

Finland in Space

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The 2014 report to COSPAR marked also 50 years of Finland as member of the Committee on Space Research (COSPAR) and outlines its space activities from the very beginning. The detailed report is available on the website of the Finnish national Committee of COSPAR. [1], a brief summary is presented here.

Policy

Finnish space activities fall in the areas of space research, Earth observation, navigation, telecommunication, and instrument development. International and national collaboration continues to be at the heart of the Finnish space strategy: Finnish membership in the European Space Agency and targeted participation in the ESA programs forms the backbone of the Finnish space activities. Opportunities offered by Finland's membership in the European Meteorological Satellite Organization (EUMETSAT) and European Union whose space activities are rapidly increasing guide the strategic choices also in the national arena.

Tight collaboration between universities, research institutes and companies are fostered and developed in different sectors of the space segment from instrument building to scientific exploitation of the data, product and service development. Space science is in a research-intensive phase, as ESA missions such as Cluster, SOHO, MarsExpress, and Venus Express continue to bring results on the processes by which solar activity influences the space environment of the Earth, Mars and Venus, Planck has completed its full sky surveys, and the community is actively preparing for upcoming astrometric measurements from Gaia and cometary data from Rosetta. In Earth observation, a major milestone was reached when Envisat completed its decade of observations and the full and rich dataset now is exploited in conjunction with other still ongoing missions such as NASA's EOS program satellites. The space strategy emphasizes opportunities for new businesses in the space sector. For example, navigation, communications and remote sensing service industry are all heavy users for space technology. Several small enterprises are already operative in the field of navigation, new opportunities are offered by the new navigation systems from Europe (Galileo), Russia (Glonass) and China (Compass). The use of Earth observation data utilization in commercial products is both increasing and transferring from research institutes to commercial activities. Strong research institutes in the field support the growth of the private sector.

Applications based on remote sensing, satellite communications and navigation aim for global business. However, they are equally important in securing the safety of the people (e.g., marine safety, forest fires, landslides, etc.), operations of the society (seafaring in icy conditions, hydropower generation), or economical activity and environmental protection (mining activities, global change). Participation in European Galileo and Copernicus programs and GEO (Group on Earth Observation) is a vital element to gain access to the vast body of observations needed for these services to be useful.

Space assets are also important in guarding the safety and security of the society including monitoring of environmental changes as well as managing rescue missions or logistic services. In order to reach these strategic aims, we have identified several key areas that Finland will focus on in the next year to come: • Development of space-based applications for Arctic regions; • Opening positioning data to foster growth of applications industry; • Active participation in ESA and EU space research programmes to increase the impact of basic research; • Increasing the volume of the space industry by specialization.

Programs and Co-operations

Finnish space science instrumentation and industrial participation in ESA space science missions as well as international co-operations are listed in the following tables

Programme	Finnish participation	Schedule
SOHO, ESA Solar and Heliospheric Observatory	SWAN and ERNE instruments	Launched 1995
Cluster / Cluster-2, ESA 4-spacecraft magnetospheric mission	EFW instruments; satellite power system electronics units	Launch failure 1996, launched 2000
Huygens, ESA descent module to Titan in the NASA/ESA Cassini/Huygens mission	HASI instrument; ESA funded radar altimeter	Launched 1997, descent 2005
XMM-Newton, ESA X-ray mission	Telescope structure and satellite electronics	Launched 1999
Integral, ESA gamma-ray mission	JEM-X instrument	Launched 2002
SMART-1, ESA Moon mission	XSM and SPEDE instruments	Launched 2002
Mars Express, ESA Mars mission	ASPERA-3 instrument, participation in Beagle-2 lander; satellite power electronics	Launched 2003
Rosetta, ESA cometary mission	COSIMA, PP, MIP instruments and lander CDMS; satellite structure and power electronics	Launched 2004
Venus Express, ESA Venus mission	ASPERA-4 instrument participation; power distribution units for spacecraft	Launched 2005
Herschel/Planck, ESA infrared and cosmic mission	LFI microwave receivers onboard Planck; mirror polishing for Herschel, onboard software for both	Launched 2009
Galileo GIOV	electronics for two navigation satellites	Launched 2012
GAIA, ESA Galaxy mapping mission	Electronics and software	Launched 2013
LISA Pathfinder, ESA test mission for gravity wave observations	Solar array structures	Launch 2015
BepiColombo, ESA/JAXA mission to Mercury	PI of SIXS, participation in MIXS (X-ray instruments), participation in SERENA particle instrument.	Launch 2017
Solar Orbiter	Power control electronics	Launch 2018
Euclid	ESA dark energy mission data analysis (ground) system	Launch 2020

