Astro 331X Lab 2: Camera Payload

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Overview

FlatSAT's payload is an ArduCAM-M-2MP Plus visible-light camera. You will use this camera to capture images of a test chart at ranges from 0.5 to 5 m to validate prelab predictions and determine if the camera will be able to provide 100 m resolution from its 500 km circular orbit.

Content

For each distance in Table 1, calculate expected diffraction-limited resolution and pixel-limited resolution using the information provided in the Appendix.

Table 1 Predicted resolution

distance	diffraction-limited	pixel-limited
50 cm		
1 m		
2 m		
5 m		
500 km		

Comment on whether the camera's resolution is diffraction-limited or pixel-limited. Comment on your results, including whether they system will meet mission requirements. Discuss design changes to improve system performance.

math

Diffraction-limited resolution (Equation 1):

$$X' = \frac{2.44\lambda h}{D} \tag{1}$$

Pixel-limited resolution, from SMAD Fig 9-8:

$$X = \frac{2R}{p} \tag{2}$$

Magnification:

$$\text{magnification} = \frac{f}{h} = \frac{r_d}{R} \tag{3}$$

A. Arducam specifications

- Power supply Normal: 5V/70mA
- Low power mode: 5V/20mA
- SPI speed: 8MHz
- Frame buffer: 384KB
- Size: 34 x 24 mm
- Weight: 20 g
- Temperature: −10 °C~55 °C
- Active array size: 1600x1200
- Shutter: rolling shutter
- Lens: 1/4 inch
- Resolution support: UXGA, SVGA,VGA,QVGA,CIF,QCIF
- Format support: RAW, YUV, RGB, JPEG
- Pixel Size: 2.2 µm x 2.2 µm

SPECIFICATION:

1.Sensor Format:	max Ø5.3mm
2.EFL:	3.96 mm
3.F-number:	2.6
4.Construction:	4P+1IR
5.TV Distortion:	<1.2%
6.FOV:	56.8°
7.FBL:	1.29mm
8.IR:	645nm

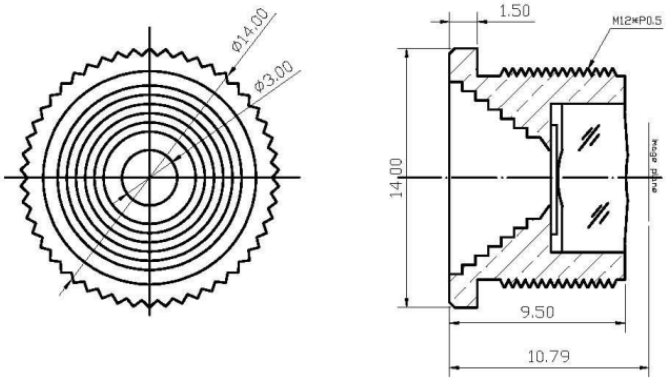

Fig. 1 ArduCAM S mount lens

Table 2 ArduCAM parameter summary

Active array size *	1600 px × 1200 px
Pixel size	2.2 µm x 2.2 µm
Focal length	3.96 mm
Aperture Diameter	3.00 mm
FOV	56.8deg

*Use the larger number for pixel-limited resolution