

► "The eyes of the future Mars robot"

STEMMER IMAGING has the pleasure to present you this application that has been developed by Magellium and uses several of its products.

The stereoscopic vision systems (image 1) - the eyes of the future Mars robot - are composed of two cameras providing a 3D-reconstruction of the environment. This application will be validated and operated by the ESA (European Space Agency), by Thales Alenia Space and Astrium UK.

After six years of research and development, the systems have been realized by Magellium (Toulouse) in collaboration with the laboratory for robotics of the CNES (National Space Research Centre, France) (image 2).

The application comprises of 5 vision systems that have been developed at the CNES for the members of the ExoMars project team (European Mars exploration mission). 25 cameras, 25 lenses and 25 filters and filter holders were needed for this purpose.

The hardware supplied by STEMMER IMAGING for the stereoscopic bench includes 2 USB uEye cameras (1440M, 1540M), synchronized via an external trigger, 2 Schneider Cinegon lenses as well as 2 Schneider filter holders.

The different application stages are as follows:

- Assembly of the system
- Optical calibration (subpixel)
- Mechanical calibration
- Operation: acquisition of image pairs, distortion correction, image rectification, left/right assignment of images to obtain the 3D information



Image 1: Exploded drawing of a stereoscopic vision system (3D bench)

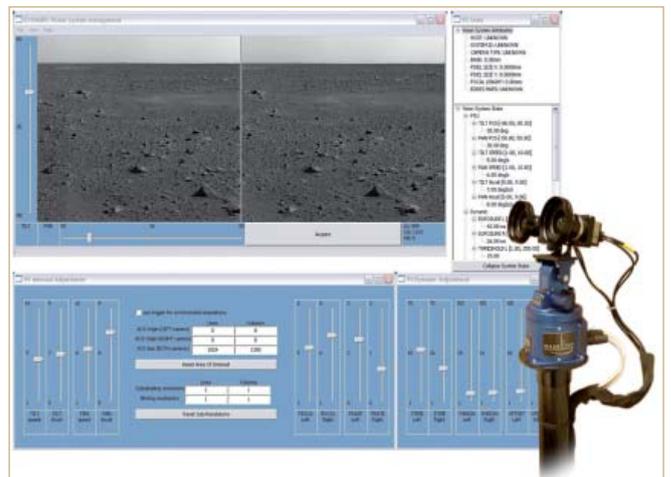


Image 2: Stereoscopic image acquisition system and software interface for robot prototype

► COMPONENTS

Imaging components supplied by STEMMER IMAGING:

- | | |
|---|---|
| <input type="checkbox"/> Illumination | <input type="checkbox"/> Acquisition |
| <input checked="" type="checkbox"/> Optics | <input type="checkbox"/> Software |
| <input checked="" type="checkbox"/> Cameras | <input type="checkbox"/> Systems |
| <input checked="" type="checkbox"/> Cabling | <input checked="" type="checkbox"/> Accessories |

► FACTS

- | | |
|---------------------------|-------------------------------|
| Industrial sector: | Space robotics |
| Task: | Development of the robot eyes |
| Hardware: | uEye cameras |
| Software: | SDK under Linux |
| System integrator: | Magellium/CNES |



► Application chronology

"Two cameras were attached to a mechanical support in order to record a scene from two different viewpoints. Software processes now allow us to perform a 3D reconstruction of the scene (image 3) with the purpose of detecting obstacles or measuring a displacement. The light and economical 3D sensor for highly accurate, contactless measurements is particularly suitable for robotic space applications.

For almost six years, the cameras, lenses & filters have been supplied by STEMMER IMAGING in order to develop and validate the 3D perception system, which is supposed to be installed on the future European robot by 2018. Successive improvements in hardware and software have enabled us to design a high-performance prototype of a stereoscopic system which is highly distributed among the main actors of the ExoMars mission. We have equipped the two ground robot prototypes being validated.

The utilization of these stereoscopic test systems will soon lead to the definition of the expected performance data of the flight versions", says Stéphane MAS, engineer in research and development, vision and 3D perception in robotics at Magellium.

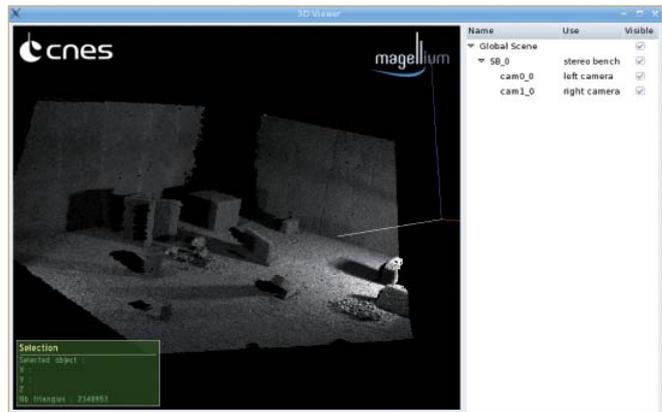


Image 3: Example of a 3D reconstruction obtained with the stereoscopic vision systems

► OUR PARTNER MAGELLIUM

The Magellium company was founded in 2003 by Jean-Pierre Madier and Patrice Berranger and is a medium-sized service and engineering company, mainly acting in the areas of space, defence, environment and health.

Magellium offers high value-added solutions in leading-edge technology sectors such as :

- Image processing (air and space observations, medical, scientific and industrial applications)
- Geomatics: GIS, cartography and geospatial applications
- Space, ground and medical robotics - intelligent systems

The company also acts in the following fields:

- Innovative technologies for education, learning and training
- Support of the activities related to ground segments for observation satellites (channels Mission and Image)
- System and hardware engineering

The company has its head office in Ramonville (Toulouse) and employs 120 people, of which many are doctors. It has a branch in Pecq near Paris and another one in Harwell, UK, the scientific centre for space research.

Magellium makes large investments in research and development. In 2009, the company's turnover was 7,4 M€ (a turnover of 10M€ is planned for 2010).