PlanetScope

==highlight== shows info to be input into instrument specs json file

[1] https://earth.esa.int/web/guest/missions/3rd-party-missions/current-missions/planetscope

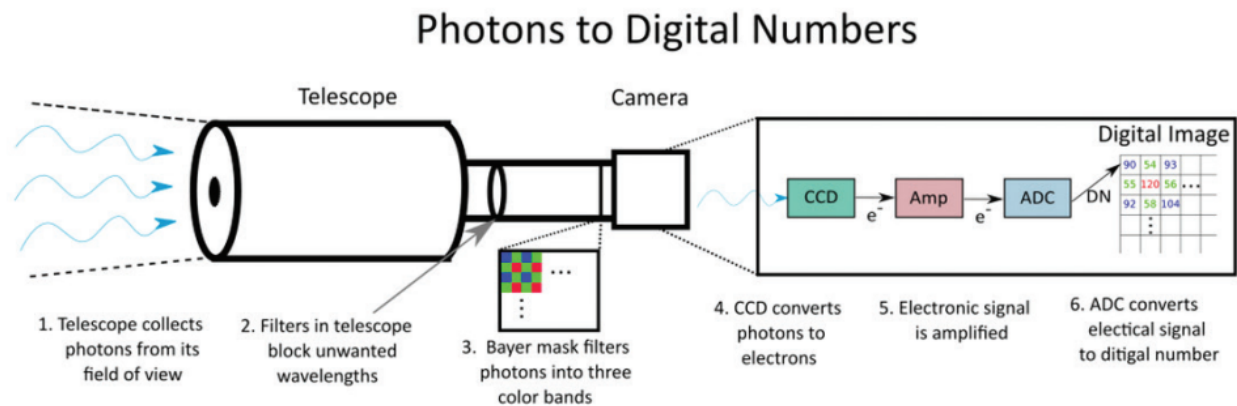- **Sensor Specification**

Sensor Type	Four-band frame Imager with a split-frame NIR filter
Spectral Bands Blue Green Red NIR	455 – 515 nm 500 – 590 nm 590 – 670 nm 780 – 860 nm
Ground Sample Distance (nadir)	3.5 m - 4 m depending on flock
Frame Size	24.6 km x 6.4 km (approximate)
Maximum Image Strip per orbit	20,000 km^2
Revisit Time	Daily at nadir (2017)
Image Capture Capacity	340 million km^2/day
Camera Dynamic Range	12-bit

[2] Planet Labs Specifications: Spacecraft Operations & Ground Systems 2015

- Planet Labs has launched three versions of its optical system, Planet Scope 0, Planet Scope 1, and Planet Scope 2.
- Planet Labs satellites each carry a telescope and a frame CCD camera equipped with Bayer-mask flter. The CCD sensor converts fltered photons into electrons, which are then amplifed in order to produce a digital number corresponding to each pixel in each band.

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Photons to Digital Numbers

Telescope **Camera**

Digital Image

| | | |
|90|54|93|
|55|120|56| ...
|92|58|104|

CCD → Amp → ADC → DN
e⁻   e⁻

1. Telescope collects photons from its field of view
2. Filters in telescope block unwanted wavelengths
3. Bayer mask filters photons into three color bands
4. CCD converts photons to electrons
5. Electronic signal is amplified
6. ADC converts electical signal to ditigal number

- PS0 features a 2 element Maksutov Cassegrain optical system paired with an 11MP CCD detector. Optical elements are mounted relative to the structure of the spacecraft.

PS1 features the same optical system as PS0, aligned and mounted in an isolated carbon fber/titanium telescope. This telescope is matched with an 11MP CCD detector.

PS2 features a fve element optical system that provides a wider feld of view and superior image quality. This optical system is paired with a 29MP CCD detector.

PS2
475km altitude
HFOV: 24.6km
VFOV: 16.4km
Area: 405 km sq
GSD: 3.73m

- Images are captured in 12 bit aboard the satellites and are then encoded to 8 bit for data transmission to the ground station

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Spectral Bands	Red: 610-700nm Green: 500-590nm	Red: 610-700nm Green: 500-590nm Blue: 420-530nm

	Blue: 420-530nm	
Orbital Insertion Altitude	420km	475km (target altitude for future SSO launches
Ground Sampling Distance (Nadir)	2.7m - 3.2m	3.7m - 4.9m

[3] Overview of the Planet Labs Constellation of Earth Imaging Satellites In Space to Help Life on Earth March 2015 Mike Safyan

- 90 mm aperture optical payload

[4] High performance optical payloads for microsatellites Roland Geyl, Jacques Rodolfo, Jean-Philippe Girault, SPIE 2017

These satellites are initially based on a commercial telescope optics, probably the Questar 3.5 90 mm aperture telescope with 1400 mm focal length and 1.4° FoV only and offer 3,70-m GSD from relatively short lived 475 km orbit.

[5] Questar Standard 3.5" Telescope Specification Sheet

TYPE:	Maksutov Cassegrain Catadioptric. No coma, astigmatism or spherical aberrations.
CLEAR APERTURE:	3.5 inches, 89mm (Center Obscuration, 27.9mm)
FOCAL LENGTH:	Basic Visual 50.5 inches, f/14.4, 1300mm
	Camera close, 56 inches, f/16, 1400 mm
FOCAL LENGTH:	Camera with Ext. Tubes, 64 inches, f/18, 1600mm
	4" Fl., 4x and 8x, Field 12° and 8°
FOCAL LENGTH:	Powers are eyepiece dependent and can range from 40x to 270x with Questar Brandon eyepieces
FINDER	Resolves 1 sec. Arc at 50feet EFL
LENS:	Photographic model, 1°30min, visual field of view 1.1o to .16o

POWERS: POWERS LIMIT: FIELD OF VIEW:	

Determined PlanetScope sensor specs (highlight are "guessed-values"):

CT Swath: 24.6 km at 475 km altitude=> CT-FOV = 2.9662 deg

AT Swath: 16.4 km at 475 km altitude=> AT-FOV = 1.9773 deg

max exposure time = 5.5e-6/0.7095 *475e3 / 7.1e3 = 0.51861556 ms

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    "power": 5,
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        "alongTrackFieldOfView": 1.9773,
        "crossTrackFieldOfView": 2.9662
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        "sideLookAngle": 0
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    "_references": {
     "ref1": "https://earth.esa.int/web/guest/missions/3rd-party-missions/current-missions/planetscope",
"ref2": "Planet Labs Specifications: Spacecraft Operations & Ground Systems 2015",
"ref3": "https://www.isispace.nl/cubesat-platforms/"
    }
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    "@type": "Passive Optical Scanner",
    "name": "PlanetScope-PS2",
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    "power": 5,
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        "crossTrackFieldOfView": 2.9662
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        "sideLookAngle": 0
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    "focalLength": 0.7095,
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    "operatingWavelength": 475e-9,
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    "apertureDia": 89e-3,
    "Fnum": 8,
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erical (ISIS) 3U cubesat payload capacity advertisement.",
"Telescope and detector specs are guessed.",
"datarate is wrong."
],
    "references": {
     "ref1": "https://www.isispace.nl/cubesat-platforms/"
    }
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