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Year 11
Number 2
june 2006
site: www.vrind.be

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Vlaamse Ruimtevaart Industriëlen
Flemish Space Companies

NEWSLETTER

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Realisation with the support of:

Vlaams Innovatienetwerk
met steun van IWT

EDITORIAL

The new file of VRI has been approved by IWT. This means that VRI can continue to work with the support of the Flemish government for the next 4 years.
From the beginning our approach has been very ambitious, but realistic in the mean time. Our aim is to turn the Flemish Space Industry into a competitive expansive sector and our members have realised this.
Since our new start we don't focus only on ESA but as well on the EU, whose role is becoming more and more important.
The recognition of the impact of space research and industry on the Flemish economy is of great interest. There aren't many sectors in which technological innovation and economical success are so closely knit.

VRI's proposal for a renewed support by the Flemish government has been approved. VRI is granted a subsidy covering part of its working costs for a four-year period enabling us to continue the tasks set out ten years ago.
From the start our aims were ambitious yet realistic. Starting from our position as a tiny player on the global market we wanted to become a fast growing industry by building networks within VRI . The members of VRI have succeeded in this challenge.
Our internal organisation was in line with this option: lean and efficient.
But our focus has of course shifted: more technology based and more attention towards the EU whose role next to ESA is growing steadily.
More important than the support for VRI as an organisation is the implicit recognition of the importance of space research and of the space industry for the Flanders region. Rare are the sectors where technological innovation and success on the market are so closely interwoven. Is it therefore too ambitious to consider ourselves as a laboratory for successful innovation? ■

Dirk Breynaert,
president

LIVING IN SPACE

The experience that EPAS has in industrial waste water treatment technology, is already used for 14 years for the development of "Life Support" systems in Space.

Supply
Already for a long time several space organisations as NASA and ESA, prepare scripts for space travel to distant planets. The Moon and the planet Mars seem to be preferred candidates. Such explorations are concerning duration and distance of a different order than a Space Shuttle or a Soyuz flight to the ISS (International Space Station), which is in orbit at a height of 350 km. A flight to and a stay on Mars could take up to 3 years. This means that the life support of the crew can not longer depend on supply by, for instance, an unmanned Progress Spacecraft as for ISS. As on earth, sufficient food, drink and oxygen must be available to survive.
The new generation "Life Support" technologies are inspired by the ecosystems on earth and the industrial technologies to process waste materials for the recovery of raw materials. Such systems are a solution for long duration space stays. This is the framework of the space activities at EPAS. By order of ESA and together with several international technology partners, among which also the VRI members VITO and Verhaert Space, EPAS develops systems for the recycling of water and the production of food from raw materials, made of waste material produced by the crew.

Waste water treatment
Waste water is treated in several steps. During a first step the most important contaminants are removed by aerobic and/or anaerobic micro-organisms which consume organic material. Next, advanced filtration and disinfection technologies make the water suitable again for consumption. These technologies are also used in industrial water treatment . Contaminants that are left in a concentrated stream are instead of dumped further processed to produce raw materials such as nutrients for plant cultivation.

Produce oxygen
The development of completely closed short cycles, requiring no extra supply of materials or products, seem at the moment unachievable. However it is possible to use materials, which are available on the planet or on the moon where the space base is situated. Mars has an extremely thin atmosphere, but is particularly rich in carbon dioxide, which by photosynthesis can be converted into oxygen. On Mars the intensity of photosynthetic radiation is lower than on earth, which causes lower growth velocity of plants. Supplementary illumination with artificial light could be a solution. Another material on Mars is water that is available in the subsoil in the form of ice.

The development of "Life Support" technologies becomes more and more important in the programs of space organisations and EPAS has seized an important pioneer position in this field.

