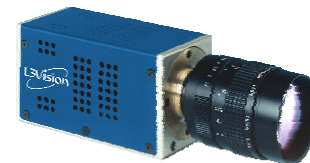
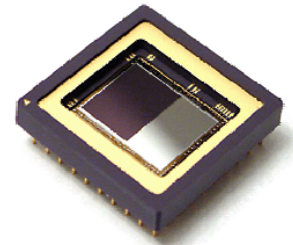
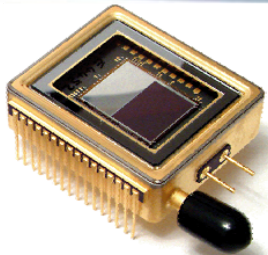


L3Vision – Low Light Level Cameras Overview



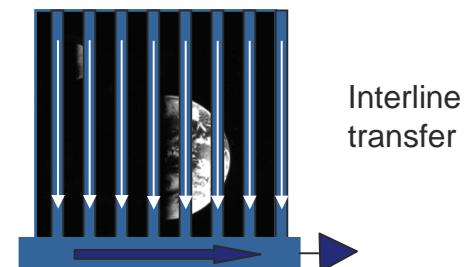
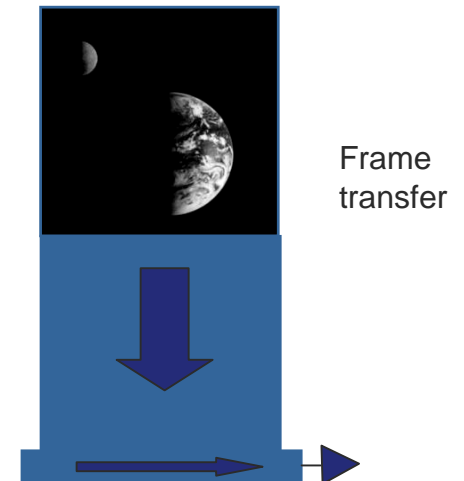
L3Vision Technology

How sensitive is a CCD?



Three key factors determine the low light sensitivity of a CCD:

- **Number of photons / pixel / unit time**
 - Dependent on pixel area
 - With all else equal, a $16\mu\text{m}$ square pixel gathers 4x more light than an $8\mu\text{m}$ square pixel
- **How well light is converted to signal electrons**
 - High quantum efficiency
 - Back illuminated CCDs convert over 90% of 550 nm light to signal electrons
- **Maximum open area ratio**
 - Frame transfer CCDs are 100% fill factor
 - Interline transfer CCDs are not 100% fill factor
- **How low the noise floor is**
 - Noise sets the limit to the minimum detectable signal



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Maximizing Signal to Noise



Main Sources of Noise

- **Shot Noise on the Dark Signal**
 - Cool sensor to eliminate dark current
- **Noise from the CCD Output Amplifier**
 - Reduce readout rate
- **Noise added by the video chain electronics**
 - Optimise design of electronics

**Benefit from
L3Vision
Technology**

Reduce the noise = Improve the CCD Sensitivity

L3Vision Technology

What L3Vision is...



- **Low Light Level Technology**
- A CCD technology that provides <1 photo-electron equivalent read noise at video frame rates or higher
- An impact ionisation gain process within the CCD that amplifies signal electrons up to 1000 times so that they may be detected above the CCD output and camera electronics noise.
- A unique technology developed by e2v technologies

L3Vision Technology

What L3Vision is **NOT**...



- L3Vision CCDs do NOT use image intensifiers
- L3Vision CCDs are NOT electron bombarded CCDs (EBCCDs).
- L3Vision CCDs are NOT CMOS image sensors

... L3Vision CCDs are simply CCDs

... and are sometimes known as EMCCDs (Electron Multiplying CCDs)

L3Vision Technology

L3Vision CCDs vs ICCDs

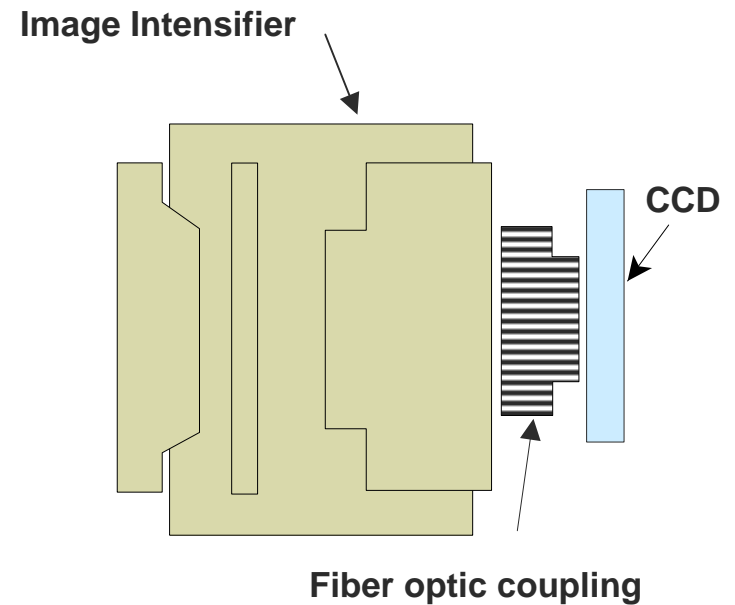


ICCD Advantages

- Gated operation
- Mature and accepted technology
- Low power consumption

ICCD Disadvantages

- Poor daylight performance
- Susceptible to damage
- Poor resolution
- High excess noise factor



