JAI vision

2. edition 2006

CAMERA NEWS

THE POSSIBILITIES ARE ENDLESS
Why change a brand?!?!

NEW PRODUCTS
The new common Camera Concept (CCC or C3)

MULTI-SPECTRAL IMAGING
For Machine Vision

Application Case Stories - Upcoming Imaging Events - Product News

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See the possibilities

JAI UPDATE

Welcome to this fall ‘06 edition of JAI Vision Camera News, in time for the important Vision 2006 in Stuttgart, where you will find our latest launches in reliable camera technology

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JAI has been in business since 1963 – which says quite a bit about reliability, quality and stamina.
Spanning three continents and employing over 250 people we work everyday to enhance effectiveness within a large variety of industries.
Often hardware does not meet the promises and customers get disappointed. At JAI we know how to design and build hardware that meets critical performance criteria, in applications running around the clock. The markets we serve are experiencing new ways of using machine vision in every step of the manufacturing processes – however also migrating outside the factory floor i.e. in sport judging and high end surveillance applications, which make this industry so positive and exciting.

We are eager to present the latest products to our customers. Next opportunities to see the new products and meet the experts behind the technology will be at upcoming tradeshows in November in Stuttgart as well as in Japan (Yokohama) in December ‘06.

Look forward to meet you at upcoming Tradeshows – where you will be able to see challenging live demos of our latest products.

Henrik Ilsby
Senior VP, JAI Camera Solutions

UPCOMING IMAGING EVENTS 2006

- **November 7 - 9**
  Vision 2006
  Stuttgart, Germany
  www.vision-messe.de
  JAI Camera Solutions

- **December 6 - 8**
  Exhibition on Image Technology and Equipment
  Yokohama, Japan
  www.seiki-tsushin.com/ite/eng/
  JAI Camera Solutions

- **February 14 - 15, 2007**
  IPOT 2007
  Birmingham, UK
  www.ipot.co.uk
  Firstsight Imaging

- **June 6 - 8, 2007**
  Exhibition on Sensing via Image Information
  Yokohama, Japan
  www.seiki-tsushin.com/sensing/eng/
  JAI Camera Solutions

- **June 12 - 14, 2007**
  Robots & Vision 2007
  Chicago, IL, USA
  www.robots-vision-show.info
  JAI Camera Solutions

THE POSSIBILITIES ARE ENDLESS

Throughout the lifetime of a company, the corporate identity will most likely change or be refined. This can be the result of mergers or acquisition or simply due to a change in strategy. The major brands that we are exposed to in our everyday life, such as from the food & beverage, entertainment, automobile, airline or finance industries have all undergone change at one point or another.

Why change a brand? Isn't it enough just to be well known?

Naturally, the main objective of marketing your brand is to make it well recognized. Having a well established brand makes it easier to communicate with prospective customers. However, just having a well known logotype is not sufficient. It is equally important to also communicate what your brand actually stands for. This boils down to making it easy to understand what a customer should expect to get when doing business with the company behind the brand. Company values, heritage, organization, financial status, to only mention a few, are all important factors to communicate when branding a company.

Through its more than forty years history, JAI's brand has been updated to reflect the evolution of the company. JAI started out as a trading house acting locally in Denmark, gradually transforming itself in the global organization developing, manufacturing and marketing its own high tech solutions as we know it today.

Vision products

Following the acquisition of PULNiX, there has been an increased need to create a uniform brand identity that can represent JAI's global organization. Over the years JAI's products and solutions have increasingly been making use of electronic imaging in one form or another. Be it highly sophisticated cameras or advanced sub-systems for image capture and processing, they all have one thing in common. They all involve vision - the ability to see.
The new tagline "See the possibilities" therefore becomes a natural part of JAI's future branding.

The concept "See the possibilities" is both a challenge and an invitation. Internally, it is a call for action, encouraging foresight and open-mindedness. To our customers and partners, it is an open invitation to put our products to use in their solutions and at the same time to work with us as we develop the offerings of tomorrow.