More information on www.epas.be ■

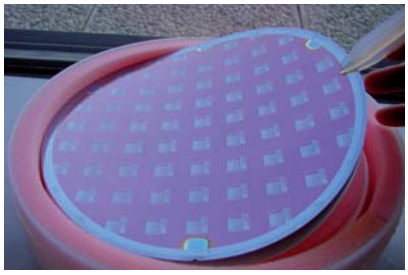
Bioreactor with micro-organisms for the treatment of waste water

Industrial pilot installation for high standard purification of waste water using membranes

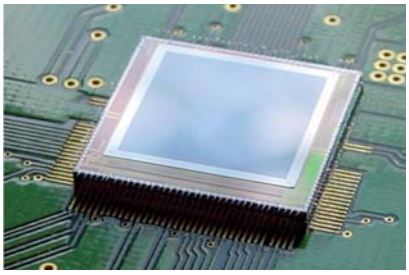
IMEC DEVELOPS THIN CMOS IMAGE SENSORS FOR ESA

The development of CCD (Charge-Coupled Device) optical sensors meant a real revolution in the photo and video landscape. It was the start of digital photography and video. CCD-optical sensors are extremely photosensitive and this way they can produce pinpoint-sharp pictures. Also in space this technology is used e.g. to make pictures of planets.
An alternative to the CCD are APS (Active Pixel Sensor) image sensors. This technology is still rather new, but has the advantage of being based on a standard CMOS process flow. Because of this, they are cheaper and it becomes possible to integrate the sensors with logic circuits, which means that intelligence can be added to the system (e.g. to compress an image before sending it to earth). Especially for this last reason ESA is interested in APS image sensors, of course on condition that progress is made concerning the photosensitivity of APS.

By illuminating the image sensors on the backside through a thinned substrate, the photosensitivity improves significantly. This can be explained because the frontside consists of a thick layer of oxide and metal strips, which absorb and/or reflect a part of the light. At the backside, the light easily travels through the silicon, through an anti-reflective layer, after which the created charged particles are collected by the sensors. For CCD image sensors this technology was used for very demanding space projects with low light intensity. For the thinning and the back illumination of APS image sensors European expertise didn't exist. Therefore ESA launched in 2002 a call to the European companies and research institutes to develop such a technology.
IMEC, Cypress Semiconductor Belgium bvba (Fillfactory) and Galileo Avionica complied with the request and so the project "Hybrid APS" (2003 – 2006) was born. An important challenge within the project was the thinning of the silicon wafers with APS image sensors. This is necessary to make backside illumination – and thus improved photosensitivity – of the sensors possible. The solution developed by IMEC starts with gluing the APS silicon wafer on a substrate in such a way that the APS image sensors are pointed to the substrate. Then the backside of the silicon wafer can be mechanically thinned to an optimal thickness of 35 µm. During this thinning process impurities and crystal defects occur right under the surface. This damage reduces the sensor's photosensitivity in particular for blue light. Since charges, initiated by blue light, are found close to the surface and



Example of a 50µm thin silicon substrate.



Thinned CMOS image sensor integrated on a chip with readout electronics, which is connected to the test board by wire bonding.

are 'captured' by the defects. Therefore IMEC's thinning process contains an etching step so that the damaged surface layer is largely removed. A proper surface treatment (implantation followed by laser annealing) further neutralizes the remaining defects. An anti-reflection layer allows as much light as possible to penetrate in the silicon. Finally the substrate is being removed so that the electrical connections can be made. Another substrate is placed at the other side to support the thinned silicon wafer.
Thanks to the work of Cypress Semiconductor Belgium bvba (Fillfactory) (design), IMEC (thinning and connecting) and Galileo Avionica (Quality test) ESA will be able to launch very sensitive APS camera's in the future. Especially the addition of intelligence to these cameras is a great step forward.

www.imec.be ■

IMEC expertise in the field of image sensors
In 1987 IMEC started with the design of CMOS image sensors, also for use in space. This way a CMOS-camera was manufactured, a so called star tracker, which, by detection of stars, determines the exact position and orientation of a satellite. IMEC also developed a CMOS camera, which was used for inspection, more precisely for the follow up of the separation of a part of the Ariane missile. Based on this expertise IMEC created in 1999 the spin-off Fillfactory, today integrated in Cypress Semiconductor Corporation. After the creation of Fillfactory other common research projects were done in the field of adding intelligence to CMOS cameras for space. Later on, IMEC's research activity shifted from design of CMOS image sensors to thinning technology for image sensors.