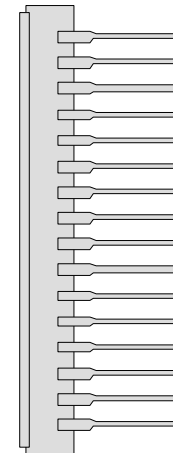
L3Vision Technology

L3Vision CCDs vs ICCDs



L3Vision CCD Advantages

- Increased spatial resolution & SNR giving greater dynamic range
- No halo from bright sources allowing visible detail in adjacent pixels
- Not susceptible to damage from bright lights
- No scintillations giving improved image quality
- High photo-sensitivity (QE up to ~95%)
- Solid state giving lower life-cycle cost
- No high voltages required
- Excellent for day and night operation



L3Vision CCD Disadvantages

- Moderate power consumption

L3Vision Technology

Example Camera Features



- High Dynamic Range



L3Vision Technology

Example Camera Features



- Spot light performance is far superior to Gen III ICCD



L3Vision Technology Feature Summary



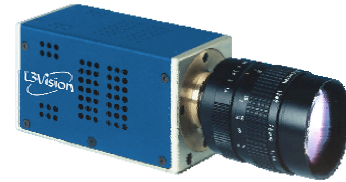
- **Electron Multiplication allows even the smallest signals to be seen**
- **Back-illumination means superb quantum efficiency**
 - ~95% QE at 550 nm
- **L3Vision Cameras fully exploit the L3vision technology, and feature**
 - Automatic gain control
 - Digital image enhancement (filtering, dynamic gamma)
 - Digital & analogue outputs
 - Ultra-low light level performance
- **L3Vision CCD Sensors also available**

L3Vision Technology Video Camera Products



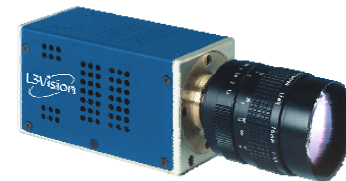
L3C60

- 128(H) x 128(V)
- 500 frames per second
- Analog video output
- Internally cooled CCD for reduction of dark current
- IMO for reduced dark current
- Automatic gain control adjusts to varied lighting



L3C65

- 576(H) x 488(V) or 576(H) x 576(V)
- Analog video output
- Internally cooled CCD for reduction of dark current
- Automatic gain control adjusts to varied lighting



L3C95 / L3C85

- 768(H) x 488(V) or 768(H) x 576(V)
- Analog or Digital video output
- Internally cooled CCD for reduction of dark current
- Digital control of operating modes – USB2.0 or RS232
- Real time digital image enhancement
- Extremely low minimum usable light level (10x lower than L3C65)
- Fully automatic operation over NINE decades of illumination.



Customization available

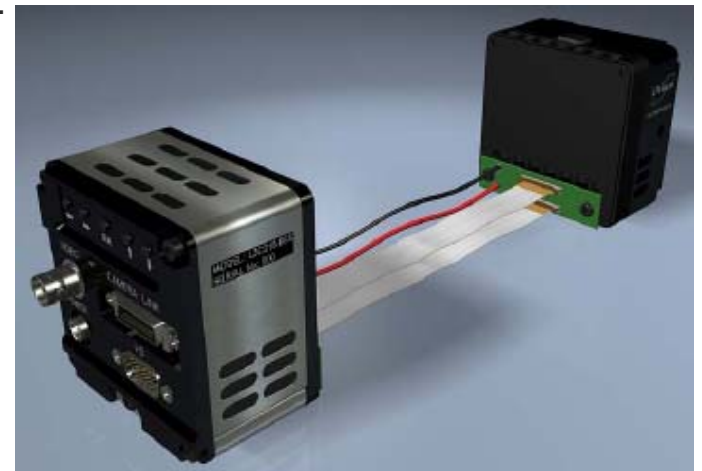
L3Vision Technology Video Camera Products



L3C216 (Due for release May 2008)

- 768(H) x 488(V) or 768(H) x 576(V)
- Analog or Digital video output
- Internally cooled CCD for reduction of dark current (fan-less)
- Back-thinned L3Vision CCD with QE up to ~95%
- Digital control of operating modes – Camera Link or RS232
- Real time digital image enhancement
- Extremely low minimum usable light level (10x lower than L3C65)
- Fully automatic operation over NINE decades of illumination.
- Reduced power consumption (12W max)
- Reduced size (and modular design version available)
- RoHS Compliant

Customization available



L3Vision Technology Video Camera Customization



- Camera customisation to meet military specifications and airborne applications
- Also available as a driver board-set and as CCD sensors

Please send us you requirements!



L3Vision Technology Application areas



Surveillance and Reconnaissance

- TV format
- Airborne & Ground-based surveillance
- Underwater Imaging
- Driver view enhancement
- Commander's night-sight
- Pushbroom imagers

Scientific imaging

- Single molecule fluorescence
- High throughput screening
- Adaptive optics / wave-front sensing
- Photon counting
- Ground based astronomy

L3Vision Technology



The End