Putting it to use

We are proud to start making use of our new identity and helping our customers to see the possibilities. You can see the visual effect of our new branding in this issue of the JAI Vision Camera News. At the Vision 2006 in Stuttgart we will be making our first public appearance with the new identity and corporate colors.

NEW COMMON CAMERA CONCEPT

The new Common Camera Concept (CCC or C3) was created to provide a number of common design platforms for JAI's worldwide R&D organization. Putting it to use in the future will result in the same functionality, look and feel for products whether they have been developed in the USA or Japan. This means that physical dimensions, connector pin assignments and camera controls will all be the same. At present, C3 has three platforms: Compact, Basic and Advanced. Depending on the requirements for features & functionality or size, the different platforms can be considered when planning new products.

The C3 also introduces a new naming convention, whereby the user can decipher key specifications from the product name. Information about resolution, monochrome/color, and interface are all contained in the part number.

Compact cameras with mini-CL

As part of JAI's new Common Camera Concept two new mini-CL cameras will be released at the end of this year. They make use of the C3 Compact platform, contained in a 29 (height) x 44 (width) x 75 (length) mm housing.

Featuring a resolution of 1392 x 1040 pixels, based on a 1/2" CCD sensor, the CM-142 MCL operates at 33 frames/second. This camera provides a digital upgrade path from JAI's enormously popular CV-A1 camera. There is also a color version (raw video Bayer mosaic) being launched, the CC-142 MCL

Featuring a resolution of 1628 x 1236, using a 1/1.8" CCD sensor, the CM-202 MCL operates at 20 frames/second. This model is the digital equivalent of the CV-A2 cameras. A color version (raw video Bayer mosaic), named CC-202 MCL, is also being launched.

Both cameras make use of the new MiniCL connector, which is part of the Camera Link standard. MiniCL allows for a much smaller camera housing than the standard Camera Link connector. The MiniCL cable is also much more flexible than standard Camera Link cables.

TM-2030 CL/GE AND TM-2040 GE

This fall, JAI's offering of mega pixel cameras gets wider and deeper with the introduction of two new JAI camera series.

The TM-2030 series adds four new HDTV models (1960 x 1080 pixels) designed for traffic, defense, or machine vision applications that demand a wide field of view. Users can choose color or monochrome cameras, in models offering Camera Link or Gigabit Ethernet interfaces.

For applications using more traditional 4:3 aspect ratios, the new TM-2040GE series adds UXGA resolution (1600 x 1200 pixels) to JAI's growing line of Gigabit Ethernet cameras. Color and monochrome models are available.

Both the TM-2030 and the TM-2040 cameras feature the company's recently redesigned front-end circuitry, with a 12-bit A/D for an improved signal-to-noise ratio. Like the recently introduced TM-4200 series cameras, users can use the built-in GUI to choose 12-bit linear images, or configure the cameras for 8-bit or 10-bit images modified by a user-defined look-up table (LUT).

All of the new cameras feature dual-tap operation capable of delivering frame rates of 32 frames per second with automatic channel balancing. A software-selectable single-tap mode is also available. Other key features include image center partial scanning (1000, 500, or 250 lines), electronic shutter speeds to 1/16,000 second, and an asynchronous reset, no-delay shutter.

With their combination of high performance and high fidelity, these new cameras are a solid addition to the JAI product line.

PRODUCT NEWS

MULTI-SPECTRAL IMAGING FOR MACHINE VISION

For the most part, imaging applications can be solved with monochrome or color cameras working in the visible spectrum, meaning roughly 400 to 700 nm. Certain applications, however, make use of other parts of the spectrum, i.e. the non-visible parts below 400 nm and above 700 nm, in order to enhance details or to see below the surface of organic materials.

When there is a need to combine information both from the visible and non-visible part of the spectrum, the solution normally involves using two cameras that need to be carefully aligned in order to have the same field of view.
Alternatively high-end multi spectral 4-CCD cameras are implemented. Both approaches have cost implications that may disqualify a multi-spectral approach.

