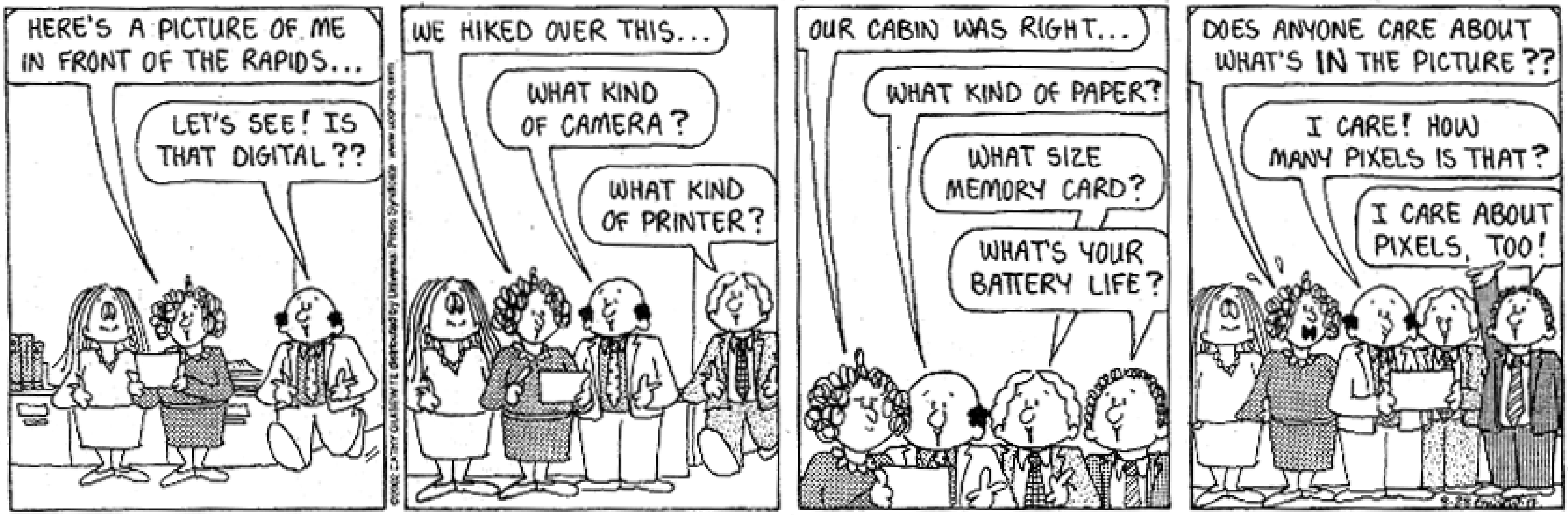
future of digital cameras

future of photography

CATHY | Cathy Guisewite



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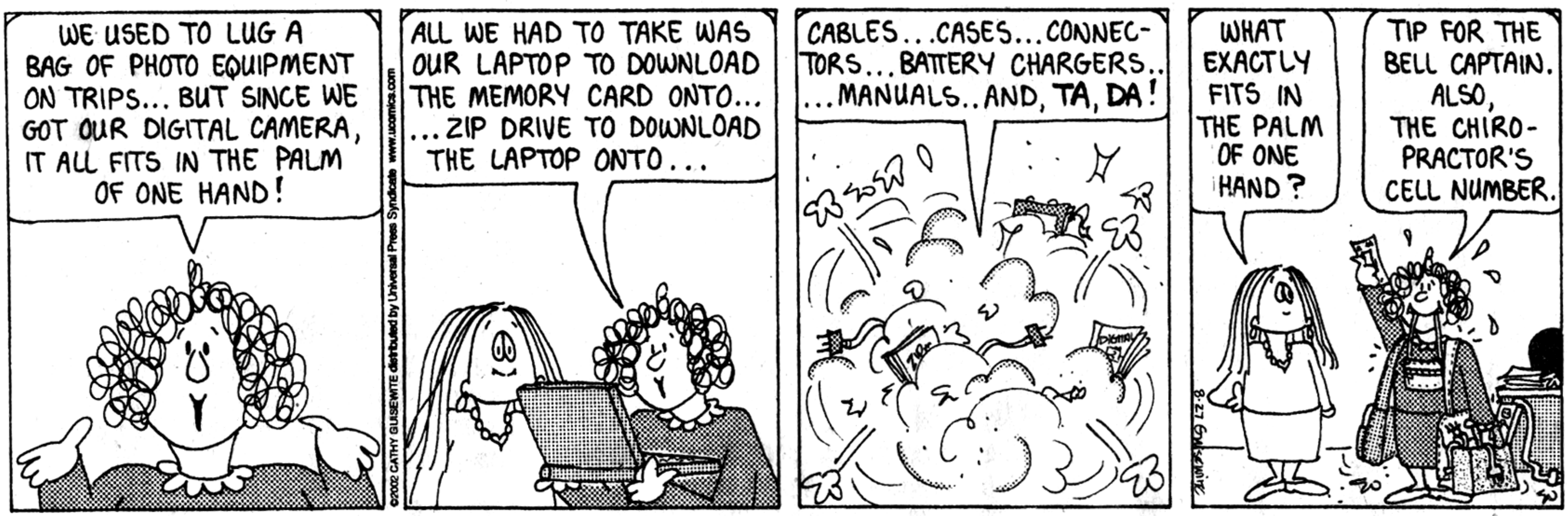


photography market data - year 2000

3,100,000,000 rolls of film

350,000,000 single use cameras

61,000,000 film cameras

11,000,000 digital cameras

major opportunity for growth in digital cameras !

