



**Trends in 3D Scanning,
Technology, and USB 3.0 Cameras**



WWW.PTGREY.COM

- Point Grey Overview
- 3D Scanning Technology: Definition and Market Trends
- Advantages of USB 3.0 cameras in 3D scanning

- We are a world-leading designer and manufacturer of **innovative, high-performance digital cameras** for industrial, scientific, GIS, traffic, and surveillance applications.
- We offer a unique and comprehensive portfolio of **USB3 Vision, GigE Vision, FireWire**, and **USB 2.0** products known for their outstanding quality, ease of use, and unbeatable price-performance.
- Our drive for **innovation** has led to many **industry firsts**, including the world's first FireWire 1394b and USB 3.0 cameras.



- Founded: **1997**
- HQ: **Richmond, BC, Canada**
- Employees: **170+ worldwide**
- Ownership: **Private, self-funded**
- Sales channels: **Direct** (NA and EMEA) and **distribution** (Asia)
- Production capacity: **120-150K** cameras per year
- Quality management system:
ISO 9001:2008



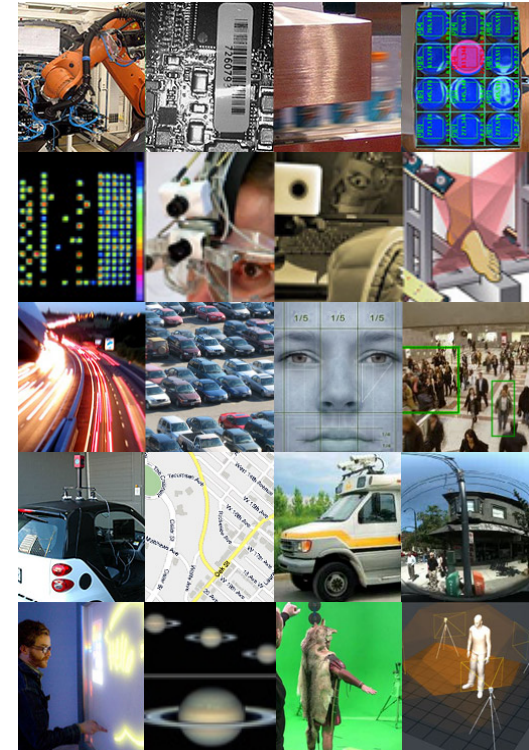
- Range of **general purpose, 3D stereo vision, and 360 spherical** cameras
- Our focus is on providing imaging **components**, not solutions, that adhere to common **imaging standards**
- We offer more than 150 **standard off-the-shelf** models, while still providing options for **OEM customization**
- Among our design goals is to integrate significant **proprietary IP** (e.g. USB 3.0 link layer) in **flexible, low-cost** designs
- We offer **reliable, end-to-end** imaging with fully tested **accessories**, free software **drivers** and **APIs**, and **third-party software** compatibility



USB™ VISION **GiGE™** VISION
GEN<i>i>CAM



- Industrial and FA
 - Factory automation, electronics, packaging
- Medical and Life Science
 - Medical, microscopy, robotics, pharmaceutical
- Traffic and Surveillance
 - License plate, tolling, speed, biometrics, security
- GIS and Immersive Imaging
 - Surveying, mapping, street-level viewing
- Prosumer and Entertainment
 - Astronomy, interactive media, 3D imaging



- State-of-the-art manufacturing: SMT lines; 2D and 3D AOI; X-ray; clean room; environmental chambers
- Automated test stations: heat; thermal cycle; optical path; power
- Every camera must pass 100% to receive the “Seal of Quality” label
- Quick response worldwide tech support, within one business day



Camera Test Report
General Camera Information
External version of Production Results Summary

id	1144072
date	Apr 22 2013 04:58:03
status	Passed
passed	pass
parent_passed	pass
hostname	192.168.0.4
worker	00000
serial	1134228
part	002-FW-4390-C
model	00000000-000-000-0000
vendor	Point Grey Research
firmware_version	1.0.3.0
firmware_build	1987 Nov 17 10:11:47 2010
cam_name	0020000
sensor_name	0020000
sensor	Sony ICORRAL 2.0" 138A/138R 000
driver_name	FMVNC Driver v2.0.0.0
driver_version	FMVNC Driver v2.0.0.0
sensor_serial	00000000
img_number	00000000
img_speed	0000
batch_code	00000000
tests	
testBrightness	pass
testCamField	pass
testCamNoise	pass
testCamPixelCorrection	pass
testCamPorts	pass
testColourSensor	pass
testDataStorage	pass
testExternalTesting	pass
testFirmwareVersion	pass

- **Bumblebee** cameras ideal for mobile navigation, medical imaging, bin picking, people tracking
- 0.3, 0.8 and 1.3 megapixel, IEEE-1394 FireWire interface
- Selection of **lens focal lengths**, 2.5 to 6 mm
- GPIO for **trigger, strobe**
- **Pre-calibrated** against distortion and misalignment, no in-field calibration / recalibration required
- **Stereo processing SDK** provides real-time 3D depth data



