

Project

Omnisys Instruments

Company Presentation

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1 Company Description

Omnisys Instruments AB is a private company founded 1992. The company has 32 employees and its major business areas are customized scientific instrumentation for research applications. Main fields are satellite based research and ground based radio astronomy. Major clients and partners are European Space Agency (ESA), Swedish National Space Board, Airbus D&S and European Southern Observatory (ESO). The company is owned by the company management, Stefan Andersson and Dr Anders Emrich, founders and technical directors and Martin Kores, CEO. The organisation is shown in the organigram below.

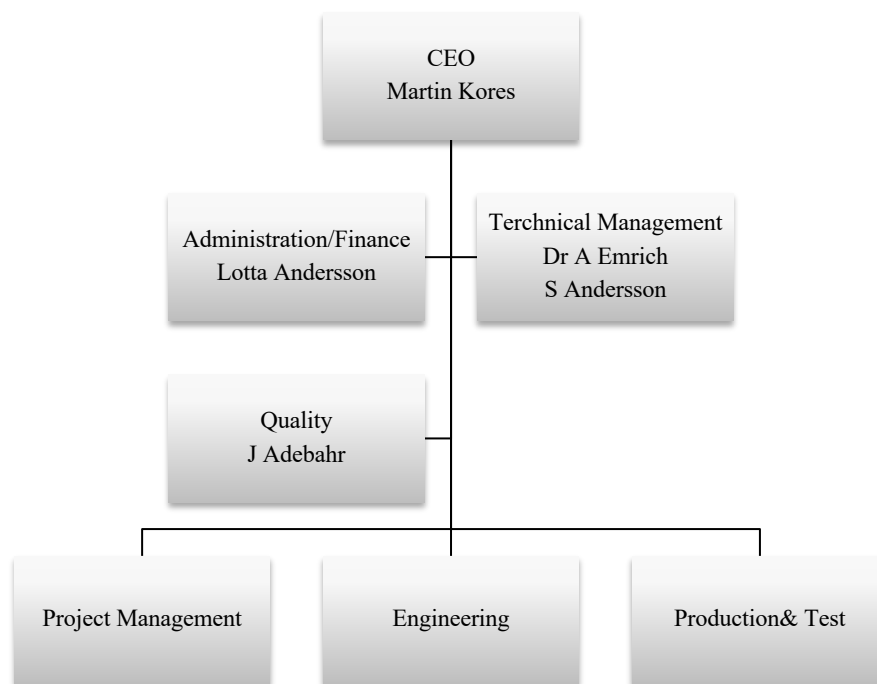


Figure 1: Organisation chart of Omnisys Instruments AB.

2 Background and Experience

Omnisys' main operations are development and production of high performance electronics hardware for space research and ground based radio astronomy. Omnisys competitive advantage in developing state-of-the-art technology solutions is enhanced by continuous research collaborations with Chalmers University of Technology. Omnisys has delivered space flight hardware for all three recent Swedish satellite projects, i.e. ODIN, SMART-1 and PRISMA. Omnisys has also delivered hardware to the SMILES instrument on ISS. Ongoing flight contracts comprises hardware contributions for ESA MetOp Second Generation and the Sub Millimetre Wave Instrument at JUICE as well as the Swedish research satellite MATS and the HABIT instrument for Exomars.

2.1 Odin

Omnisys was responsible for the development, design, manufacturing and testing of several sub-systems for the ODIN satellite during 1993-1998. These incorporated analog and digital full custom ASIC's, several embedded computers and 10 FPGA devices. In addition, advanced micro-wave designs and precision analog electronics were incorporated. The payload consists of a very sensitive radio receiver, with five bands between 100-600 GHz, using cryogenically cooled receivers. EMC aspects were of particular importance in the design as well as thermal design constraints and radiometric stability.