barriers for film $\rightarrow$ digital conversion

cost

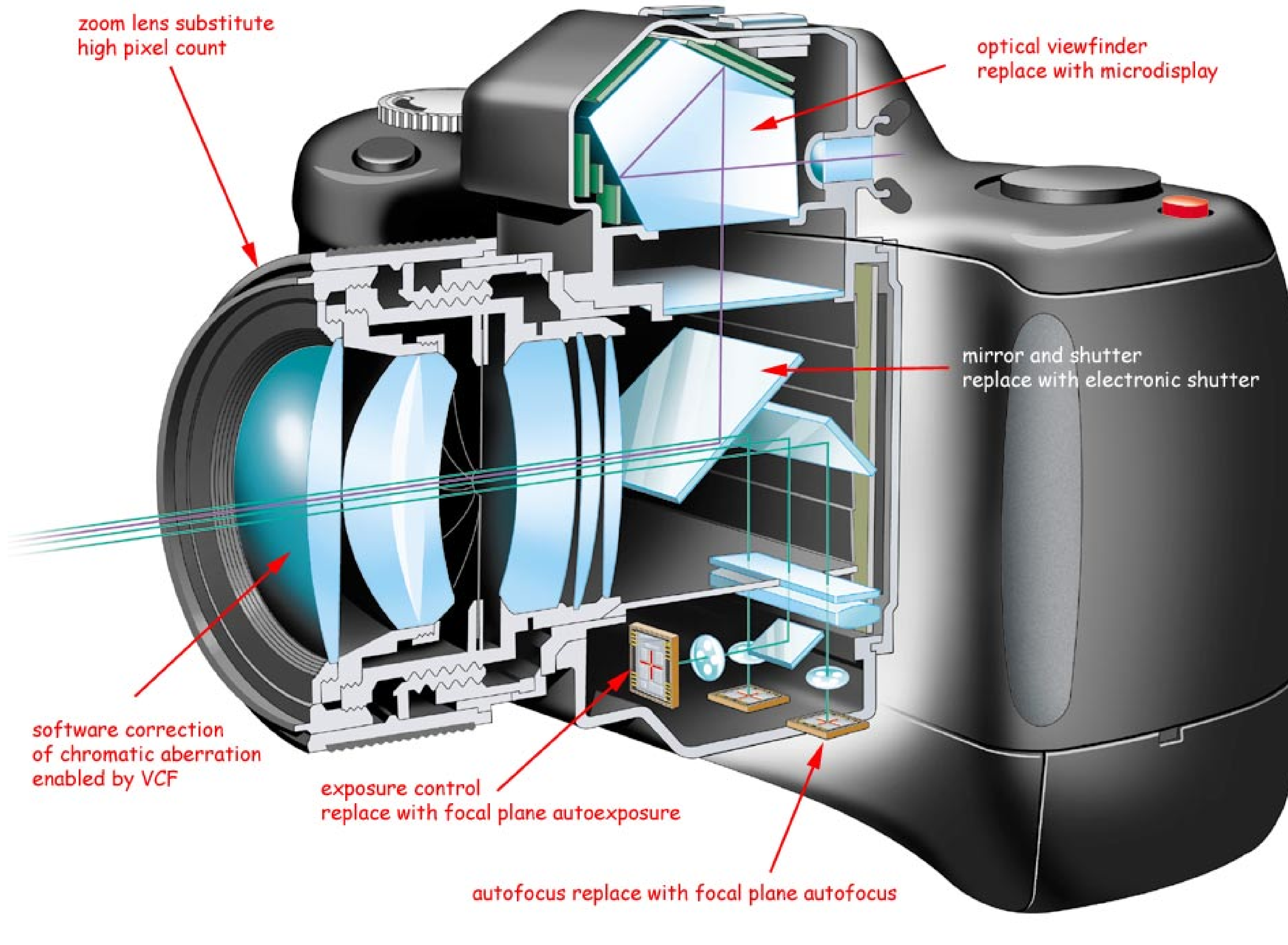
inertia

critical mass

disenchantment with hype

image quality

ease of use


zoom lens substitute
high pixel count
optical viewfinder
replace with microdisplay
mirror and shutter
replace with electronic shutter
software correction
of chromatic aberration
enabled by VCF
exposure control
replace with focal plane autoexposure
autofocus replace with focal plane autofocus

chromatic aberration in first tier camera company lens $1800

easy to correct in software if full color information is available

optics correction expensive

biggest lens issue for photographers

global electronic
shutter 1/4000

no motion
artifacts

no moving
parts

more
reliable

1.333 times
transistors
in array

how many pixels is enough ?

