Press

Presse

The world is not enough: Micro valves in their way to mars...

Has life existed on Mars, or does it even still exist? Does all life on our blue planet stem from extraterrestrial origin? These are questions mankind is currently posing itself. We are gradually coming close to finding answers, as space flight has been gaining momentum in recent years. Micro valves are an essential component of space missions. The world is not enough for such valves…

The 28 valves of the European Space Agency's (ESA) „Rosetta“ space probe have had a turbulent history. Over the course of a decade, they travelled more than six billion kilometres. In August 2013, the Rosetta space probe finally reached its destination: the comet Tschurjumow-Gerassimenko. Since then, the probe has been orbiting the comet in a distance of six to 30 kilometres. The comet itself has a diameter of five by three kilometres. Both the probe and the comet are now travelling towards the sun.

First landing on a comet

The space probe is equipped with eleven scientific instruments, in order to examine the chemical composition of the coma, and determine the densities of noble gases helium, neon, argon, krypton and xenon. Based on the gas densities, scientists are able to determine data on the environmental temperature and time of the comet's formation. The coma is being further examined for content of atomic or ionised oxygen, hydrogen, nitrogen and carbon. Rosetta already discovered how water and carbon dioxide molecules rapidly breakup, and are then emitted into the comet's atmosphere.

VALVE WORLD EXPO DÜSSELDORF

Düsseldorf, Germany
29 Nov – 01 Dec 2016
10. Internationale Fachmesse mit Kongress für Industrie-Armaturen
10th Biennial Valve World Conference & Exhibition
www.valveworldexpo.com

Valve World 2016 CONFERENCE

Messe Düsseldorf

Messe Düsseldorf GmbH
Postfach 10 10 06
40001 Düsseldorf
Messeplatz
40474 Düsseldorf
Germany

Telefon +49 (0) 2 11/45 60-01
Telefax +49 (0) 2 11/45 60-6 68
Internet www.messe-duesseldorf.de
E-Mail info@messe-duesseldorf.de

Geschäftsführung:
Werner M. Dornscheidt (Vorsitzender)
Hans Werner Reinhard
Joachim Schäfer
Bernhard Stempfle
Vorsitzender des Aufsichtsrates:
Thomas Geisel

Amtsgericht Düsseldorf HRB 63
USt-IdNr. DE 119 360 948
St.Nr. 105/5830/0663

Mitgliedschaften der Messe Düsseldorf:

The global Association of the Exhibition Industry

Ausstellungs- und Messe-Ausschuss der Deutschen Wirtschaft

FKM – Gesellschaft zur Freiwilligen Kontrolle von Messe- und Ausstellungszahlen

Öffentliche Verkehrsmittel:
U78, U79: Messe Ost/Stockumer Kirchstr.
Bus 722: Messe-Center Verwaltung

In space, Rosetta is not alone: the probe transported the lander “Philae”. The miniature laboratory landed on the comet in November 2014 – the first ever landing in the history of mankind. However, it landed on a spot with a lot of shadow. As a consequence, Philae went into hibernation after two and a half days, due to lack of power. More than half a year later the lander woke up from hibernation and is meanwhile sending data back to earth. Philae is transmitting again!

Cosmic refrigerator

This was a lucky thing, as Philae and Rosetta have to bring an important mission to an end: the results could help explain the origin of life on earth. Or, in different words: how life possibly came from space unto planet earth.

Comets are seen as “index fossils” of our solar system. “They were created 4,5 billion years ago, together with the sun and the planets, but in contrast to them, they haven't changed,” explains Berndt Feuerbacher, director emeritus of the Institute of Space Systems at the German Aerospace Center (DLR). Comets are situated in a sort of “cosmic refrigerator” at the outskirts of our solar system – at temperatures close to absolute zero, Feuerbacher adds.

Cometary impacts

They can give insights of great significance. Research results could show if life came from space, to earth. Astronomers assume that comets contain complex organic carbon compounds – that are the basic elements of life. They could have been brought to earth by way of cometary impacts.

Philae is equipped with cameras to document the surroundings. “A drill takes samples from under the surface and analyses them in mass spectrometers or gas-phase chromatographs, in order to characterise the original material of our solar system,” reports Feuerbacher of the DLR. The inner of the comet nucleus was

examined with a penetrator, with ultrasound and microwave tomography.

28 silicon valves

A closer look at the lander Philae is also worthwhile: it is loaded with 28 valves Hoerbiger developed for use in extreme conditions. „Each weighs less than two grams and is designed for a temperature range between -60 to +220 degree Celsius," explains Dr. Jochen Schaible, the leading project manager. These are 2/2 way silicon valves that are monostable and powerless open. Its dimensions are 10 x 16 x 5.4 millimeters. The valves, located behind a cappucino-coloured plastic casing, have a dead volume of less than 50 microliter and a circuit time of 1 millisecond. "Valves furthermore need to be extremely light and compact, hardly require power and need to work virtually leek free," adds Dr. Fred Goesmann of the Max-Planck Institute for Solar System Research (MPS).

