


How to Take Pretty Good Pictures for Engineering Reports


Overview

- Why are photos used in engineering reports?
- Micro to macro and beyond
- Camera “techno” stuff
- Backgrounds and lighting

Why Include Photo's?

- Documentation
  - Improves communication
  - Sometimes the ONLY way to properly document
  - Makes verbal description easier
- Add interest to the report

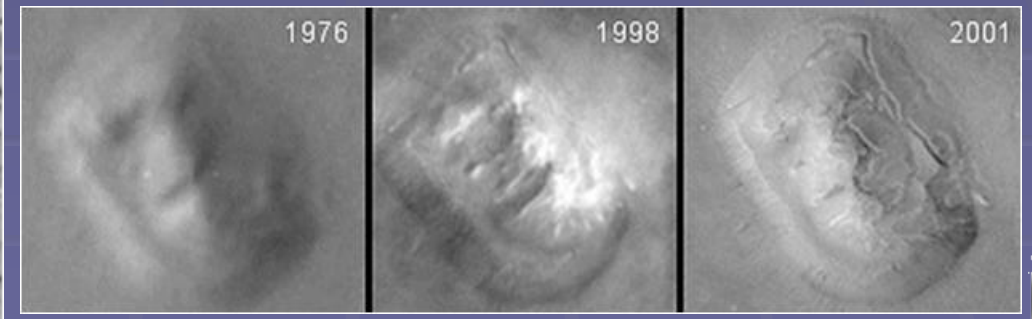
Micro-to-Macro and Beyond

- The size and weight of the object affects the ability to photograph it
- It affects lighting control, lenses, etc.
- Sizes:
  - Microscopic: optical microscopes and SEM
  - Very small: low power optical microscope
  - Small parts: macro/micro lenses
  - Mid-sized parts (easily maneuvered): camera
  - Large parts (immovable): camera

Lighting

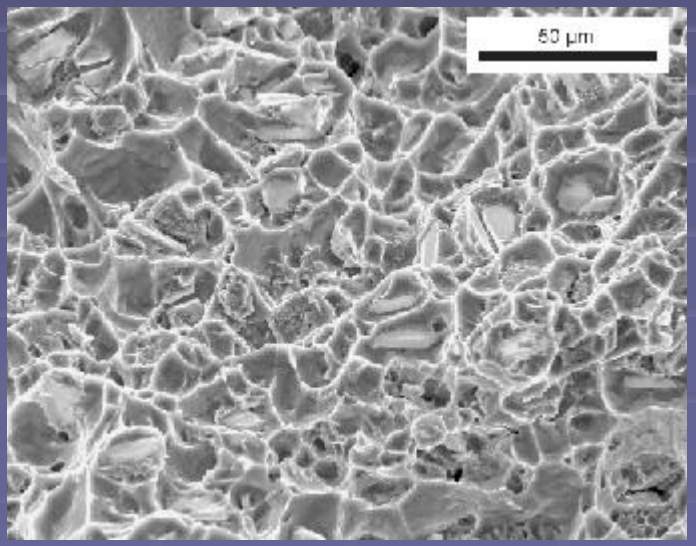
Regardless of scale, lighting is a critical element to control:

- Type of lighting (natural, fluorescent, etc.)
- Brightness, emphasis, contrast
- Shadows:



Microscopic

- Scanning Electron Microscope
- Large depth of field
- Features on the order of 10^{-6} meters



Source: www.stolenpicture

Microscopic

- Optical microscope
- 50X to 2000X (0.001 to 0.1 inch)
- Low depth of field (narrow focus range)
- Limited control over lighting (dark field, light field)
- Filters may enhance features
- Used primarily for microstructure

Low Power Microscopic

- Binocular microscope
- 5X to 40X (0.1 to 1 inch)
- Oblique lighting may be used to enhance surface details

Small Parts

- “Micro/Macro” Lens
- Close up (about 0.5 inch to 20 inches)
- Significant control over lighting
  - May be “back lit”
  - Oblique lighting may enhance surface features

Moderate Sized Objects

- Can be maneuvered but not easily lifted
- Cars, bikes, similar
- Lighting and positioning may be controlled to a limited extent

Big Objects

- Cannot be maneuvered
- Natural lighting (depends on weather, time of day, etc.)

Camera “Techno” Stuff

- Depth of field (focal length ratio)
- Aperture + shutter speed controls:
  - “Brightness”
  - Depth of field, “blurriness”, etc.
- Light settings (incandescent, fluorescent, natural)
- Digital: resolution and quality
- Lenses

Depth of Field

- Depth of field describes the distance in front of and beyond an object that appears to be in focus
- F-ratio
  - (focal ratio = focal length/aperture diameter)
  - Large number (f/22) means small aperture
  - Small number (f/4.5) mean large aperture
    - Focal length is 4.5 times larger than aperture

Depth of Field

- What is “good”?
- Large DOF – good for showing details of an object that are at differing distances from the lens
- Small DOF – good for reducing background or foreground distractions

Depth of Field

- Examples:

Small aperture (f22)
Long depth of field

Large aperture (f4.5)
Short depth of field

Depth of Field

- Example:

Small aperture (F/22)
Long depth of field

Large aperture (f/4.5)
Short depth of field

Shutter Speed

- Slow shutter speed causes moving objects to appear blurred
- Can be used to show motion
- Can be distracting and unwanted

Shutter Speed

Slow shutter speed (1/20 sec)

Fast shutter speed (1/200 sec)

Aperture and Speed

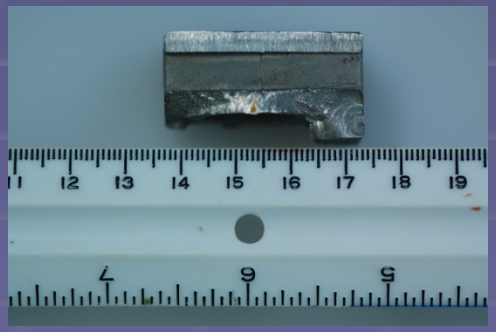
- Together, aperture and shutter speed determine exposure brightness
- High f-ratio (large focal ratio) means small aperture. This requires slower shutter speed for same exposure.
- Low f-ratio (small focal ratio) means larger aperture (requires faster shutter speed).