10.5 million sensors $\approx$ 35mm equivalent quality

is it only a marketing issue ?

large pixel counts

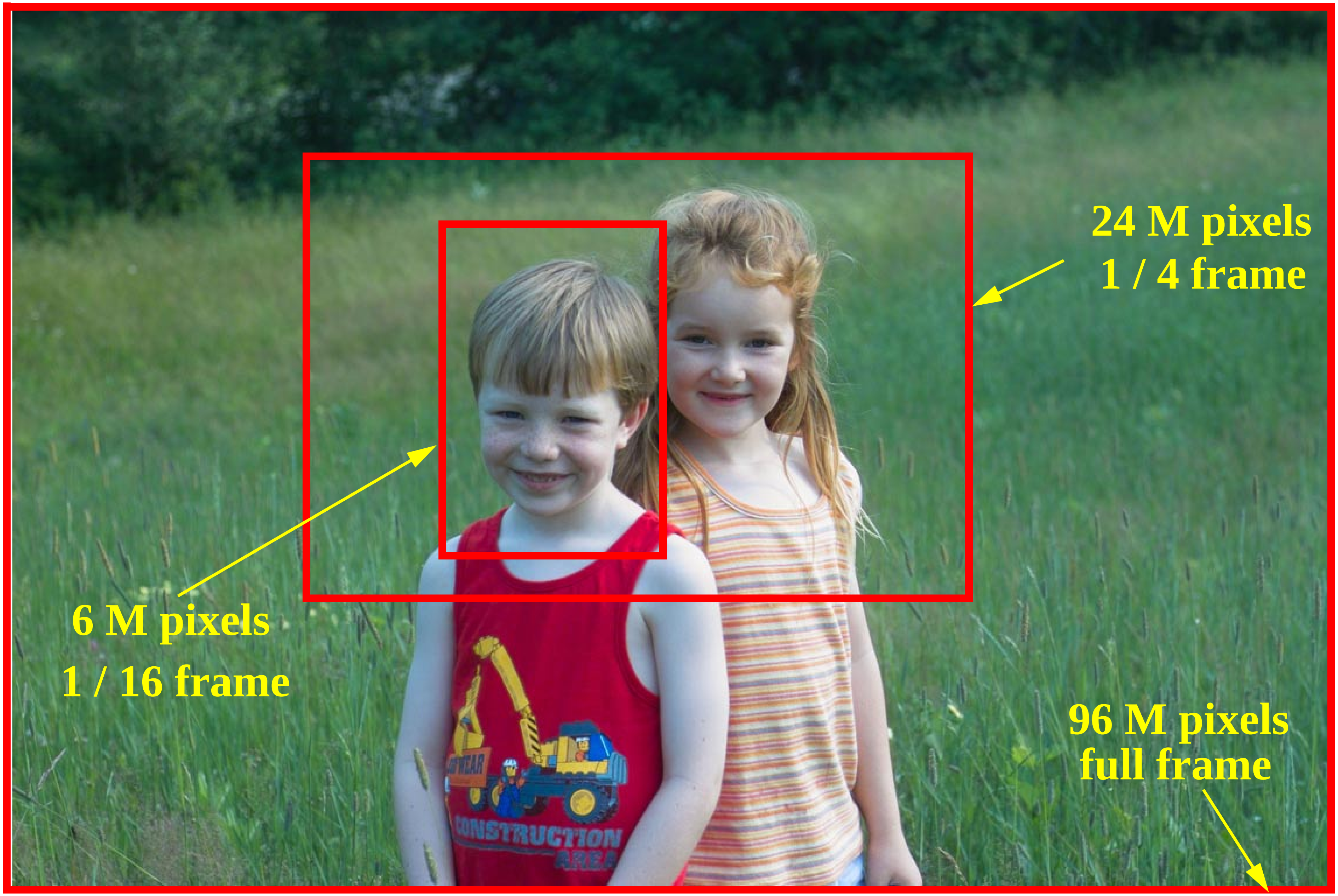
cropping to account for framing incompetence (ease of use)

electronic zoom cheaper than optical

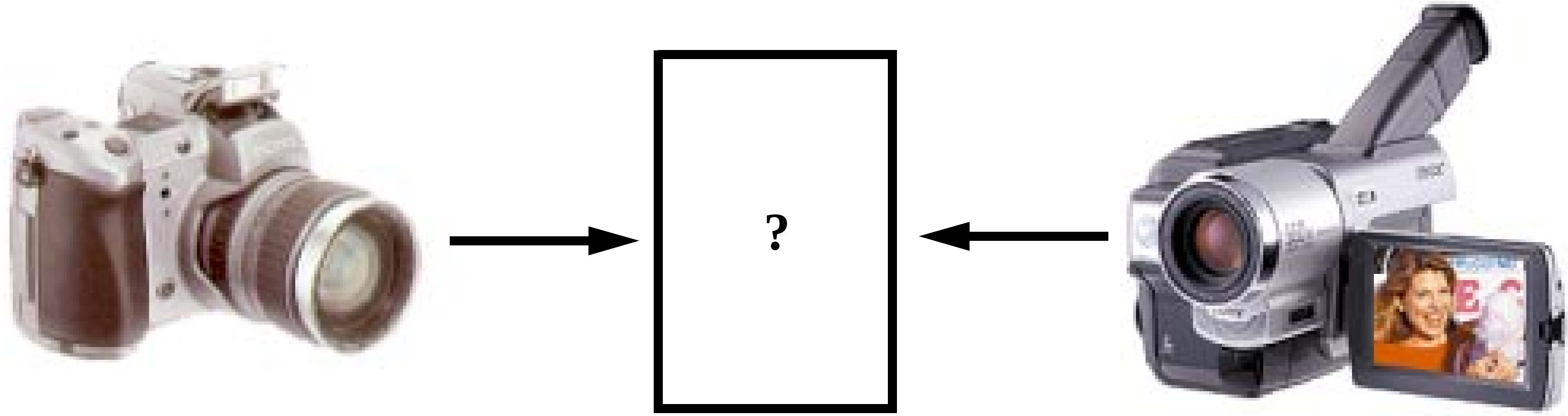
extra pixels can be averaged to reduce noise if not needed

or reduce aliasing by sampling within the lens blur spot

or used for very large blow up for once in a lifetime image !



