Uncooled Infrared Imaging Market: Commercial & Military applications

Sample report
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  - Thermopile Arrays
  - Panasonic Thermopile IR detector development
  - Thermopile FPAs
  - Ferroelectric BST (Barium Strontium Titanate) FPAs
  - Pyroelectric imagers
  - Microcantilever
    (Multispectral Imaging, now Agiltron)
  - Photo Emission Approach by Agiltron
  - Photo Emission Approach by Sirica
  - RedShift Systems
  - Quantum Films by InVisage Technologies (NIR only)
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  - The NIR Window
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An infrared thermal camera is a thermal system which converts infrared (IR) radiation into visible image.

Main parts of an IR camera:

- **Camera core (with electronics and sometimes IR lenses)**
- **Detector (Uncooled Focal Plane Array - UFPA)**
- **Pixel (each sensor – retina – has thousands of pixels)**

- Cores are the modules that include detectors + electronics and sometimes lenses. Without lenses it is called also video engine.
- Detectors are also called UFPA (Uncooled Focal Plane Arrays) or IR sensors.
- A detector can have various formats (1024 x 768 to 47 x 47) and pixel pitch (usually from 17µ to 40µ in 2010)
Market Research Scope and Methodology

• Market research scope
  – The report surveys the Long Wave Infrared (called LWIR or FIR) uncooled camera and detector markets for both commercial and military businesses.
  – An overview of the Near Infrared (NIR), Short Wave Infrared (SWIR), and medium wave infrared (MWIR) technologies and markets is also presented.
  – Market estimation are done for the 2009 – 2016 time period in $ (with 1,3 $ for one euro conversion)

• Methodology:
  – This research has been prepared based on:
    • Primary information sources: direct interviews with companies all along the value chain (detector manufacturers, camera manufacturers, camera distributors, final users).
    • Secondary information sources: conferences, web sites, newsletters....
  – All data, graphs, tables, and calculations in this report are based on Yole’s investigation.
2011 report added content compared to 2010 version

- Full market analysis and forecast update on both commercial and military applications

- Analysis of military applications by application segments (Thermal Weapon Sight, Vehicle Vision, Soldier Vision, Remote Weapon Station, Other military applications), and competitive landscape.

- Latest industry news and analysis of the new market entrants and exits.
Infrared technologies spectrum range from NIR to LWIR wavelengths. Each part of the spectrum provides different information and hence targets different markets:

- NIR (Near IR) – SWIR: active vision enhancement (need an NIR light source), high temperature thermography, material analysis
- MWIR (Medium Wave IR): thermography, passive vision enhancement, material analysis
- LWIR (Long Wave IR) called also FIR (Far IR): Thermography and passive vision enhancement (no need for light source)
Uncooled Infrared Camera Market forecast

Global uncooled thermal camera business (units)

- Total military
- Total commercial

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## Main IR Uncooled Camera Manufacturers Positioning

<table>
<thead>
<tr>
<th>Thermography</th>
<th>Commercial vision enhancement</th>
<th>Military vision enhancement</th>
</tr>
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<tbody>
<tr>
<td>Irisys</td>
<td>PELCO</td>
<td>Raytheon</td>
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<tr>
<td>FLUKE</td>
<td>BOSCH</td>
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<td>Testo</td>
<td>Pelco</td>
<td>Qioptiq</td>
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<td>NEC</td>
<td>Axis</td>
<td>ITT</td>
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<td>Lumasense</td>
<td>Current Corporation</td>
<td>Zeiss</td>
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<td>Bullard</td>
<td>Selex Galileo</td>
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<td>MSA</td>
<td>Thales</td>
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<td>Autoliv</td>
<td>Safran</td>
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<td>BAE Systems</td>
</tr>
</tbody>
</table>

- **Thermography companies**: 20 players
- **Commercial Vision companies**: 50 players
- **Military companies**: 30 players

**Generalist camera companies**

- DALI
- SATIR
- Guide Infrared
- Ulirvision
- L3 Communications
- DRS
- BAE Systems
IR Camera Markets Analysis

**Thermography**
- Predictive maintenance
- Building inspection
- Others thermography

**Commercial vision**
- Surveillance/CCTV
- Automotive
- Fire fighting
- Maritime
- Other commercial vision

**Military**
- Thermal Weapon Sight
- Vehicle Vision
- Soldier portable vision
- Weapon station
- Other military
Lowest price camera from FLIR and Fluke: Cheaper and cheaper

Flir is heading the price battle for low price camera but Fluke is just behind.
Surveillance CCTV
Prices are coming close to thermography cameras

Surveillance cameras are following the same price reduction rate than thermography cameras
FLIR automotive detectors sales: large take off in 2013

Projected Automotive Volume/Cost

Source: FLIR
Main infrared military systems market players positioning and rankings

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<th>Vehicle Vision Enhancer</th>
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<tr>
<td>DRS Technologies</td>
<td>2</td>
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<td>BAE SYSTEMS</td>
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Other Infrared military systems suppliers:

- Raytheon
- D3 Communications
- ZEISS
- THALES
- FLIR Systems
- OPGAL
- QIOPTIQ
- Safran Sagem
- Selex Galileo
- Irvine Sensors Corp.
- ITT
- Northrop Grumman
- AIV
- Elbit Systems
Figure 6. A new generation of smaller, lighter thermal sights enabled by 17μm microbolometer technology will enhance mission capability.
Microbolometer Players Locations

- FLIR/ON Semi (US) Santa Barbara/Pocatello
- Raytheon / Freescale (US) Santa Barbara / Austin
- Teledyne Dalsa (CA)
- Melexis (B- R&D)
- Sensonor (NO – R&D)
- Silex & Faun (SW – R&D)
- Fraunhofer (DE- R&D)
- Bosch (DE- R&D)
- NEC Avio (JP) Fukushima
- Lumasense ITC (US) Buellton
- BAE (US) Lexington
- Finmecanica DRS technologies (US)
- L3 Com (US) Dallas
- Ulis (FR) Grenoble
- Mikrosistemler (TU – R&D)
- SCD(IS) Haifa
- Magnity (CN - R&D)

Microbolometer technologies: a-Si, VOx, others (R&D)
Technical evolution for microbolometers are at 4 different levels: IR optics, packaging/ROIC integration and at the pixel level. Main motivations are to reduce cost and to increase integration.

**At the IR optics level:**
- Chalcogenide lenses
- Wafer Level Optics

**At the packaging level:**
- Wafer Level Packaging
- Pixel level packaging

**At the pixel level:**
- Pixel size reduction
- New materials (than VOx, aSi)
- New design

**At the integration level:**
- Integration technology (Direct bonding?)
- 3D TSV
- Loophole
- New functions integrated by software (temperature compensation, one-point temperature measurement)
Microbolometer WLP roadmap

- Raytheon
- FLIR
- NEC
- ULIS
- CEA-LETI
- sensonor
- L3 Communications

Pixel Level Packaging (PLP)

R&D - Production