- Applications

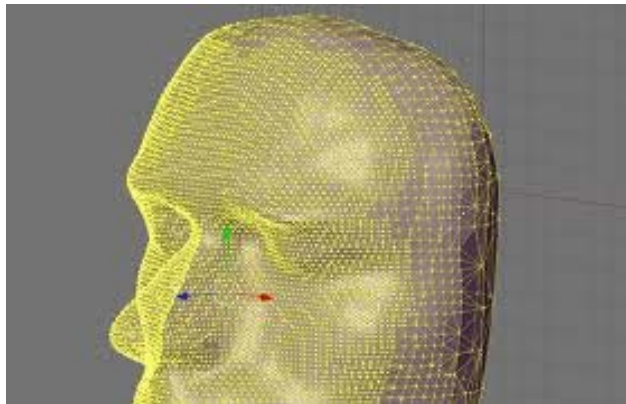
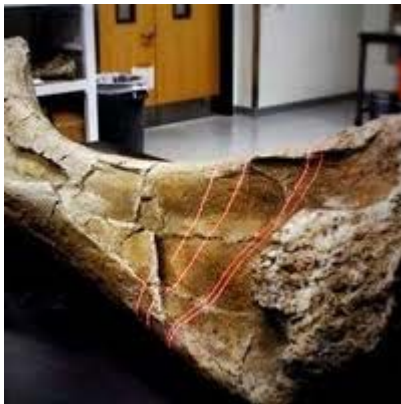
- GIS visualization
- Navigation systems
- Real estate management
- City planning
- Entertainment industry

Ladybug5

- 360° spherical camera
- 30 MP (5 MP x 6 sensors)
- USB 3.0 interface (5Gbit/s)
- 10 fps full resolution (JPEG12)
- 12 bit image output
- > 90% of full sphere
- Post processing workflow



- A 3D Scanner is a device that analyzes a real-world object or environment to collect data on its shape and possibly its appearance (i.e. color). The collected data can then be used to construct digital, three dimensional models.



- Many different technologies can be used to build these 3D scanning devices; each technology comes with its own limitations, advantages and costs.

- Two main scanning technologies: Contact & Non-contact
- Contact Scanners: Coordinate Measuring Machine (CMM's) use probes to transfer physical objects onto a computer. The probe records X, Y and Z position information of the probe. The probes can be light or lasers, but in contact scanners, they're always mechanical.



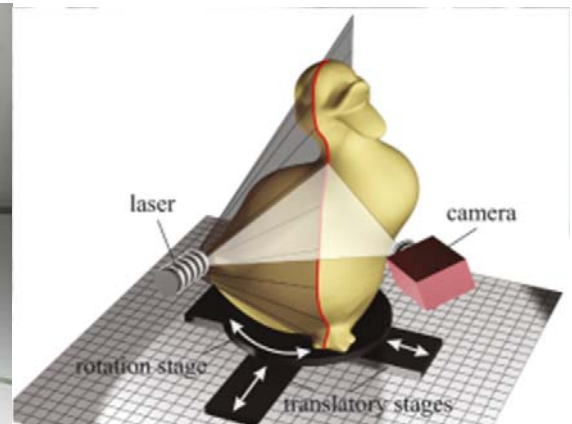
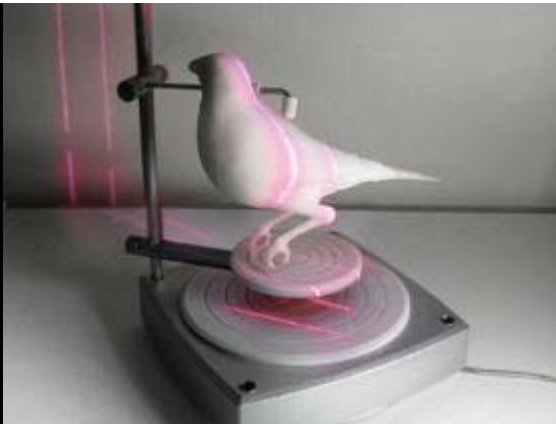
- Non-Contact are further classified as Active or Passive Scanners.
- They may involve any number of cameras or light projection devices. There are also scanners that can use other forms of marking mechanism, but almost all commercial 3D scanners use some form of light.
- The major options available are using laser light, white light (presentation projectors) or multiple cameras setups.



- 3D Laser Scanners use laser light to scan objects. 3D laser scanners commonly found today are either:
 - Handheld where the stripe sweeps over the part like a paint gun or,
 - Tripod mounted where the laser line sweeps across a field to cover an area



- Laser Scanning: 3D Laser Scanning or 3D Laser Scanners can generally be categorized into three main categories (may use combinations of these in a given system):
 - Laser triangulation
 - Time of flight
 - Phase shift



- White Light Scanning (Structured Light Scanning)
 - A structured-light 3D scanner measures the three-dimensional shape of an object using projected light patterns and a camera system. A coded structured light system is based on the projection of a single pattern or a set of patterns onto the object which is then viewed by a single camera or a set of cameras



- 1 to 2 cameras
- 1 light source
- The camera(s) and the projector are generally connected by a micro-controller which controls the exact timing between projection and image acquisition



Pros and cons of Structured Light Scanning compared to Laser Scanning

- + Scanning without calibration panels in the background
- + Much faster (laser systems need to scan over the object)
- + One-click scan
- + No moving parts / no influence of hand tremors etc
- - Projectors are still more expensive than lasers
- - Room needs to be darker than required for laser
- - Not suitable for very small objects

Medical Science / Biometry

- Various applications exist already in orthodontics, prosthetics, orthopedics, plastic surgery, reconstructive medicine, forensic medicine, Dentists, ORL and cosmetics. Face and Bodyscanner, Fingerprint etc.