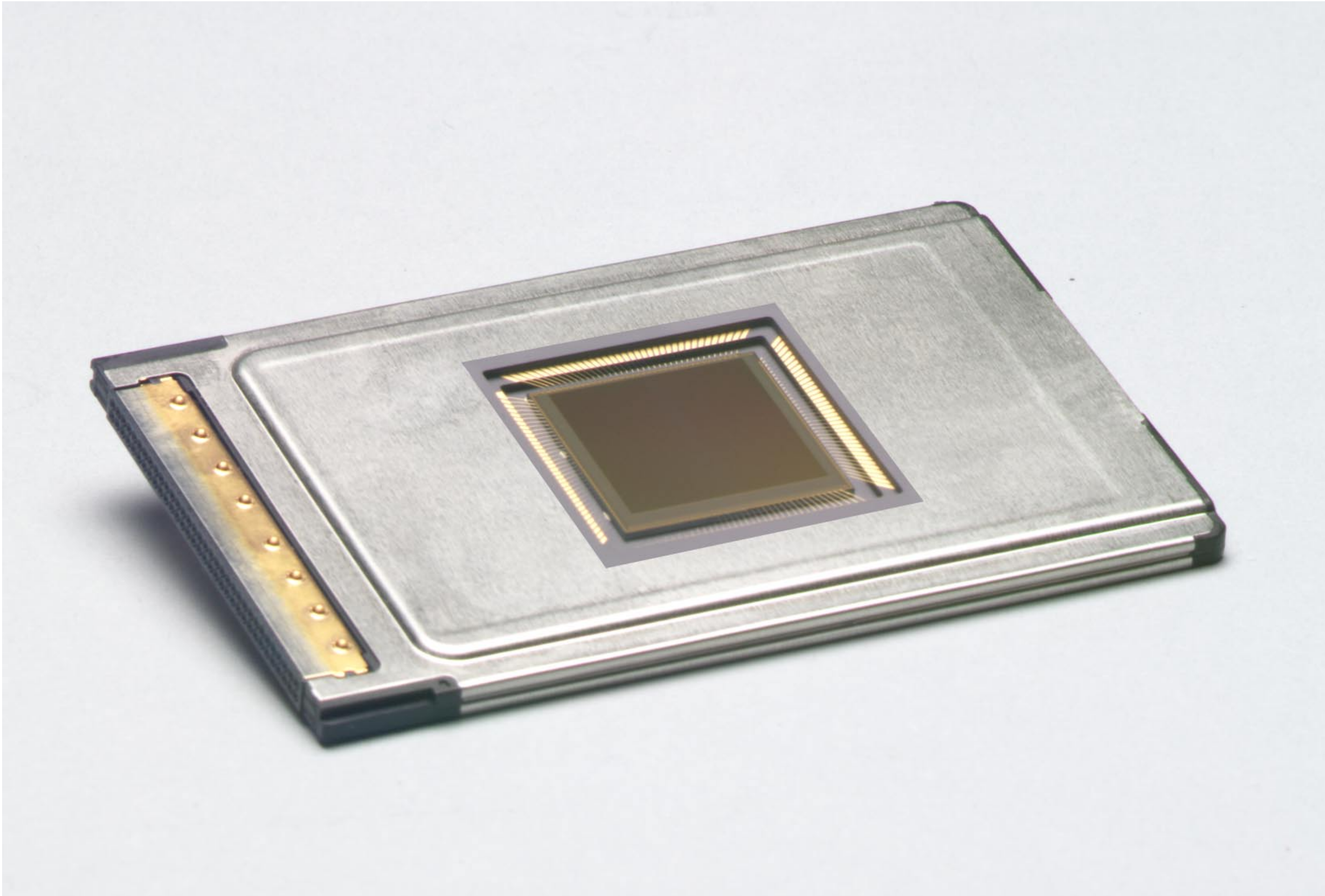
6928 x 4618 x R x G x B 4.33 um pixels in 30 mm x 20 mm field



uncompromised still images combined with uncompromised video

only one camera needed in the household !

