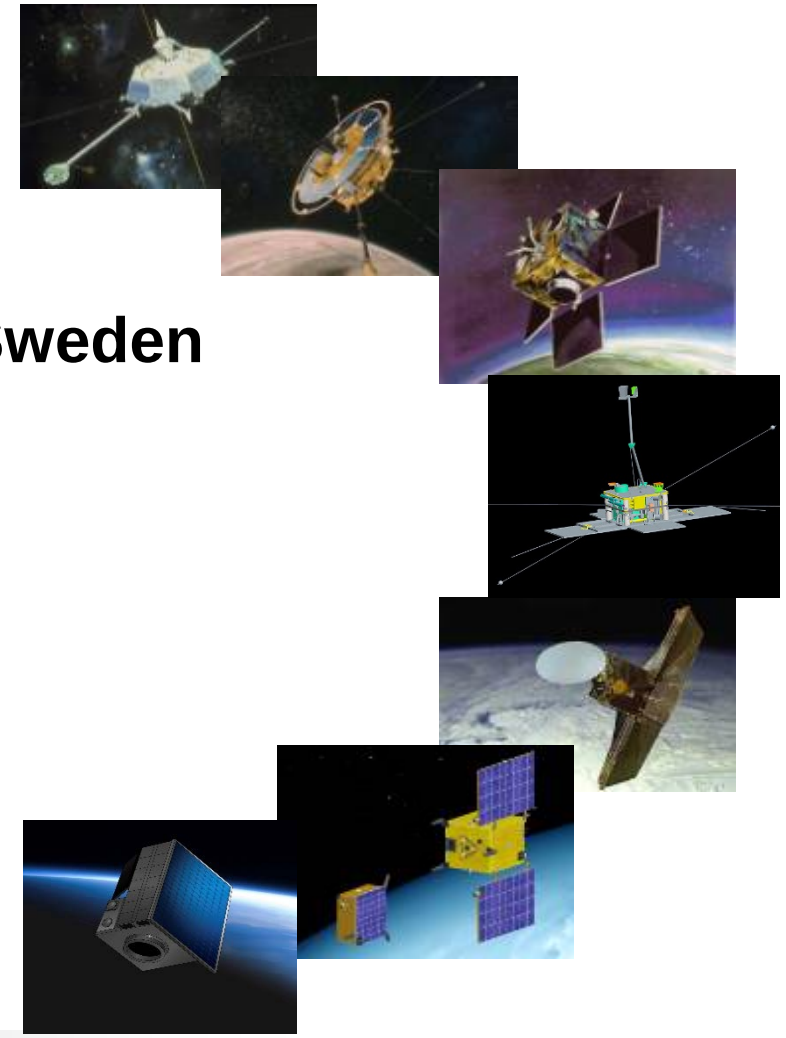
Innovative research satellites in Sweden

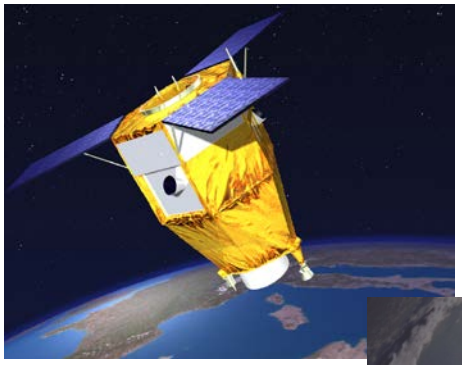
Dr. Olle Norberg
Director-General
Swedish National Space Board

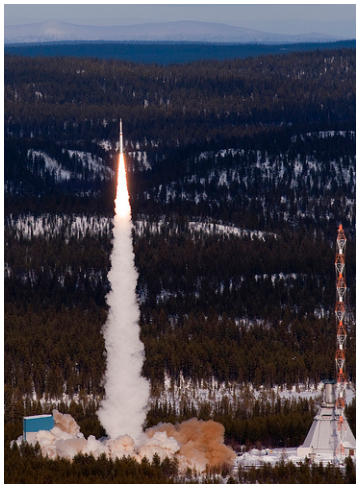


RYMDSTYRELSEN
Swedish National Space Board

Swedish National Space Board

- Governmental space agency under the Ministry of Education and Research
- Responsible for national and international activities related to space and Earth observation
- Satisfy Sweden's need of space infrastructure
- Promote Swedish space industry and space research
- Annual budget ~100 M€
- Established in 1972