LMS® ENGINEERING INNOVATION

ALCATEL ALENIA SPACE ITALIA QUALIFIES SPACE SYSTEMS WITH LMS TEST.LAB

Alcatel Alenia Space Italia selected LMS Test.Lab Environmental for superior ease of use, improved efficiency and minimized risk to hardware.

Alcatel Alenia Space Italia (Rome, Italy) recently deployed LMS Test.Lab Environmental to perform vibration qualification tests on satellites, launch systems, space infrastructures and other space assemblies. The deployment includes a 64-channel vibration control system and a 24-channel structural testing system at the Rome development site, and a 24-channel vibration control system at the L'Aquila site. Alcatel Alenia Space Italia selected the LMS Test.Lab system for its ease of use, proven measurement accuracy, and extensive analysis and reporting capabilities. LMS Test.Lab's real-time acquisition and analysis capabilities support Alcatel Alenia Space Italia engineers in closely controlling the test, getting results instantly, and avoiding risk of damage to expensive space flight hardware.

Alcatel Alenia Space is an affiliate of Alcatel (67%) and Finmeccanica (33%), and brings together the vast experience and know-how of Alcatel Space and Alenia Spazio to form a new leading force in European space technology. Alcatel Alenia Space positions itself as a leader in satellite systems and orbit infrastructures, and develops space systems for a broad range of applications: from navigation to telecommunications, from meteorology to environmental monitoring, from defence to science and observation.

The development of satellites and other complex space systems at Alcatel Alenia Space involves extensive testing campaigns to validate the performance of a design against rigorous requirements. Severe testing is applied to verify if the satellite and sensitive payloads can actually withstand extreme shock and vibration loading during liftoff, flight, and deployment. The LMS Test.Lab system supports Alcatel Alenia Space Italia in testing how space assemblies respond to the variety of extreme loading conditions. LMS Test. Lab constantly matches the response of the test assembly against predefined load profiles by means of a closed-loop vibration control system. Online data acquisition and analysis capabilities allow the Alcatel Alenia Space Italia test engineers to efficiently detect weak spots in assembly under testing.

"Lengthy test campaigns performed on spacecraft assemblies and components are easily

captured by LMS Test.Lab's intuitive and process-centric workbook concept," commented Mr. Natalino Carli, Responsible of the Rome Test Facility - Satellite Integration Area, Alcatel Alenia Space Italia. "The Test.Lab system guides our test engineers through the different steps of the testing procedure, from initial setup, through the actual test and data acquisition, up until the analysis of the test and the final reporting. This results in a strongly increased productivity, minimal training requirements and repeatable test procedures with maximum data consistency."

According to Mr. Carli, the use of the LMS Test.Lab systems allows Alcatel Alenia Space Italia to perform real-time processing over a large number of measurement channels and therefore to characterize assemblies in greater detail. LMS Test.Lab monitors the vibration levels of critical assembly components in real-time. This allows Alcatel Alenia Space Italia to prevent over-testing of the expensive hardware and to avoid any form of damage that could cause a lengthy delay of the space mission.