To provide a more cost effective approach to solving these types of multi-spectral imaging applications, JAI is in the process of developing a dedicated 2-CCD camera platform. It will provide the combination of visible (color) and near-IR imaging in one camera, allowing simultaneous capture of both spectral bands through the same lens.

At this stage we are in the process of defining the products that will be based on this technology. Parameters to be decided are resolution (number of pixels), cut-off wavelength between the visible and near-IR band and which type of interface to use in such products.

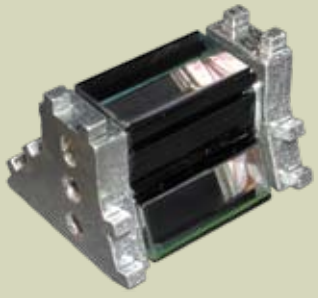
In the next issue of JAI Vision Camera News we will be presenting the first products based on this technology.

Coffee beans seen through the color channel. All beans look alike.

Coffee beans seen through the near-IR channel. The damaged bean clearly stands out

The surface of a peach seen through the color channel. It is impossible to distinguish defects and natural color variation.

The surface of a peach seen through the near-IR channel. The imperfection is clearly seen.



JAI has the unique compentency of manufacturing high-precision multi-imager optical assemblies in clean rooms

LENSES AND OPTICAL CONSIDERATIONS

"Garbage in - garbage out" still counts for image processing and JAI has, since the early days of automated imaging, pointed out the importance of choosing the right optics; both for the application and for the camera used. Yet imagers keep getting larger and cameras more complex, and so do the applications. This article focuses on new optical trends for larger imagers, for 3CCD RGB optics, and for spectral imaging, and gives a few relevant guidelines. The positive trend is more options and better hardware.

Shading

The result of shading is lower intensity towards the corners of the image. Shading is primarily the result of a limited lens image size, a shifted position of the micro lenses, and too large angles of the incoming light. As a result the micro lens response drops at some angle from normal incidence causing shading (see fig.1 and fig.2).

Fig. 1.

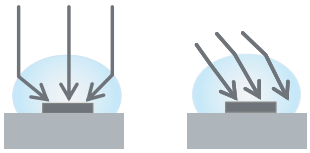


Fig. 2.

To remedy this situation the lens manufacturers have developed lenses for large imagers and camera manufacturers have introduced mounts suited for large imagers. An example from JAI is the 1.2" CCD TM-4200 camera which supports either C-mount, 42mm- or F-mount lenses. Shading can be minimized by reducing the lens aperture or by using longer focal length (longer exit pupil distance). The ultimate solution is to use a telecentric lens or an imager without micro lenses.

3CCD cameras

The obvious reasons to use a 3CCD camera are the controlled steep color filters with a minimum of color crosstalk, the high color density with a spatial MTF for R, G and B equal to a monochrome camera, and the independence of the viewing angle since no temporal delay or spatial shift between positions of red, green and blue pixels exist. For a 3CCD camera the medium between the lens and the 3 imagers primarily consists of the glass prism. This makes a difference in two ways: The non-collimated light rays will have to travel "longer distances" away from the optical center and the distances are "wavelength dependent". This distance shift is called spherical aberration and the wavelength dependence is called chromatic aberration (see fig.3). The trick is to narrow the incoming light cone by limiting the aperture and by using longer focal length lenses.

Fig. 3.

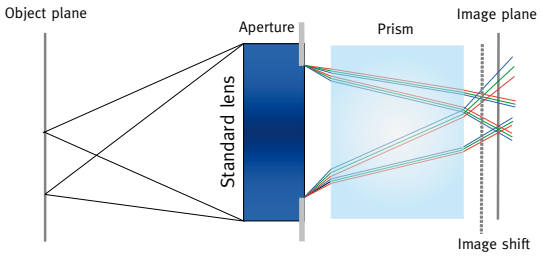
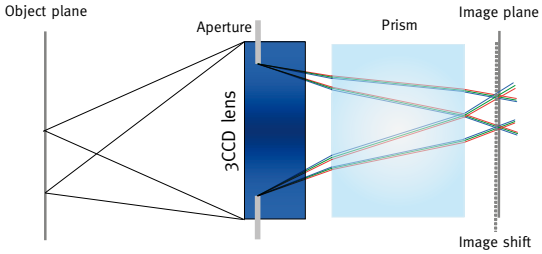


Fig. 3.1.