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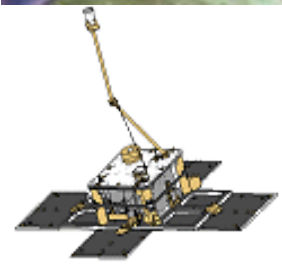
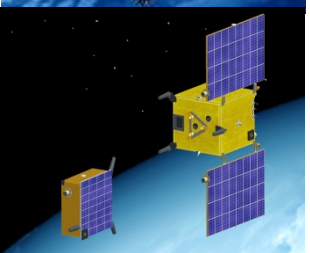
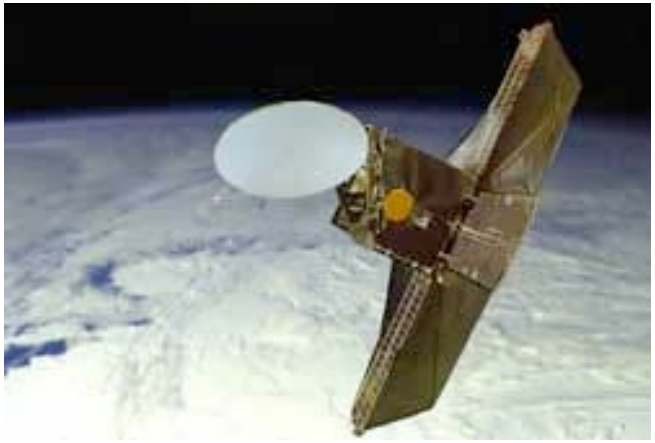
National/multilateral scientific satellites



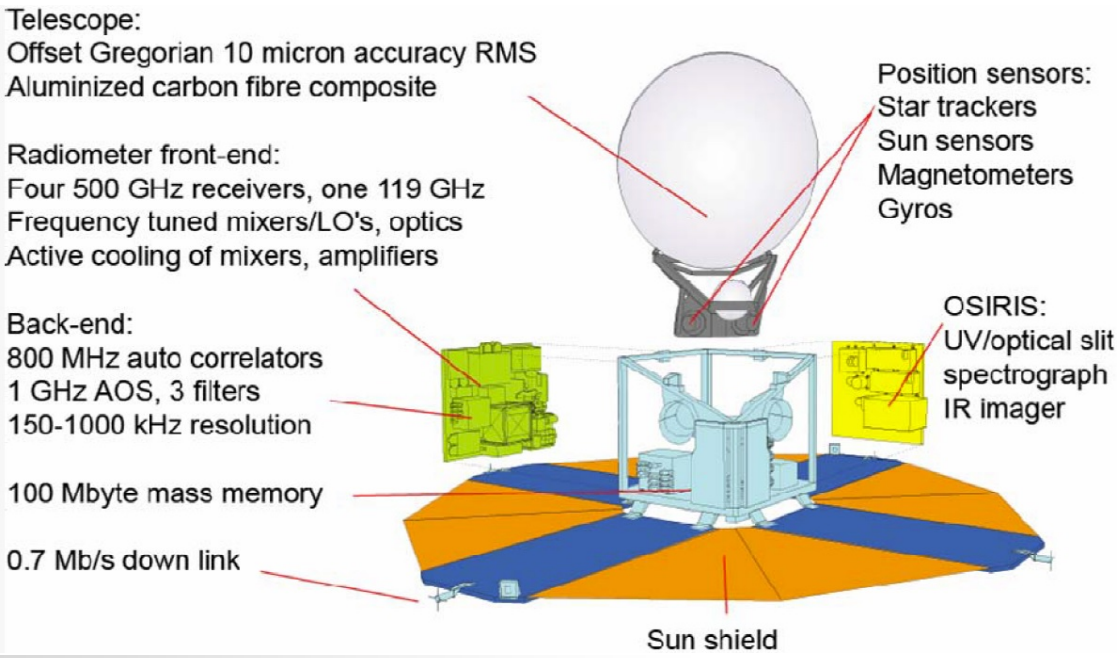


Viking	Sweden	1986-1987
Freja	Sweden, Germany	1992-1996
Astrid	Sweden	1995-1995
Astrid-2	Sweden	1998-1999
Munin	Sweden	2000-2001
Odin	Sweden, Canada, Finland, France	2001-
Prisma	Sweden, France, Germany, Denmark	2010-2015