X3 technology simplifies the problem



interchangeable sensor would provide film like flexibility

sensor can be optimized for different applications

sell more sensors, less cameras

electronic viewfinder

eliminates prism, secondary optics, flip mirror

enabled by CMOS sensor random access capability

focus, exposure, framing are EXACTLY what the primary sensor sees

movable zone to determine focus and exposure in the image target


FOVEON
focus
exposure

extended dynamic range imagers

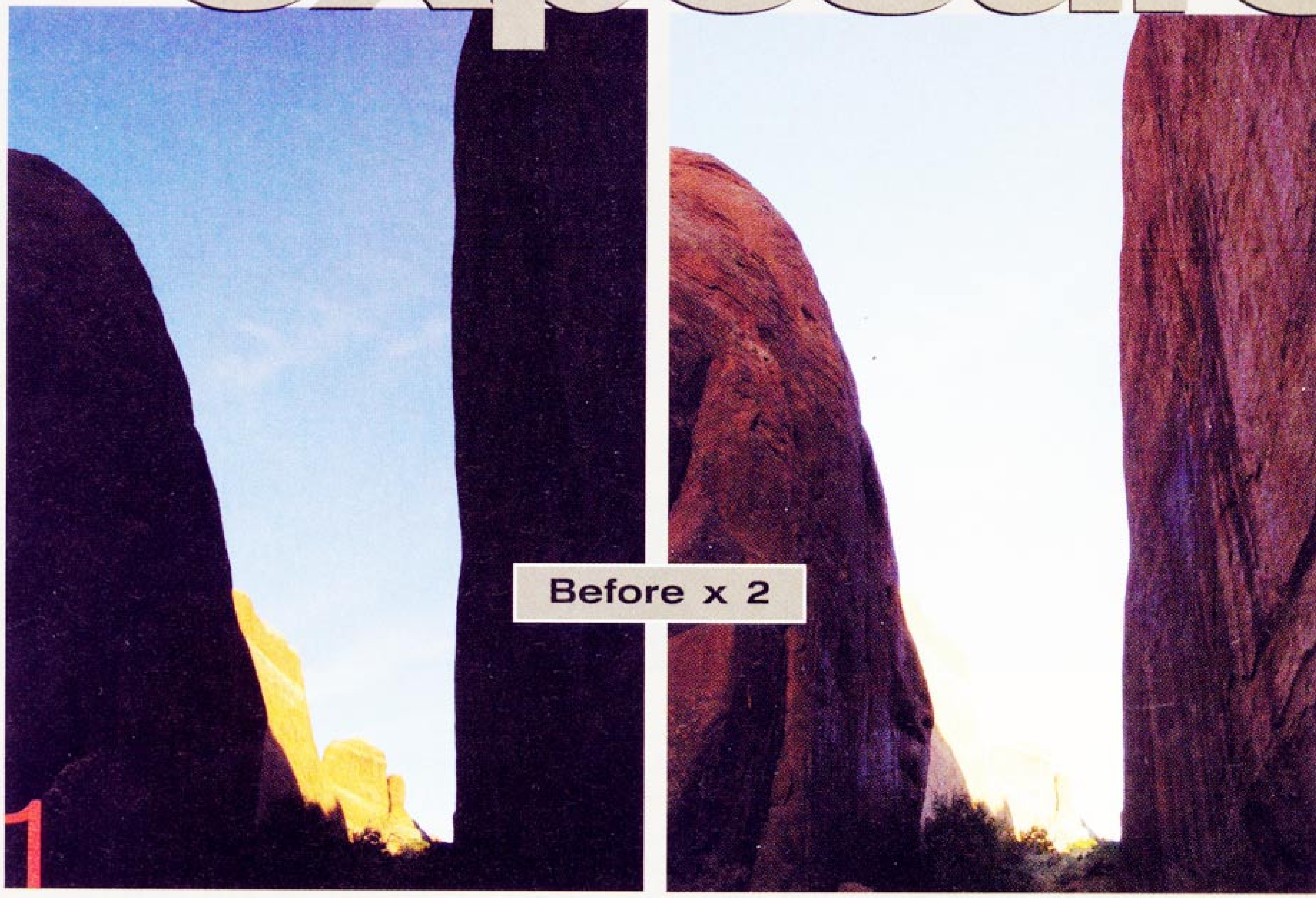
enabled by CMOS imager non-destructive readout, not possible with CCD

addresses two major ease-of-use issues:

a) exposure latitude

b) photography dynamic range < human vision

Double-Exposure exposure



1. These two photos show the original shots: The darker one is exposed to favor the highlights (the bright rock in the sun), and the lighter one is exposed to favor the shadows (the dark rock in the shade) to the point of washing out the highlights.

filter possibilities

spectral filters required for all photography to prevent invisible light from corrupting color, these filters can be as expensive as the sensor, integrating this filter onto the die would reduce cost

having this filter switch-able would allow interesting hobby shots in IR and UV

X3 technology eliminates the blur filter

self cleaning sensor would help the accumulated dust problem

depth of field and focus

traditional optics issue since 19th century

multiple focus to extend depth of field

optical filter & digital filter symbiosis

MARRYING OPTICS & electronics

Aspheric optical components and electronics improve depth of field for imaging systems.

By Edward Dowski, Jr., and Greg Johnson, CDM Optics Inc.