It is possible to use both wide angles and large apertures using dedicated 3CCD optics (see fig.3.1). For the JAI CV-L107CL line scan camera two lenses with significant improved aberration performance for large apertures exist (F2.8/28mm and F2.8/50mm).

Spectral considerations

The majority of the vision applications are centered on visible-light illumination, 400-700nm, which reflects the direct replacement of human inspection. Using new high color temperature light sources such as tubes and LEDs, more blue light and less red light is emitted. Several JAI color cameras can be delivered with IR-cut filters (or without) to better match the spectrum for these light sources. IR-cut filters may also be used for monochrome cameras limiting the spectrum in order to use lenses not corrected for the entire imager spectrum.

As described in the previous article - useful information is hidden in the near UV (300-400nm) and in the near IR (700-1000nm) spectrums. To optimize for sensitivity and for the lifetime of the near UV spectrum quartz lenses, quartz windows and imagers without micro lenses have to be used. A number of JAI cameras can be delivered with or without quartz windows and/or micro lenses.

For the near IR spectrum it is necessary to remove any IR-cut filter. Using a multi-spectrum camera, e.g. a 2 CCD camera sensitive for near IR and for the visible spectrum simultaneously, requires that the optics be corrected for the full spectrum.

APPLICATION CASE STORY

AS&E SHEDS LIGHT ON FLUORESCENT TUBE DEFECTS

When a large manufacturer of fluorescent lighting products needed a new automated inspection system for identifying defective glass tubes, they called upon Automation Software & Engineering (AS&E) of Twinsburg, Ohio, to develop a solution that would both improve the inspection process, and be easier to maintain than the 15-year-old technology in their current system.

GigE cameras from JAI help analyze the size and shape of unfinished glass tubes (above left) to insure that fluorescent lights are built right the first time

Drawing upon their extensive experience in implementing process monitoring, control, and machine vision systems, AS&E responded with a new, cutting-edge system that leverages advanced Gigabit Ethernet camera technology from JAI to deliver high-speed, high resolution images and ensure that the highest standards of quality are being met.

The manufacture of fluorescent lighting is a multi-step process that starts with the creation of a precisely-formed glass tube. When caught early, a less-than-perfect tube can simply be melted down and re-used in the manufacturing process. But if a defective tube progresses too far in the process, it becomes extremely expensive to salvage and handle the electrodes, phosphorus, mercury, and other hazardous substances.

Networked cameras

The AS&E solution uses six networked TM-1405GE cameras working with AS&E's VisTrax™ visual recognition system to detect tube defects early in the process, while keeping the production line moving at the rate of 70 tubes per minute. The glass tubes, which have been cut to length, heated, and squeezed at each end to form a slightly smaller concentric opening, are sent past the inspection system by a walking beam that positions each backlit tube under the six-camera apparatus.

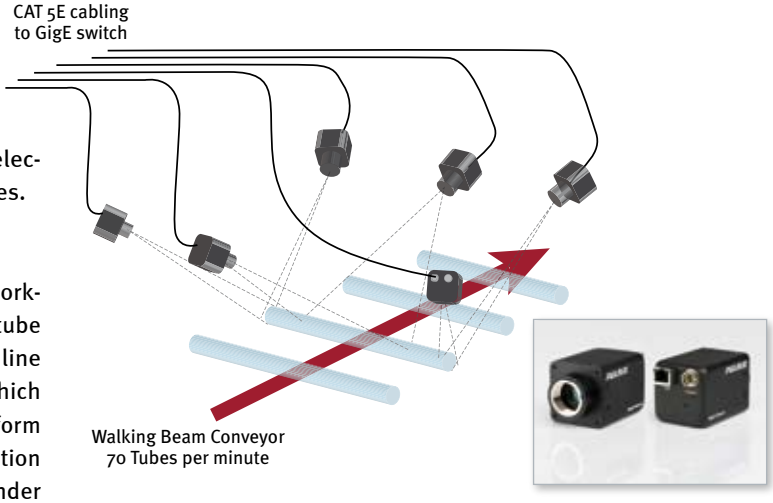
Two cameras, placed perpendicular to one another over the middle of the tube, send images to the host PC to detect any bowing. The remaining four cameras – two at each end – provide images of the formed openings, which are analyzed for size, shape and concentricity. All six cameras are networked to an Ethernet switch which is connected via an Intel Network Interface Card (NIC) to a PC running the VisTrax system.