Odin



- Radiometer for studies of the atmosphere and astronomical objects.
- Launched on 20 February 2001, close to 16 years in operation.
- 405 Articles (364 Atmosphere, 33 Astronomy)
- 25 PhD theses
- 28 Master theses



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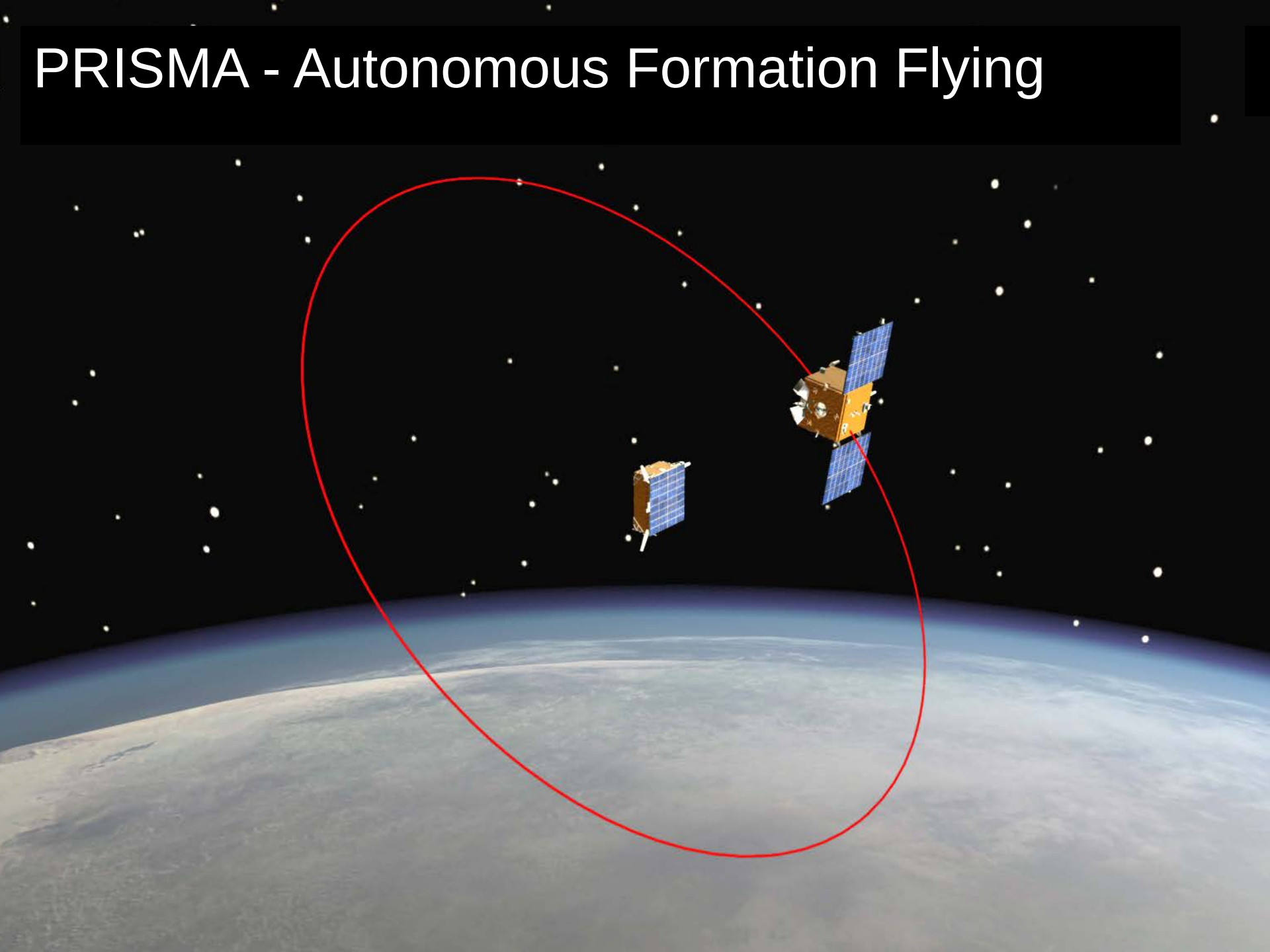
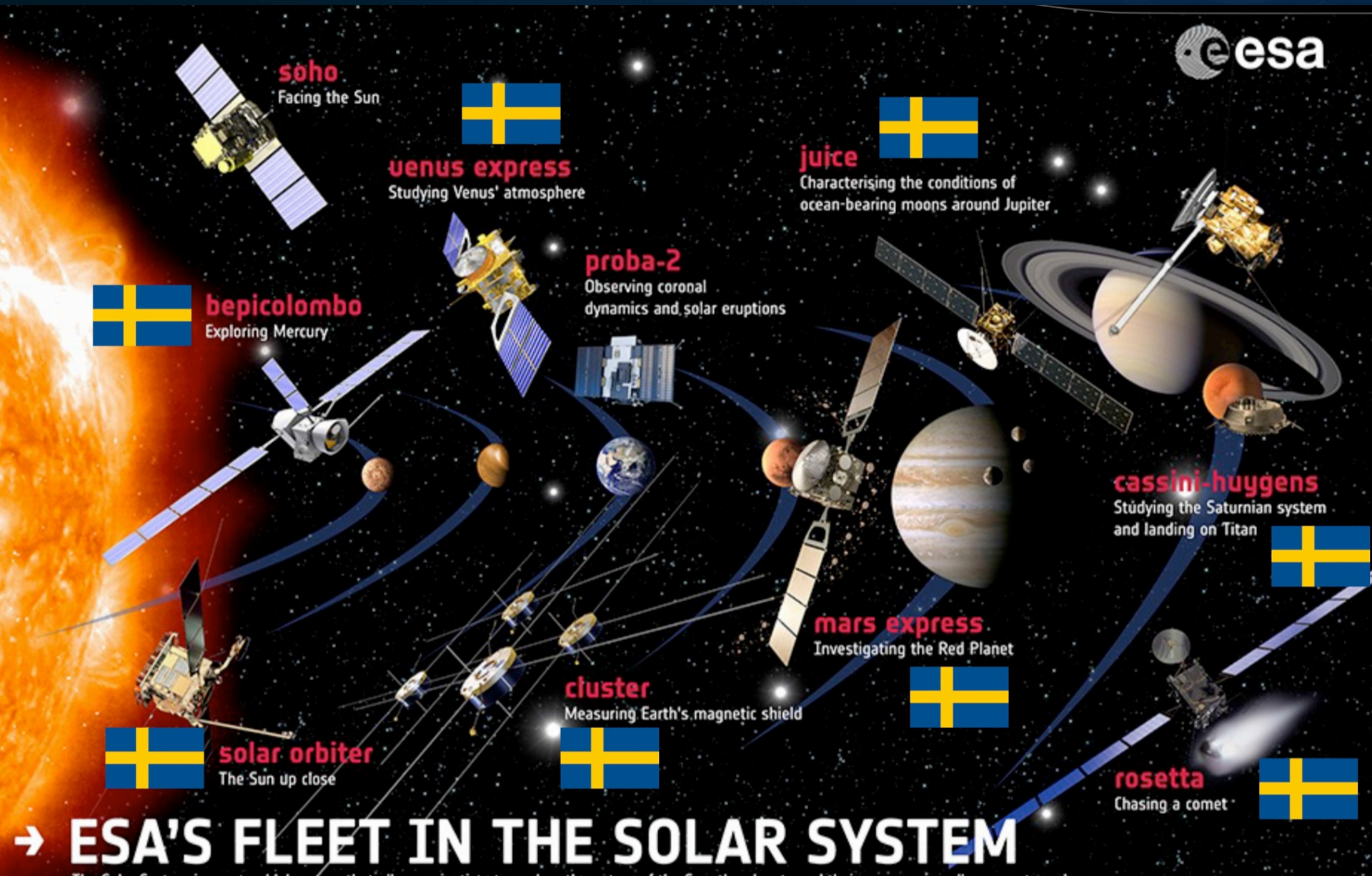
PRISMA - Autonomous Formation Flying



