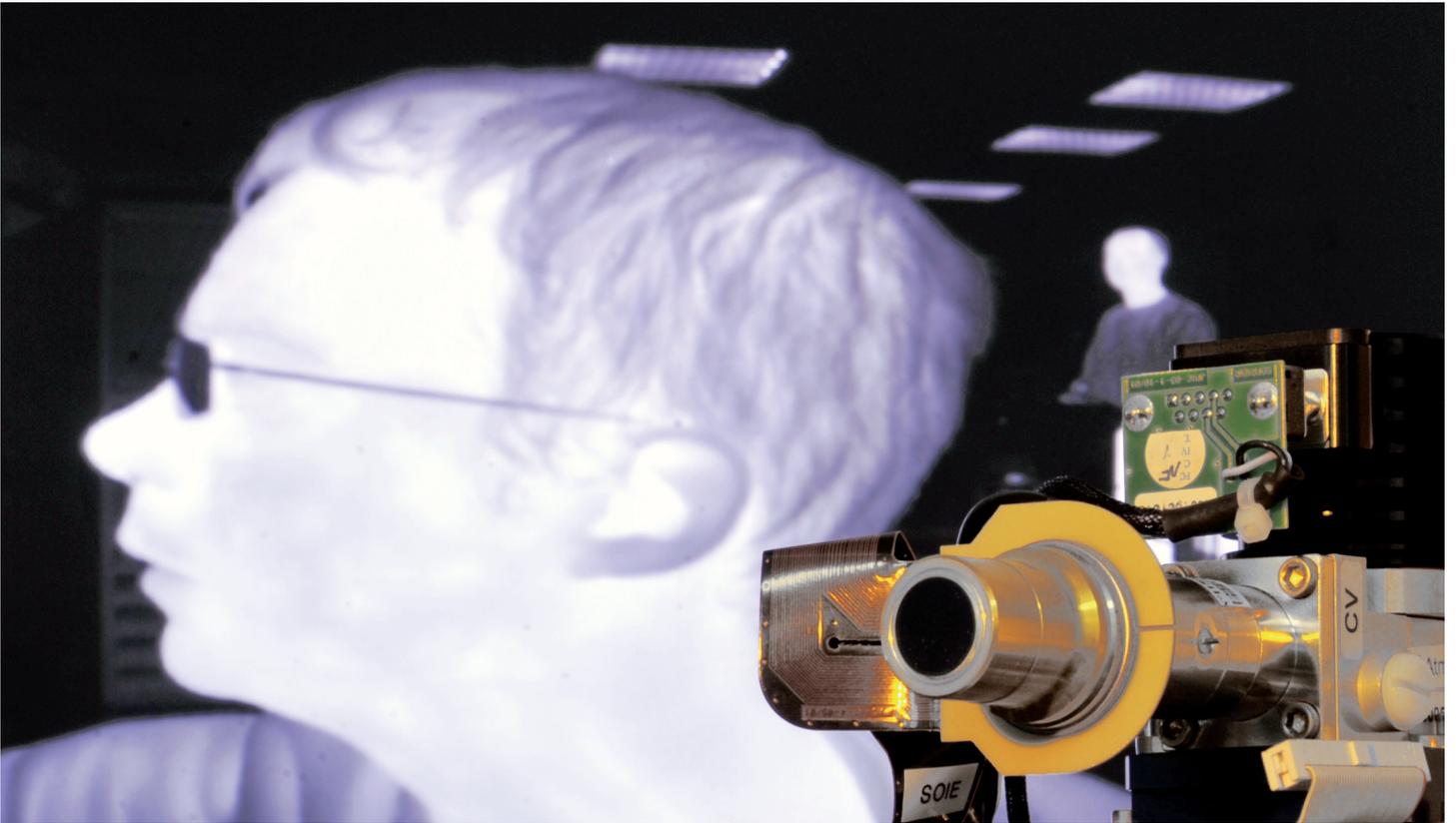
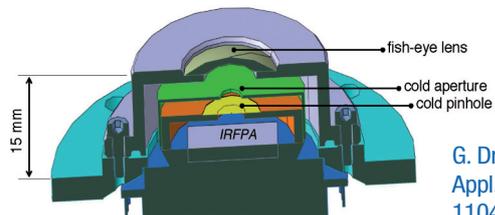