2.2 SMART-1

Other experience is from the SMART-1 project, where Omnisys has been responsible for the design and production of the PCDU, a major subsystem for the satellite/probe. Although the probe is rather small, less than 450 kg, it has a power budget of more than 2000 W, and distribution to 41 subsystems. With restrictions in size and mass, considerable requirements on design and implementation of such a device has been complied with.

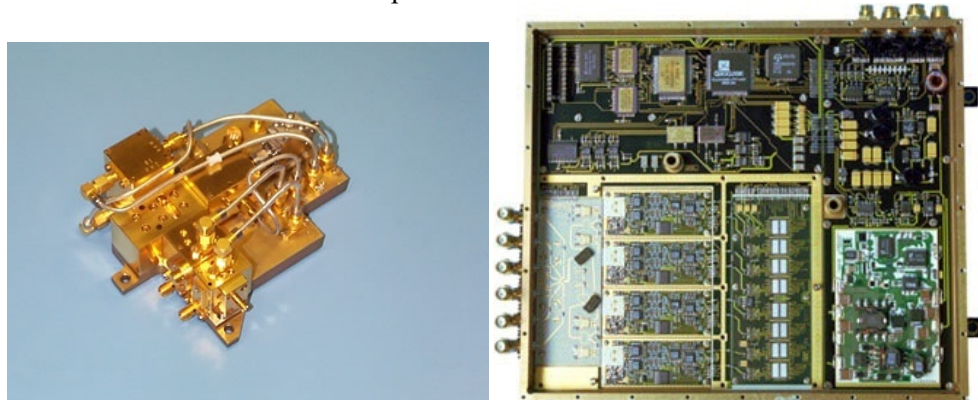


Figure 2-1: ODIN front-end unit (FM) and spectrometer (FM).

2.3 PRISMA

Omnisys has also been responsible for the development, production and delivery of the Prisma Main and Target PCDU's, under a SSC contract. The formation flying Prisma satellites were successfully launched in June 2010.

2.4 Geosounder

In two consecutive contracts for ESA, Omnisys has developed hardware for the Geostationary Atmospheric Sounder (Geosounder) instrument. The final Geosounder instrument will be a microwave interferometer at 53, 118, 183 and 380 GHz with hundreds of miniaturized receivers on a foldable rotating array. The first project, successfully completed in 2010, contained 20 dual polarisation channels at 53 GHz. A parallel MMIC receiver development activity was performed with integrated single chip MMIC receivers for 118 and 183 GHz. In a recently finalized contract, Omnisys developed an instrument with an ASIC based cross correlator backend consisting of 24 183 GHz receivers. The instrument was integrated in a joint ground based demonstrator together with



National Space Science Center in Beijing, China where the Chinese contribution was a corresponding 53 GHz channel instrument.