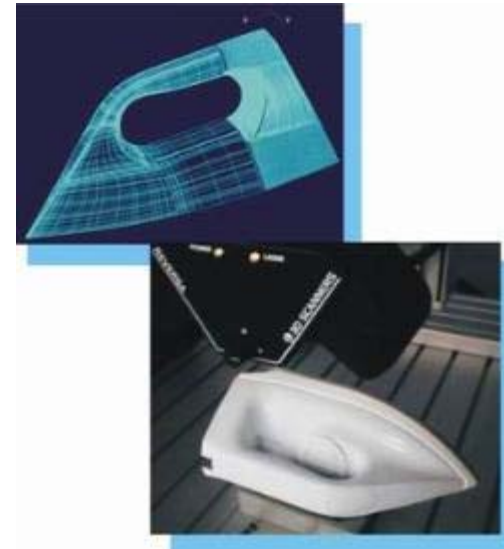
Industrial

- A typical application of 3D Scanners in the field of industrial measurement is dimensional inspection of produced parts.



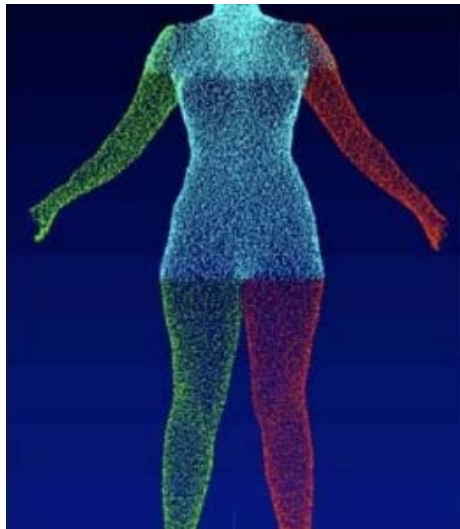
Consumer Industries

- The use of reverse engineering and rapid prototyping technologies have drastically increased for the production of consumer products. For these procedures, optical 3D surface measurement techniques are the most adequate.



Apparel / Fashion / Beauty

- Experts dealing with styling of persons are increasingly interested in commercial applications of human body digitization in their field.



- Image sensor choice
 - Global shutter
 - Good image quality and sensitivity
 - High resolution
 - High frame rate
- Synchronization
 - Multi-camera support via trigger to autosync with FireWire
 - With laser or lighting
- Small size and weight; board level
- Inexpensive
- Convenient interface for laptop support

- Good price performance ratio
- Reliable Products
- Good SDK and Support
- Size of camera
- Support for trigger and multi-sync capability

Key Advantages

- Convenient interface – supported on all new laptops/pc's
- Lower cost (e.g. no framegrabber required)
- High data bandwidth supports high resolution and high frame rate
- USB3 Vision Standard for interoperability



- Point Grey is No. 1 in USB3 Imaging
 - Most choice available in USB3 cameras
 - First to demonstrate USB 3.0 camera technology in 2009
 - Founding member of the USB3 Vision standard committee
 - First-to-market with a true USB 3.0 camera
 - Proprietary USB 3.0 link layer IP gives Point Grey complete control over the camera including provide unique features

Small Size, Light Weight

- 29x29x30 mm
- 41 grams

High Resolution

- 1.3 to 8.8 MP
- Excellent imaging performance with global shutter CMOS
 - Low read noise and low fixed pattern noise, capture sharp images of fast moving objects
 - On-chip pixel defect correction, very low power consumption
 - Appealing price/performance competitor to ICX445 products
- Features
 - FPN correction
 - LUT and Gamma correction
 - Binning and ROI speed up



High resolution, high quality CCD sensors

- 2.8 to 9 MP
- Sony EXview architecture offers excellent quantum efficiency and near IR response

CCD on USB 3.0 interface

- Multi tap CCD combined with high interface bandwidth
- Transition from FirewireB
- Displace Kodak KAI based cameras

FPGA horsepower

- Designed to support high bandwidth throughput
- Support peak frame rates with color interpolation, LUT, gamma etc.



EXview HAD CCD II™

High resolution, fast frame rate, global shutter CMOS sensor

- CMV4000 is a sensor that the MV industry is quite familiar with

High data throughput

- 4.1MP @ 90 FPS = 370MB of data from a single camera

FPGA horsepower

- Designed to support high bandwidth throughput
- Support peak frame rates with color interpolation, LUT, gamma etc.



Thank you