Lensless infrared microcameras

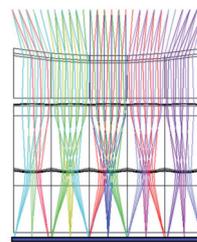


Laboratory developments

Designing a camera without optics is the dream of every optical engineer adept at minimalist design. In fact, the mother of the modern camera is the 'camera obscura,' a dark chamber pierced by a small pinhole. This simple setup having poor radiometric performance, it is necessary to improve configurations e.g. replacing the pinhole by a circular diffraction grating or adding a small lens in the chamber to imitate the human eye structure. Dewar-level integration of optics is a promising way to develop compact IR cameras. With the support of the French procurement agency (DGA) and in collaboration with the Institute of Optics and the French Alternative Energies & Atomic Energy Commission (CEA), Onera has already demonstrated proof-of-concept microcameras at laboratory level. The next step is to develop an IR detector optics inside a dewar-cooler assembly at industrial level to demonstrate a real advantage in compactness and reliability and to pave the way to new products for security applications.

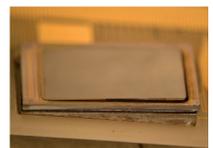


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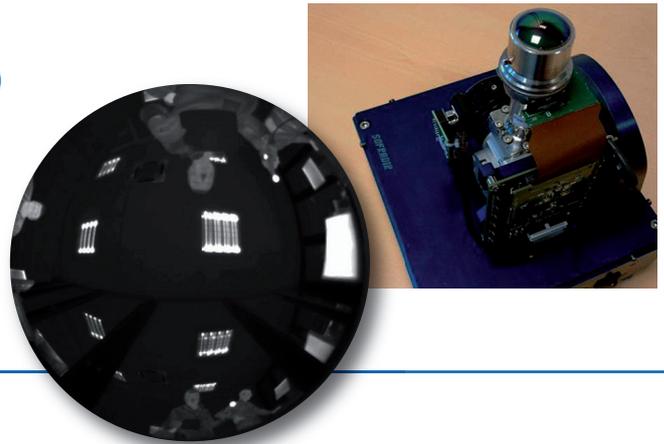
2010: first prototype of a 60°FOV micro camera (SOIE)

In 2010, this step has been reached by Sofradir, a leading developer and manufacturer of advanced infrared detectors for military, space and industrial applications. The innovative design, called SOIE, is based on a standard Sofradir small pitch video quality IR detector (640 x 512, 15 micron pixel pitch VGA format). What is new is that Sofradir and Onera have integrated an optical lens alongside the IR detector, a challenging feat that requires successful control of all the IR detector operating and performance parameters. As a result, this integrated IR detector chip can produce a stand alone image without the use of any other associated optics.



2011: second prototype of a 360°fisheye micro-camera (FISBI)

The second one, called FISBI, is a 360° panoramic camera integrating a fisheye lens. The aimed applications are multiple: border surveillance, vehicle protection and situation awareness, unmanned vehicles vision systems...



Future developments (2012)

In order to maximize the performances of FISBI concept, research works are conducted in collaboration with a Canadian company (ImmerVision). The scope is to integrate in the architecture a panomorph lens that carries out an anamorphosis by stretching the disc-image to adjust the footprint to the imager aspect ratio.

By combining the distortion-control and the anamorphic ratio as lens design parameters, the panomorph technology allows areas of interest magnification across the field of view. Then, using those design parameters as input, image processing algorithms compute distortion free views. This combination provides a unique advantage over all other types of panoramic imagers.



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