The entire inspection process, including capturing images from all six cameras and analyzing the images with VisTrax, takes place in 820 milliseconds.

For AS&E, use of the JAI GigE cameras has provided numerous benefits. The application was quickly developed by taking one of the JAI-provided sample applications, removing a few of the unneeded pieces, and adapting the VisTrax libraries to communicate with the GigE software. Meanwhile, the ability to use affordable Cat5E cabling instead of 6-pair, twisted-shielded cables, reduced cabling costs by nearly 75 percent for the 50-foot cabling run between the cameras and the PC. Further cost reductions resulted from the use of the switch/NIC combination, which has eliminated the need for more expensive frame grabber technology.

Versatile deployment

The result is a powerful, yet cost-effective solution with numerous reusable components capable of being adapted to other factory inspection applications. Already AS&E is developing a new custom inspection system featuring JAI's GigE technology for use in a steel mill environment. JAI is pleased to be helping AS&E meet its goal of providing factory automation systems and networks that help customers solve their most important business problems.



Simplified system architecture showing how the six-camera inspection system analyzes the middle and both ends of each fluorescent tube to catch defects before tubes are sent to the next step in the manufacturing process

CONDENSED PRODUCT SELECTION GUIDE

Camera model	Resolution	Imager	Standard	Frame rate	Interface	Dimensions (mm)	AccuPiXEL	Remarks
Monochrome Progressive Scan								
TM-4200CL	2048 x 2048	1.2"	-	15	CL	51 x 51 x 74	Dual-Tap	12-bit A/D. Defect pixel compensation
TM-4200GE	2048 x 2048	1.2"	-	15	GigE	51 x 51 x 85	Dual-Tap	GigE interface
TM-2030CL	1960 x 1080	1"	HDTV	32	CL	51 x 51 x 74	Dual-Tap	12-bit A/D replaces TM-2016
TM-2030GE	1960 x 1080	1"	HDTV	32	GigE	51 x 51 x 85	Dual-Tap	GigE interface
TM-2040GE	1600 x 1200	1"	UXGA	32	GigE	51 x 51 x 85	Dual-Tap	12-bit A/D GigE interface
CV-M2 CL	1600 x 1200	1"	UXGA	30/17 *	CL	40 x 50 x 120		2 tap. ITS and PIV functions
CV-A2	1628 x 1236	1/1.8"	UXGA	15	Analog	29 x 44 x 66		Analog, compact housing
CV-A20CL	1920 x 1080	2/3"	HDTV	60	CL	35 x 44 x 58		CMOS, rolling (snap-shot) shutter
CV-M4+ CL	1392 x 1040	2/3"	SXGA	24	CL	40 x 50 x 100		Special ITS functions, Near IR
TM-1325 CL	1392 x 1040	2/3"	SXGA	30/15*	CL	44 x 44 x 64	•	Near IR enhanced
TM-1327 GE	1392 x 1040	2/3"	SXGA	30	GigE	51 x 51 x 84	•	GigE interface
CV-A1	1392 x 1040	1/2"	SXGA	16	Analog	29 x 44 x 66		Analog, compact housing