Camera Control

- Most cameras allow aperture and shutter speed control.
- Nikon D40
  - A: aperture priority (you select aperture)
  - S: shutter speed priority (you select speed)
  - M: manual (you select both aperture and speed)
  - P: automatic (camera selects speed and aperture)

Lighting Sources

- Different sources of light = different colors
- Eyes may not detect it, but cameras will
- Check the first image to make sure settings are correct



Camera set to “incandescent”
With fluorescent lighting (blue)

Camera set to “fluorescent”
With fluorescent lighting (correct)

Examples of Color Problems

Camera setting: Incandescent (+3):

L– natural light, C – halogen light; R – fluorescent light

BOTTOM LINE:
check your photo's color before progressing

Resolution

- How much is enough?
- Memory is cheap, but…
- May want small files for sending via email

Image Quality

- The number of pixels defines the resolution (“clear” or “grainy”)
- The image quality describes how well the color is recorded
- The higher the quality, the larger the file size
- You decide what you want

Down Sizing

- PowerPoint and Word:
- Reduce PowerPoint from 25MB to 500KB (that's 98% reduction) without noticeable effects.
  - "Cut" and "paste" the image into the document
  - Then "cut" the image again
  - "Paste Special" as JPG

Lenses

- Macro/micro lenses:
  - Allow very close up photographs
- Wide angle lenses:
  - Give impression that background and foreground objects are separated more than they are
  - Extreme wide field objects appear distorted (curved)

Lenses

- Standard lenses:
  - Gives “normal” perspective
  - What the “eye” actually sees in real life
- Telephoto lenses:
  - Allow things far away to appear larger
  - Can “foreshorten” the image making background objects appear close to foreground objects

Telephoto and Wide Angle

Telephoto
(mountains look very close)
Source: www.stolenpicture

Wide angle
(person in back
looks far away)

Perspective

Backgrounds

- Clutter
  - Undesired objects not noticed in person may be very noticeable photograph
  - Can be very distracting
- Single color (black or white) backgrounds will make the subject standout.
- Clutter includes:
  - Shadows
  - People
  - Junk
  - Any object

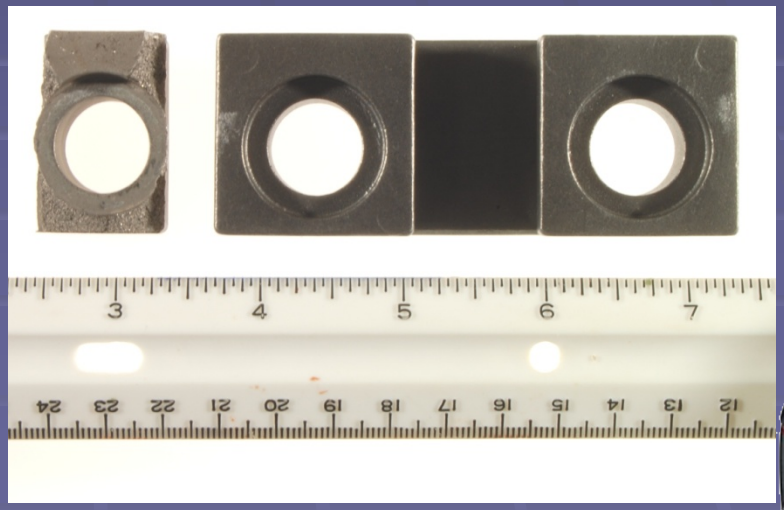
Backgrounds

2 Types of Photos

- Documentary photographs
  - “Artistic” appearance is less important
  - Angles and lighting should support the purpose of the documentation, not for dramatic effects
  - Include a scale in the photograph
- “Artistic” photographs
  - Not widely used in engineering documentation
  - May be used for cover pages, backgrounds in presentations, etc.

Documentary

- Include a scale in the photo
- “Square” the object and scale
- Use backlighting to enhance the object and reduce shadows



“Artistic”

- Moving objects should have empty space in front of them into which they move.
- Moving towards you is more dramatic

Conclusion, Part 1 of 3

- Photos for Engineering Documents:
  - Less concerned with “artistic” aspects
  - Include a scale in photos
  - May want to “square” the object
- Microscopic and macroscopic available
- Aperture:
  - Large aperture reduces depth of field
  - Small aperture increases depth of field
- Shutter speed:
  - Fast will freeze action
  - Slow can show action

Conclusion, Part 2 of 3

- Pick appropriate lighting and settings
  - Incandescent, fluorescent, natural
  - Be careful of unwanted shadows
  - Backlighting can produce professional quality
- Minimize background clutter
  - Use backlighting
  - Use large aperture
  - Remove background clutter

Conclusion, Part 3 of 3

- Immediately review the photographs
- Check for
  - Good background
  - Shadows
  - Color (correct light setting)
  - Focus