Programme	Finnish participation	Schedule
EOPP	Earth Observation technology programme	1986 -
EOEP	Earth Observation Envelope Programme developing scientific Earth observation satellites	1998 -
Earth Watch - GMES	Global Monitoring of Environment and Security - collaborative programme by ESA and EU (Sentinels 1-5 missions)	2001 -
Earth Watch - Infoterra/TerraSAR	Synthetic Aperture Radar mission development programme	2001 -
ENVISAT-1, ESA environment mission	Software and hardware for GOMOS observation instrument.	Launched 2002
Meteosat Second Generation (MSG-1)	Software for the satellite platform, hardware for the SEVIRI observation instrument.	Launched 2002
METOP-A, -B and -C, ESA/EU-METSAT polar orbit weather satellite series	GOME-2 instrument electronics and satellite bus S/W development.	Launched 2006, 2010, 2015
GOCE, ESA Gravity Field and Steady-State Ocean Circulation Mission	Onboard software	Launched 2009
SMOS, ESA Soil Moisture and Ocean Salinity	Radiometer modules, aircraft campaigns for reference measurements	Launched 2009
Cryosat-2, ESA Radar altimetry mission	Secondary structures	Launched 2010
SWARM, ESA Earth magnetic field measurement mission	Power distribution unit	Launched 2013
Sentinel 1 (ESA and EU)	SAR-radar	Launched 2014
Sentinel 3 (ESA and EU)	solar array structures	Launch 2015
Sentinel 2 (ESA and EU)	electronics	Launch 2015
ADM-Aeolus, ESA Atmospheric Dynamics Mission	Instrument electronics	Launch 2015

Programme	Finnish participation	Schedule
ARTES 1	System analysis and market surveys	1993 -
ARTES 5	Telecommunication systems and equipment technology programme	1994 -
ARTES 8	Large platform development - telecommunications satellite programme (Alphabus)	2002 -
ARTES 9	Galileo satellite navigation system development	1998 -
ARTES 11	Small geostationary orbit telecommunications satellite development programme	2006 -
ARTES 20	Integrated Application Promotion - applications relating to, e.g. the Baltic Sea	2009 -
ARTES 14	NEOSAT geostationary orbit telecommunications satellite development programme	2012 -

Programme	Main Partners	Finnish participation	Schedule
Phobos, Soviet mission to Mars and Phobos	USSR, SE, D	Electronics for ASPERA instrument and test system for LIMA-D instrument	Launched 1988, mission ended
Freja, Swedish magnetosphere mission	SE	Plasma and wave instruments	Launched 1992, mission ended
Astid-1, Swedish microsatellite	SE	Instrument electronics	Launched 1995, mission ended
Interball, Soviet/Russian magnetosphere mission	USSR/ RUS, SE	Electronics for Promics-3 instrument	Launched in 1995 and 1996, mission ended
Polar, NASA magnetosphere mission	USA	Mechanisms for EFI instrument	Launched 1996
Mars-96, Russian Mars mission	RUS	Central electronics units, sensors and software for two landers	Launch failure in 1996
Cassini, NASA Saturn mission	USA	Hardware for IBS, CAPS and LEMS instruments	Launched 1997
Space Shuttle	USA	AMS instrument	Launch 1998
Stardust, NASA heliospheric mission	USA	CIDA instrument	Launched 1999
Mars Polar Lander, NASA Mars mission	USA	Pressure instrument	Launched 1999, landing failure
Odin, Swedish-led atmospheric and astronomy mission	SE, F, CAN	119 GHz receiver and antenna measurements	Launched 2000
EOS-Aura, NASA EO mission	USA	OMI instrument	Launched 2004
Phoenix, NASA Mars lander	USA, CAN	Pressure instrument	Landed 2008
TWINS, NASA magnetosphere mission	USA	Scanning mechanisms for TWINS instruments	Launched 2007 and 2008
TerraSAR-X and Tandem-X, German EO mission	Germany	Leaf amplifiers for the SAR-radars	Launched 2007 and 2010
Chandrayaan-1, Indian Moon mission	India, UK	XSM-instrument	Launched 2008
Mars Science Laboratory	USA, E	Pressure and humidity instruments	Launched 2011
Mars MetNet Precursor Mission	RUS, E	Novel landing station(s) to be carried onboard Phobos Grunt	Launch 2016
BepiColombo MMO, JAXA part of the ESA/JAXA Mercury mission	Japan	Participation to MEFISTO-instrument	Launch 2015



Reference: [1] <http://www.cospar.fi/report>