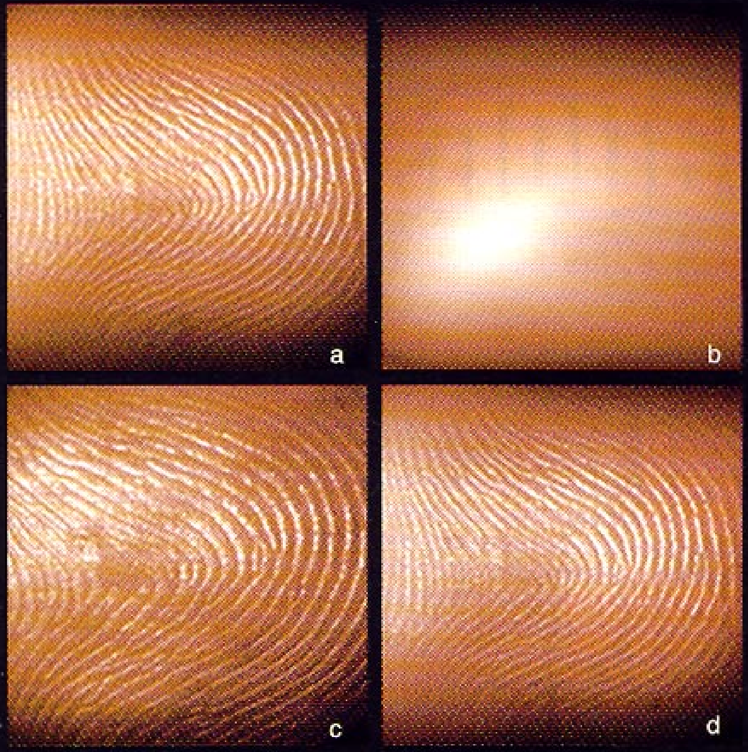


Figure 1
The fingerprint images show a traditional image at best focus (a), a traditional image badly out of focus (b), a wavefront-coded version of the system at best focus (c), and a large geometric defocus (d). Note that both (c) and (d) are sharp and clear.

The challenges to imaging systems in today's scientific and industrial markets are often insurmountable using traditional optics with their physical limitations. A hybrid imaging approach called wavefront coding combines optics and electronics to increase depth of field and reduce the number of optical elements, fabrication tolerances, and overall system cost (see figure 1).

In a wavefront coding system, the optical portion of the system "codes" the resulting images to produce intermediate images. Because the wavefront coding element purposefully blurs all points in any image, the intermediate image appears misfocused. In such intermediate images,