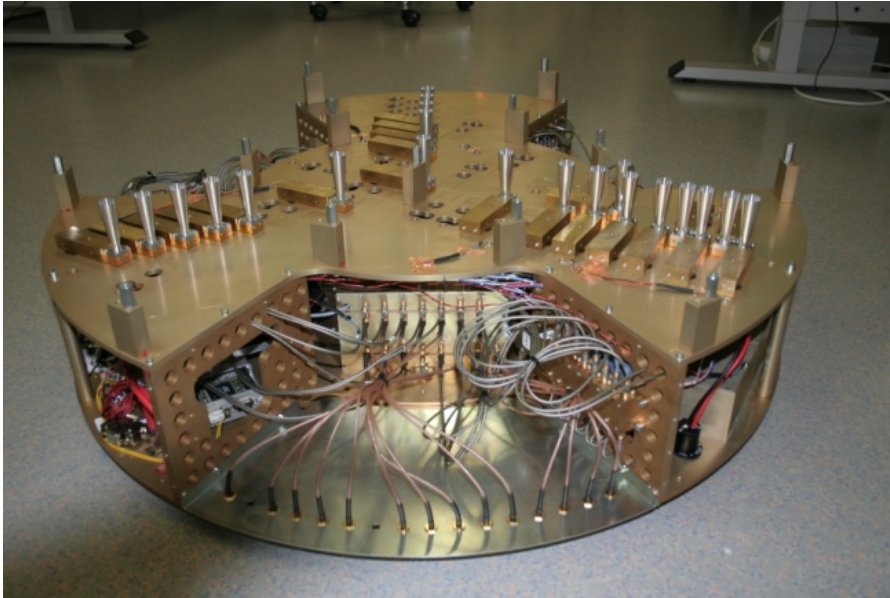


Figure 2-2 GEO MS 50GHz demonstrator during assembly

2.5 ALMA Water Vapour Radiometers

In 2007 Omnisys was awarded by ESO with the contract for 58 water vapour radiometers for the ALMA interferometer telescope in Chile. The radiometers operate at 183 GHz to estimate propagation delay caused by variations in water vapour in the line of sight for each telescope antenna. The project scope is design and manufacturing of 58 complete radiometers which of course put significant demands on building THz instrumentation in an industrial and cost-efficient scale, still keeping the high requirements on performance and reliability. The development was achieved in 18 months followed by another 18 months production phase.

Omnisys WVR delivery received excellent review conclusions in the ALMA project, both in terms of performance, reliability and ease of operation for the WVR's, but also for the Product and Quality Assurance in the project.

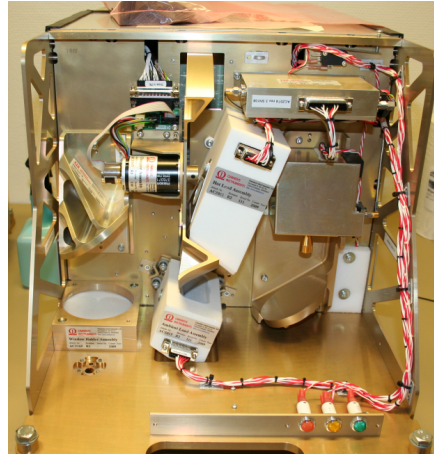


Figure 2-3 ALMA 183GHz water vapour radiometer including calibration subsystem, LO and complete front end.

2.6 STEAMR

STEAMR is microwave radiometer instrument aimed for a potential follow-up to the Odin mission. Omnisys has been responsible for various STEAMR development activities between 2008 and 2013, including breadboarding and demonstrator development. Several different implementations with the HIFAS chip have been made.

3 Recent and ongoing deliveries

3.1 SWI for JUICE

Omnisys develops 2 subsystems for the Submillimetre Wave Instrument (SWI) for ESA's JUICE mission. JUICE will explore the atmosphere around the Jupiter moons Ganymede and Europa

The subsystems are a 600 GHz front-end mixer with integrated Low Noise Amplifier and a wide band digital spectrometer.

3.2 Metop SG

During 2015 Omnisys was awarded with an ESA contract to deliver receivers to Europe's next generation of meteorological satellites, the MetOp Second Generation satellites. All Omnisys design, manufacturing and assembly processes are approved by Airbus DS during this development.

3.3 MATS

MATS, (Mesospheric Airglow/Aerosol Tomography and Spectroscopy) is an optical (IR + UV) telescope which is the complete scientific payload for the next Swedish research satellite. To be launched in December 2019.

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3.4 HABIT

HABIT, (HabitAbility: Brine, Irradiation and Temperature) is a weather station and brine measurement instrument (complete scientific payload) to be integrated into the ESA Exomars Surface platform.

3.5 GUSTO

(Galactic/Extragalactic ULDB Spectroscopic Terahertz Observatory). Omnisys delivers a multi-channel Autocorrelation Spectrometer, ACS, to NASA financed high altitude balloon astronomical experiment over the south pole.

