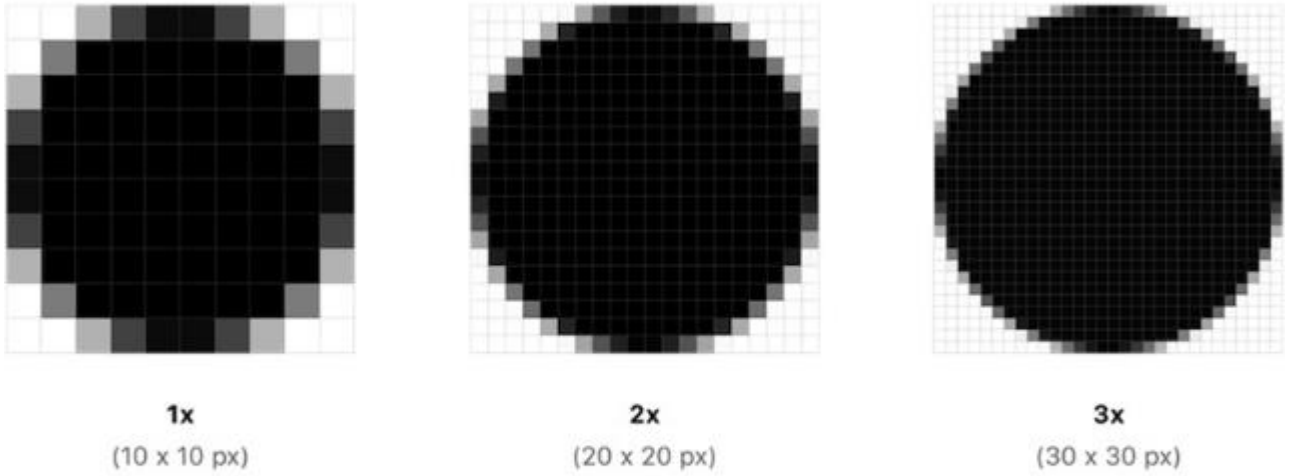
Pixels in Space



The pixel is at the heart of image processing and digital images, from space telescope pictures to rover “selfies.“

The word "pixel" is a contraction of "picture element." The use of the word "pixel" traces back to research papers written in 1965 by digital imaging pioneer Frederic C. Billingsley of the Jet Propulsion Laboratory.

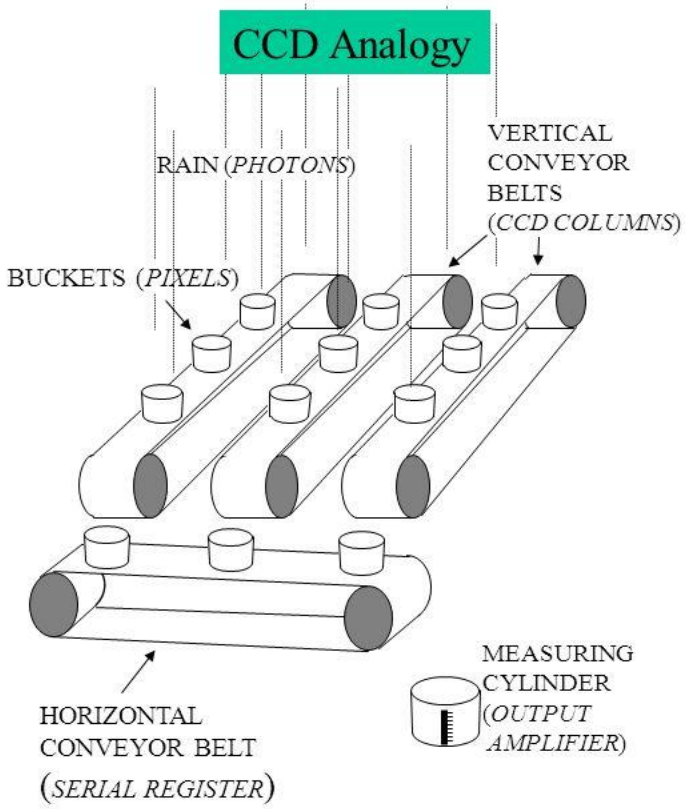
Information source:
https://mars.nasa.gov/mars2020/mission/instruments/pixl/

Image source:
https://www.flnet.tw/FLNet_Sogi/article.aspx?ArticleID=6249396

Video: https://youtu.be/5ueMGZTezfY

How Images are Captured

- The sensor is made up of pixels, each of which is a MOS (metal-oxide semiconductor) capacitor.
- The image from a CCD is black and white, but by placing a red, green or blue colored filter over the top of each pixel, color information can be read directly from each pixel – but only for one primary color per pixel.