"Space programs typically involve a large number of partners and suppliers of components and sub systems. To secure a fast turnaround of the extensive test procedures, we have to quickly pinpoint weak parts in the space assembly, and to efficiently report the massive amount of test data. LMS Test.Lab effectively responds to this need, with batch plotting of all test data immediately after the test and flexible reporting and active pictures capabilities to generate predefined or customized reports with Microsoft Office tools," explained Mr. Natalino Carli. "Overall, the LMS Test.Lab system strongly increased the efficiency of performing environmental test campaigns at Alcatel Alenia Space Italia, from the initial test setup up until the crucial sharing and communicating of test results with partners and suppliers."

www.lmsintl.com

VERHAERT SPACE
A QinetiQ Company

VERHAERT SPACE BUILT ESA'S MOST RECENT HUMAN CENTRIFUGE

Last year Verhaert Space from Kruibeke, Belgium was contracted by the European Space Agency (ESA) to develop the "Short Arm Human Centrifuge" (SAHC). By means of this equipment, specialised pan-European physicians are enabled to continue the research of the negative effects of micro-gravity on the human body. Particularly they want to further develop countermeasures to make long-term space flights possible.

The project is part of ESA's Aurora exploration program. When astronauts have to spend a long time in space, as would be the case e.g. during a possible future mission to Mars, prolonged micro-gravity would have harmful consequences to their health. Through the absence of gravity they would suffer of osteoporosis, their muscles volume would be reduced (e.g. the heart is also a muscle) and their immunity system and their equilibrium systems would suffer from the absence of gravity. For the moment, a lot of research on these effects is executed in specialized space clinics in Toulouse and Cologne.

The most common agreed thesis among the involved scientist states that being exposed during a short period (e.g. half an hour) every twenty four hours, to artificial gravity provided by centrifugal acceleration (on a SAHC) should be sufficient to counter all above mentioned negative effects of weightlessness. Centrifugation is therefore considered as a promising and complete countermeasure in view of interplanetary manned space flights.
The centrifuge developed by Verhaert Space for this purpose, is unique as far as research possibilities are concerned. The SAHC has the capacity to submit 4 people (incl. medical and scientific monitoring hardware) simultaneously to very precise acceleration profiles. Up to 550 kg of useful payload can be radial accelerated to a maximum of 6,5 g without having to balance the rotor. The test persons are placed in special beds or chairs (so called "nacelles") on the rotor of the centrifuge. The rotor, with a maximum diameter of almost 6 meter and more than 1,5 ton of weight, turns at 45 rotations per minute, but can be stopped in less than 1 rotation. The chairs and beds can be placed in different positions (translation and rotation) on the rotor.
The test persons are continuously monitored by state-of-the-art medical monitors and have on-line contact with the control room through e.g. digital audio en video systems. The software of the control room is developed in a way that scientists can design, repeat and even execute their experiments "automatically".

"Our visitors are generally very impressed and they always ask if you don't get sick after being rotated during half an hour at such a speed", says project manager Luc Vautmans. "This is not at all the case! The engineering team made countless rotations during the functional tests and no one ever got dizzy. Our test persons have their heads in so-called "dark environments", a kind of co-rotating blinded cockpits. This way the test subject doesn't notice that he is turning around and thus the peripheral visual stimuli are eliminated. Of course one can sense the accelerations, but if you keep your head steady, so that not too much corriolis forces are caused in the brain, you hardly suffer from it. The test persons can even watch a DVD on a TFT screen in the "dark environments", while being exposed to the extra g's."

Recently, the device has been presented officially to the "International Society for Gravitational Physiology", during their conference in Osaka, Japan, where it was enthusiastically received. Very recently ESA ordered a second European SAHC from Verhaert Space.

The first SAHC has been installed in the brand new Antwerp University Research centre for Equilibrium and Aerospace (AUREA) in the University Hospital of Antwerp. Until the end of 2006, Verhaert Space, in cooperation with prof. Floris Wuyts (UA), will perform the commissioning phase, in which the scientists will learn how to use the device and in which the necessary medical protocols will be verified with real test persons. Consequently, the SAHC will be installed at the MEDES Space Clinic in Toulouse (F) for experiments in combination with actual "bed rest" studies.

For more information on this project, please contact
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