Contributions from Swedish scientists to ESA space science projects

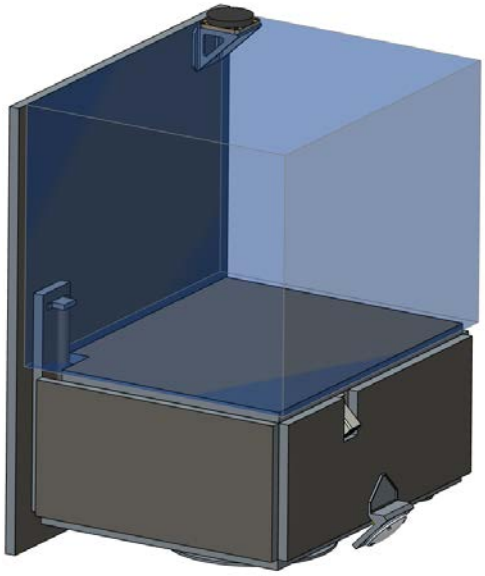



JUICE

InnoSat platform

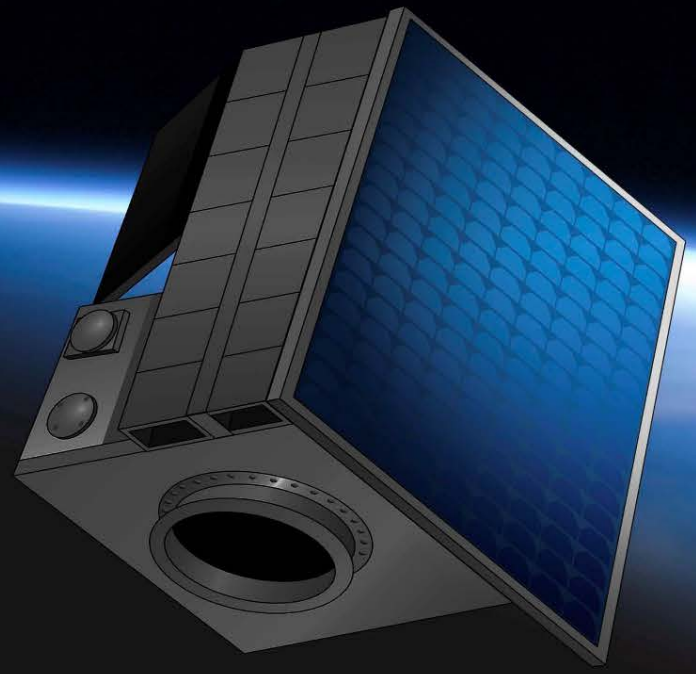
Baseline specification:

- Payload mass: 15 kg (total mass 40 kg)
- Payload size: 65×53×43 cm
- Power: 45 W on orbit average
- Data volume: 180 MBytes per day
- Limb pointing accuracy:
  5 km absolute pointing error
  0.5 km absolute knowledge error
- Sun-synchronous polar “terminator” orbit
- Lifetime: 2 years



First mission is MATS

- Mesospheric Airglow/ Aerosol Tomography and Spectroscopy
- Studies of waves in the middle atmosphere and their influence on climate
- Mass: ~40 kg
- Low cost, around 12 M€ incl. instruments
- Launch: 2019



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Current developments, future outlook

- Second call for proposals using the InnoSat platform for launch in 2021. Improved power capability allows wider range of orbits.

- Candidates under study during 2017:
  - **DICE** – Dual-frequency Ice Cloud Explorer, providing climate data for ice cloud characteristics.
  - **SIW** – Stratospheric inferred winds, a small satellite to explore middle atmospheric wind structure and related constituents fields.
  - **SPHINX** – Satellite polarimeter for high energy X-rays, opening a new window on the brightest explosions in the universe.

- University cubesats being developed as well

- Policy for avoiding space debris – orbit decay within 25 years

Orbital launches from the Esrange Space Center?

Conclusions

- Experimental scientists have progressed from;
  1. Sounding rockets and stratospheric balloons
  2. Satellites (small, low-cost, national, focused)
  3. Large international, interplanetary missions
- Constant need to maintain the two first options in order to;
  - Develop new scientific groups in new disciplines
  - Develop new instrumentation, qualify for flight
  - Maintain proficiency in managing projects, groups, students
- Excellent opportunities for industry to work together with academia on advanced projects.