SNR improvement using MIPs

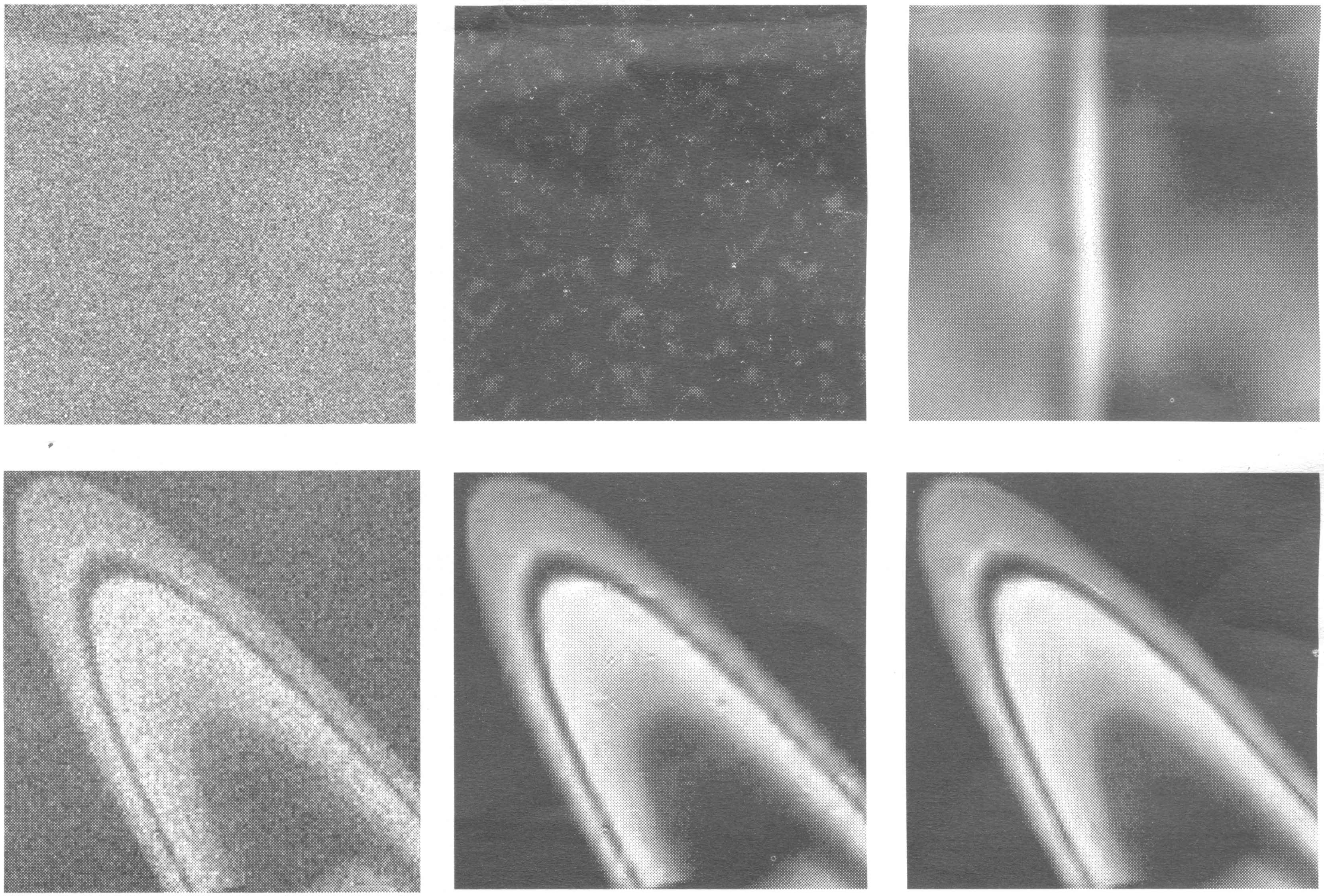


Figure 2. Top, respectively from left to right: original image containing a vertical band embedded in white noise, reconstructed image using the undecimated wavelet transform, and reconstructed image using the ridgelet transform. Bottom, respectively from left to right: noisy data (Saturn rings), reconstructed image for the wavelet coefficients, and reconstructed image from the curvelet coefficients.

memory

cost per bit trend good for digital photography

decrease in size power and weight also

format lifetime an issue

also availability & reliability

power

cost, ease of use, performance

major issue for photographers on vacation

demand side: CMOS, fewer motors, DSP,

supply side: batteries, fuel cells, ?

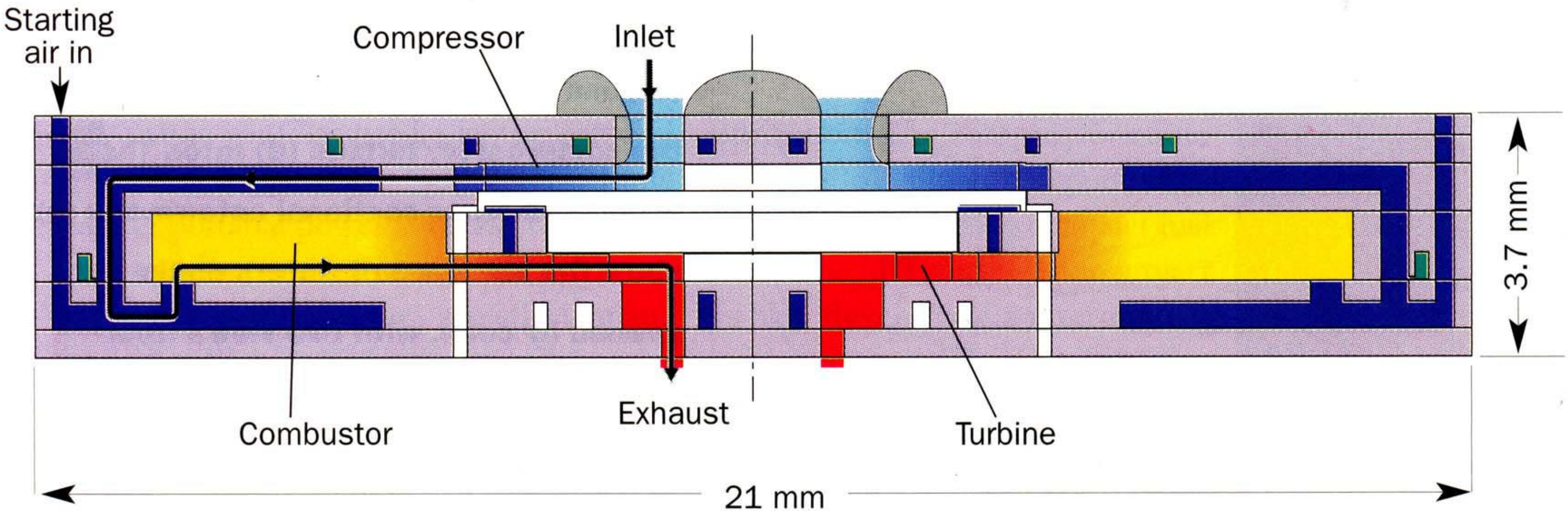


Figure 2. After the micro-engine is primed with compressed air, fuel and air are fed in, mixed, compressed, and ignited in the combustor to drive the turbine, which is axially conjoined with the compressor.

