and industry, and conditions in the market. The fields that are within these clusters are:

- Reliable complex systems
- Mechanical systems and structures
- Interactive technique
- Functional material
- Environment- and life circle technology
- Movable energy supply
- Fixed energy system
- Security and protection
- Sustainable food production
- Accessible IT
- Health- and public health service.

It is important that ideas and research results are being transformed to usable forms such as techniques, systems, products and services, and not just come to a stop as research programmes and as pure knowledge building.

Today Sweden has possibilities to keep its position in many of the present areas and take leading positions in some of the new fields that are identified, but to utilise these possibilities it is necessary to select the right areas, and make clear strategies for how they can come in leading positions in these fields.

The conclusion from the panel is

“We are convinced that technique and research can contribute to an increased wealth in Sweden with the help of guiding visions, clear goals and actions, strong prioritisations, a structured innovation system in addition to increased collaboration between trade and industry and research across borders”



*To inspire the next generation of researcher is necessary for further progress in the development.
Photo: Swedish Space Board/Jan Carlsson*