TM-1402 CL	1392 x 1040	1/2"	SXGA	30/15*	CL	44 x 44 x 64	•	Cost-effective digital megapixel
TM-1405 GE	1392 x 1040	1/2"	SXGA	30	GigE	51 x 51 x 84	•	GigE interface
TM-6760 CL	648 x 484	1/2"	VGA	60/30*	CL	44 x 44 x 64	•	Double speed, no-delay shutter
TM-6740 CL	640 x 480	1/3"	VGA	200	CL	51 x 51 x 74	Dual-Tap	H & V binning, partial scan
TM-6740 GE	640 x 480	1/3"	VGA	200	GigE	51 x 51 x 85	Dual-Tap	GigE interface
CV-A436	659 x 494	1/3"	VGA	60	Analog	29 x 44 x 66		Remote head, 17 mm lens, 2m cable
Color Progressive Scan								
TMC-4200CL	2048 x 2048	1.2"	-	15	CL	51 x 51 x 74	Dual-Tap	12-bit A/D. Defect pixel compensation
TMC-4200GE	2048 x 2048	1.2"	-	15	GigE	51 x 51 x 85	Dual-Tap	GigE interface
TMC-2030CL	1960 x 1080	1"	HDTV	32	CL	51 x 51 x 74	Dual-Tap	12 bit A/D. Replaces TM-2016
TMC-2030GE	1960 x 1080	1"	HDTV	32	GigE	51 x 51 x 85	Dual-Tap	12 bit A/D
TMC-2040GE	1600 x 1200	1"	UXGA	32	GigE	51 x 51 x 85	Dual-Tap	GigE interface
CV-M8 CL	1600 x 1200	1"	UXGA	30/17*	CL	40 x 50 x 120		2 tap. ITS functions
CV-M7+ CL	1392 x 1040	2/3"	SXGA	24	CL	29 x 44 x 66		Special ITS functions
TMC-1325 CL	1392 x 1040	2/3"	SXGA	30/15*	CL	44 x 44 x 64	•	High sensitivity
TMC-1327 GE	1392 x 1040	2/3"	SXGA	30	GigE	51 x 51 x 84	•	GigE interface
TMC-1402 CL	1392 x 1040	1/2"	SXGA	30/15*	CL	44 x 44 x 64	•	Cost-effective digital megapixel
TMC-1405 GE	1392 x 1040	1/2"	SXGA	30	GigE	51 x 51 x 84	•	GigE interface
CV-M9 CL	1024 x 768	3 x 1/3"	XGA	30	CL	50 x 60 x 99		3CCD, RGB, shading correction
CV-A70 CL	782 x 582	1/2"	SVGA	60	CL	35 x 44 x 80		Double speed, auto shutter
CV-M71 CL	782 x 582	1/2"	SVGA	60	CL	40 x 50 x 80		Internal DSP, RGB output
CV-M71 A	782 x 582	1/2"	SVGA	60	Analog	40 x 50 x 80		Internal DSP, RGB output
TMC-6740 CL	640 x 480	1/3"	VGA	200	CL	51 x 51 x 74	Dual-Tap	Partial scan, no binning
TMC-6740 GE	640 x 480	1/3"	VGA	200	GigE	51 x 51 x 85	Dual-Tap	GigE interface
Color Interlaced Scan								
CV-M91	NTSC/PAL	3 x 1/3"		30/25	Analog	50 x 60 x 99		3CCD, RS-232C. RGB, Y/C, Composite
Color 3CCD Line Scan								
CV-L107 CL	3 x 2048	28.7mm linear		19 kHz	CL	90 x 90 x 90		Flat-field correction, CameraLink
Accessories / Cam2Net								
Cam2Net	Camera Link to Gigabit Ethernet interface adapter. For all JAI and PULNiX base configuration CL cameras							

**Selectable frame rate*

For complete information, please visit www.jai.com

Produced and published by JAI Camera Solutions · Produktionsvej 1 · 2600 Glostrup
Copenhagen · Denmark · Phone +45 4457 8888 · Fax +45 4491 8880 · www.jai.com
Editor: Henrik Ilsby, JAI Camera Solutions · Layout: Katrine Beenfeldt and Søren Bilde, Corporate Marketing

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