hydrocarbon fuels have ~ 100 times the energy density of batteries

bandwidth

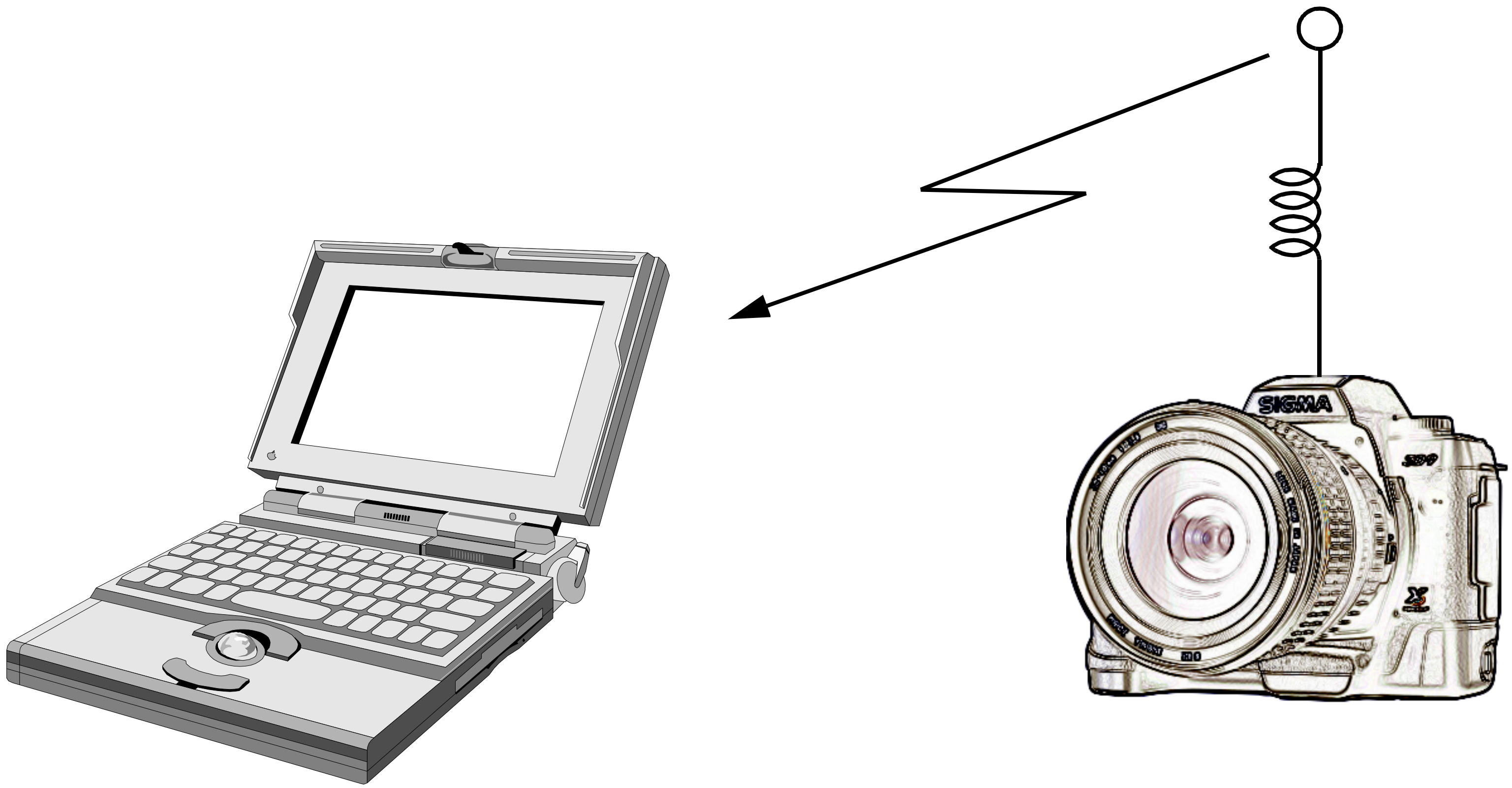
digital photography can help burn bandwidth (and MIPs)

higher bandwidth required for digital imaging to achieve full potential

user interface improvements

voice control camera well suited to speech recognition
small number of talkers, small number of control words

viewfinder control display with pointer control



wireless cameras would reduce critical pieces that can be lost

archiving

in principle digital has longer lifetime

issue is longevity of the media / format

solution is centralized database to maintain and organize data

4800 dpi Printing


Specification Sheet

PlasmaSync 50MP2
50-Inch Plasma Screen
Multimedia Display Screens

Reach a wider audience. Dazzle them, delight them, impress them. The PlasmaSync™ 50MP2 is the best way yet to reach an audience and hold their attention. Its flat 50-inch display is not only impressively large, its images are stunningly beautiful. But that's not all this advanced screen has to offer.

1 **Presentations are doubly effective with video and computer images together.** Now, for the first time in a plasma screen, you can simultaneously display video and computer images. Multi-screen operations let you show a video accompanied by data from a PC screen – or even view websites as the presentation proceeds. Display products with explanations about their use, or sales data with comments by the marketing team. Previously, video and computer images couldn't be displayed together because of their different refresh rates, but NEC solved the problem by developing a new multi-rate processing LSI. *A screen ratio of 4:3 and 16:9 may be selected for both PC and video sources, depending upon resolution and software.

2 **Capsulated Colour Filter technology for True-to-life Colour and Contrast.** A key to the PlasmaSync™ 50MP2's performance is NEC's exclusive Capsulated Colour Filter (CCF) technology. CCF employs embedded colour filters in each pixel to remove the orange colour emitted by the neon gas and to optimize the colour spectrum and decrease screen reflection. The results are true-to-life colours and enhanced contrast. In addition, because the PlasmaSync™ 50MP2 achieves "true colour balance" – the correct balance of red, green and blue – it is able to reproduce pure white tones.

Visual Communication
Multimedia Display Screens

NEC
PlasmaSync

large wall mount displays

more dynamic range than prints

multi use (TV, monitor, ...

more pixels

lower cost

summary: photography in the next 50 years

cheaper cameras

easier to use

better image quality exceeding film by a large margin

completely new applications / markets

communications intensive

rapid evolution, followed by standardization

edible camera

robot dog

"In the broadband future, almost every portable product will have a camera," Sony Corp (news - web sites) President Kunitake Ando declared to a global gathering of dealers in Yokohama earlier this month.