3.6 Arctic Weather Satellite

Omnisys is prime contractor for the radiometer instrument for the ESA Arctic Weather Satellite (AWS) mission. AWS is a forerunner to a constellation of 16 satellites with microwave sounder payloads. The AWS constellation will provide frequent coverage of Earth for improved nowcasting and numerical weather prediction. It will carry a cross-track scanning microwave radiometer and provide measurements of atmospheric humidity and temperature.

4 Facilities



Figure 4 Omnisys laboratory

Omnisys Instrument has a cleanliness controlled area since 2010. It features mounting and soldering stations, chemistry area and test facilities such as benches for functional tests, thermal vacuum chamber and a XYZ-scanner for quasi optical tests. The personnel are ESA certified for manual soldering, inspection and repair.

4.1 Production and Inspection

The in-house production and inspection equipment consist of:

- Fully equipped solder rework station

- Laminar flow workbench and particle counter
- Manual wedge bonder
- Manual die bonder
- Bond pull and die shear tester
- MCM probe station
- Convection reflow oven
- Visual inspections system with digital camera interface
- Pre tinning / de-golding
- PCB and mechanics cleaning facility
- PCB-milling machine (LPKF)
- Vacuum and thermal test chamber
- Three burn-in and test ovens

4.2 Test and Measurement

The test and measurement instrumentation consist of:

- LabVIEW work stations with internal and external analogue/digital I/O
 - Several oscilloscopes up to 10 GS/s sampling (TDS7104,TDS420A)
 - Vector and linear Network analysers up to 70 GHz (VectorStar MS4647A)
 - Spectrum analysers (HP8563E, Anritsu MS2602A),
 - Erickson Power Meters (70-800 GHz)
 - Several CW sources between 0-190 GHz
 - Optical/antenna test bench with 55 dB dynamic range, 2x1x1 meter test range with 0.1 mm accuracy with laser alignment.
 - Ambient and LN2 loads reference loads covering at least 80-400 GHz.
 - Power Electronics Test Equipment for 2-4 kW
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- Vacuum chamber with thermal regulation between -20 to +80 degrees with 100 DC feedthroughs and RF feedthroughs up to 18 GHz.



Figure 5 Test and measurement facilities.

4.3 Software

The software tools consist of:

- Altium Designer, Schematic Capture and PCB layout
 - ICAP/4, Intusoft, Spice simulator, HSPICE, Synopsys Microwave design
 - GENESYS, Eagleware, Microwave design
 - Microwave Studio, Microwave design
 - ADS, Microwave design (through GHz Center)
 - HFSS, 3D electromagnetic simulation (through GHz Center)
 - VIRTUOSO, Cadence, ASIC design
 - SolidWorks, Mechanical design including thermal simulation
 - MATLAB, The Mathworks, Calculation
 - LabVIEW, National instruments, Test and measurement software
 - Subversion, Apache, Version Control System
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4.4 Mechanical Workshop

Omnisys has its' own set of tools used for this machine for milling of our most fine precision mechanics such as THz receivers. The precision of the machine is better than 1 um.



Figure 6 KERN Micro, high precision milling machine.

5 External collaborations

5.1 Vibration, Shock and EMC Facilities

Omnisys has a successful collaboration with RUAG Space in Göteborg and has several times utilized their vibration facilities for different flight projects. They also have EMC measurement equipment which Omnisys has used for both ground-based and flight projects.

The SP Technical Research Institute in Borås is also a possible partner for vibration and shock which Omnisys also has previous successful collaboration with.

5.2 Radiation Facilities

Sahlgrenska University Hospital, located 5km from Omnisys, has a Cobalt-60 source for total dose radiation tests. Omnisys has good relations with Sahlgrenska and has previously used their facilities for different flight projects.



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5.3 External mechanical machining

As a complement to our in-house workshop, Omnisys has a long term cooperation with Hagemma, a mechanical workshop not far from Omnisys. Hagemma has recently procured a new milling machine, KERN Micro, as a result of this cooperation and the increased demand for machining tolerances from Omnisys.