The valves have the extremely important function of regulating the gas flow in the analysis process, where they work as a control valve for the gas chromatograph. An injector introduces the gaseous substances into a flow of carrier gas, that streams through a system of thin stainless steel and silica glass tubes, the capillaries. "The capillaries are coated with a special material on the inside, that reacts differently to the molecules flying past and slows them down," states Hoerbiger. This leads to characteristic transit times for each type molecule. A detector unit is fitted to the end of the capillaries, which conveys information on the molecules found. A mass spectrometer connected to the system is used for further analysis.

Rosetta mission extended

As space technology is both complex and demanding, partners need to collaborate: as industry partner of Hahn-Schickard, Hoerbiger initiated research and development projects in the field of microsystem technology earlier than others, says project manager Schaible. Based on research performed at Hahn-Schickard, a

silicon valve was developed ready to go into production in 2002. Schaible: “And this type met the requirements of the Max Planck Institute for Solar System Research”.

Rosetta and Philae still have enough tasks to perform. The mission was extended by nine months, until September 2016. If everything goes as the European Space Agency (ESA) hopes for, the mission will come to a spectacular end: Rosetta itself is supposed to land on the comet, following in the footsteps of its lander Philae, the lander it transported for twelve years. A memorable end for a historic mission, that perhaps might bring further answers to the origin of life on earth, and on the early period of the solar system.

ExoMars programme, with valves

The next major programme is already being prepared: “ExoMars” will search for life, both past and present. It will study the biological environment of Mars, and its soil.

The first mission will begin in January 2016. A satellite will travel 225 million kilometres, until it reaches Mars after nine months flight. A small module is used to test landing technologies, while Orbiter analyses the planet's atmosphere. The second mission will see two rovers land on Mars, where they will examine the planet independently of each other. As a matter of course, both missions require valves – once again made by valve manufacturer Hoerbiger.

Extreme conditions

Despite numerous advances in space technology, there still are numerous unknown factors. Testing the resilience of components for rockets, satellites and probes takes place each day. Rocket systems are an example: a major aspect for successful missions is the behaviour of propellants in extreme conditions. Germany's space agency DLR and the European Space Agency (ESA) want to go strike out in a new direction in handling propellants for Europe's future launch vehicles – for instance the Texus 48 sounding rocket.

During a full-fledged simulation of a journey into space, two new Propellant Management Devices for handling super-cold liquid hydrogen and oxygen propellants were tested.

The two test modules carried by the Texus 48 sounding rocket were developed by Astrium. Both of these test modules were equipped with three axial flow valves from Stöhr's Axius series of valves. During the tests, the behaviour of hydrogen and oxygen as liquid fuels for new ignitions was examined. The tests using valves from Stöhr were successful. The Axius valves can be used in operating temperatures between 4K and 323K. Nominal pressure is up to 420 bar, with a control pressure of 6 to 8 bar, optionally up to 40 bar, and the nominal diameters range from DN4 to DN40.

Good prospects

Who only thinks about grand questions of humanity and our solar system when hearing about space missions underestimates the huge economic potential of the industry, in which France plays the leading role in Europe. Germany is the second-largest European space nation, and has great ambitions. The German government put an emphasis on space technology in its Hightech Strategy 2020: space technology is listed as a key technology. “Space technologies are important instruments of a modern information and industrial society,” explains the Federal Ministry for Economic Affairs and Energy (BMWi). Communication and TV, or precise climate and weather analyses are highly dependent on space technologies.

This gives space technologies great economic potential. Turnover for the German industry amounted to 2.4 billion euro, in the year before last. “The perspectives for growth and employment continue to be good in the mid to long term,” underlines the BMWi. In contrast to the aerospace industry and the commercial market it serves, astronautics is financed by state space strategies and the national budget.

Growing competitive pressure

Germany can serve as an example: spending on space technologies was markedly increased in recent years, and consistent investments were made into areas where space technologies contribute to reaching economic, scientific, strategic and societal goals. A main focus of investment for the German government is, for instance, automation.

Independent of public funding of space technologies, competitive pressure in the market is on the rise. Timeframes and cost frameworks are becoming more important in a market developing faster than before. Simulations before and during production are absolutely essential. High expectations are a matter of course for the sector, as the stakes are high: if a space mission fails, the costs are enormous.

A development intensive sector

The outlooks for the develop of space technology are very positive. A development valve manufacturers can profit from. However, one won't be able to enter the market without considerable investments in research and development. The required high tech valves are development intensive, and more often than enough one will boldly have to go where no engineer has gone before. Not only in space, but also in production…

Press Contact Valve World Expo 2016
Petra Hartmann-Bresgen, M.A.
Ulrike Osahon
Tel.: +49 (0)211 4560-541
Fax: +49 (0)211 4560 87 541
E-Mail: HartmannP@messe-duesseldorf.de