Information source: https://www.wired.com/2009/10/ccd-inventors-awarded-nobel-prize-40-years-on/
Image source: http://slideplayer.com/slide/4936296/

How Images are Transmitted

- The data is first converted into binary numbers.
- From a CCD, the number of photons hitting a pixel is assigned a single number representing the total brightness for that pixel.
- Satellites communicate by altering radio wave amplitude & wavelength to send analog signals to the antennas on the Earth which reassemble the pixels into an image.

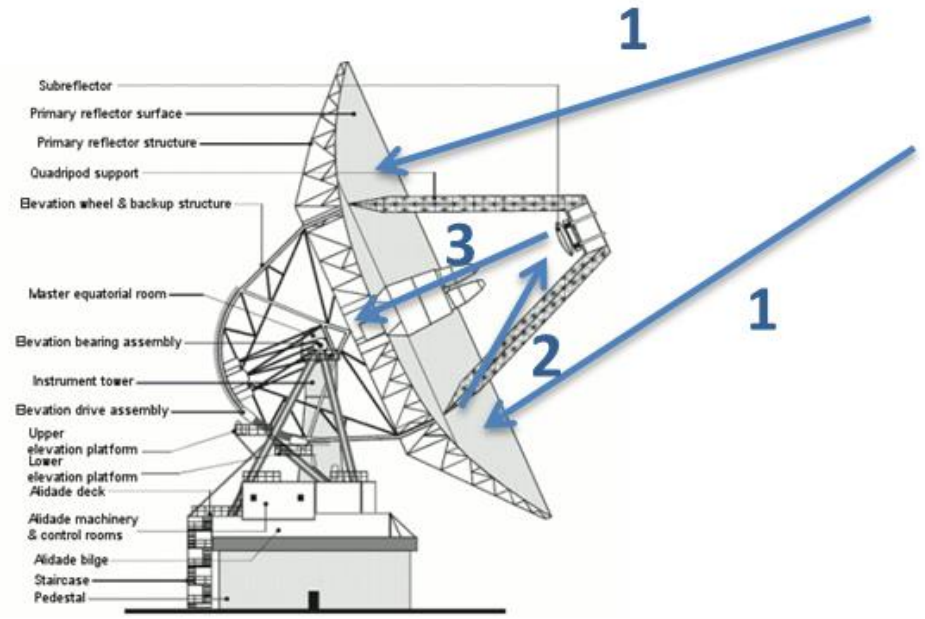


Image Source: https://www.nasa.gov/directorates/heo/scan/communications/outreach/funfacts/txt_antenna_work.html

Activities & Additional References

- Pixel This! - https://spaceplace.nasa.gov/classroom-activities/en/
- Write Your Name in Binary Code - https://www.sciencefriday.com/educational-resources/write-your-name-in-binary-code/
- Deep Space Network - https://deepspace.jpl.nasa.gov/
- Remote Sensing Math (Math 1) - https://www.nasa.gov/pdf/637834main_Remote_Sensing_Math.pdf
- Image Scale Math (6th Grade Math) - https://www.nasa.gov/sites/default/files/atoms/files/image_scale_math.pdf
- Waves & Information Transfer Educator Guide - https://www.mos.org/sites/dev-elvis.mos.org/files/docs/offerings/mos_educator-guide_nasa_waves-and-information-transfer.pdf
- The NASA Imager Dentists Use Daily - https://www.nasa.gov/directorates/spacetech/spinoff/feature/the-nasa-imager-dentists-use-daily
- Smoky Mountain STEM Collaborative Repository - https://www.southwesterncc.edu/stem-repository