

IIUM-DEIMOS

SOLUTION POSTER FOR
LENS DESIGN OF MULTISPECTRAL
CAMERA FOR FLOOD DETECTION
NATIONAL SPACE IMAGING PAYLOAD COMPETITION

MISSION OBJECTIVE AND GOAL



To minimize damage and enhance disaster response and relief efforts, effective flood detection and monitoring is essential.



1

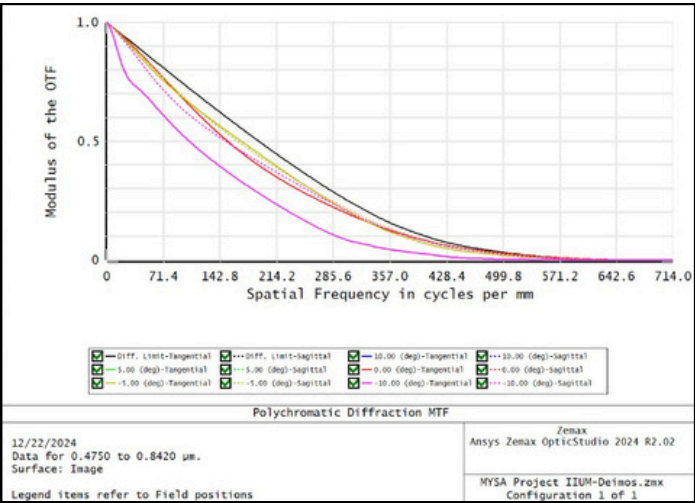
To capture **high-resolution multispectral and RGB** imagery to identify water bodies, flooded areas, and changes in land cover.

2

To demonstrate the **feasibility** to integrate with **CubeSat**

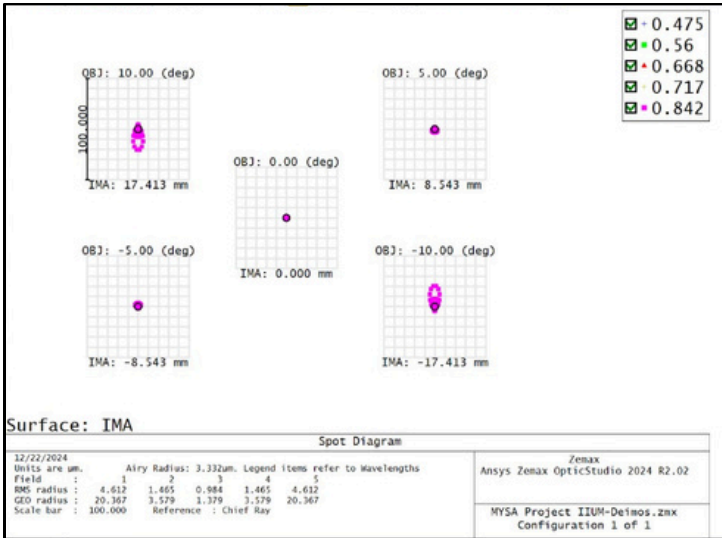
GSD	10 m
Altitude	700 km
Pixel Size	1.4 μ m
Focal Length	98 mm
FoV	20°

FFT MTF



- Curves show **less sharp decline**.
- Curves are much **closer to the diffraction limit**, illustrating **better performance**.

Spot Diagram



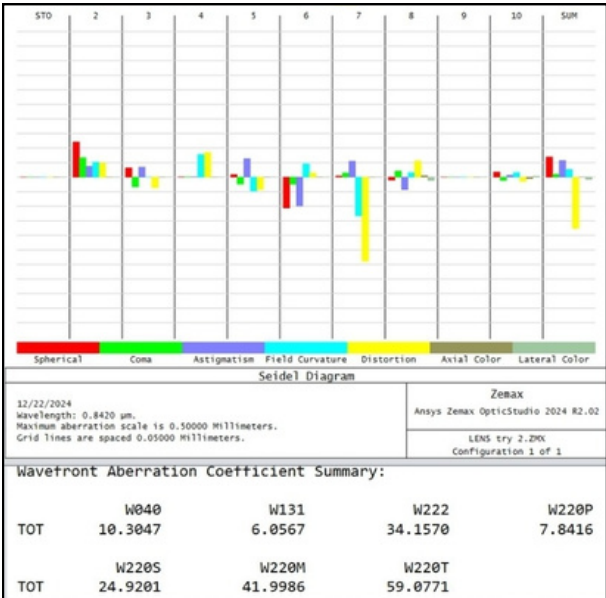
- Most of the RMS radius are **within the Airy disk radius**
- Diffraction-limited** at the center of the field
- Aberrations increase** at larger field angles

FINAL DESIGN

Lens Data

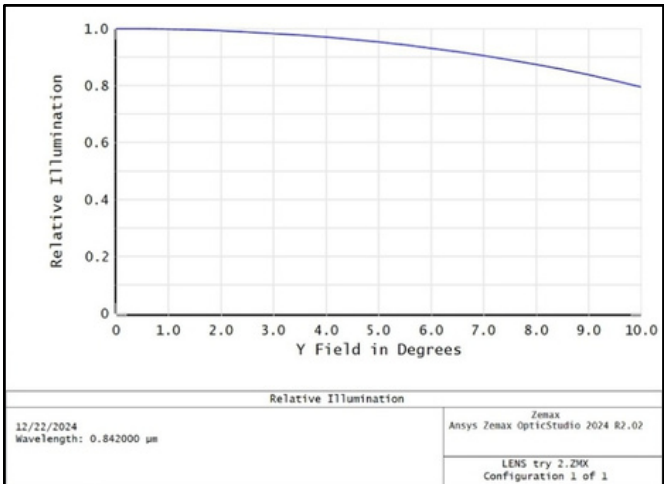
Surface	Type	t	Radius	Thickness	Material	Coating	Clear
0	OB	Standard	Infinity	Infinity			
1	STC	Standard	Infinity	2.000			
2	Standard		41.983 V	25.000	1.50,0.0 M		
3	Standard		Infinity	2.000			
4	Standard		56.020 V	13.000	1.50,0.0 M		
5	Even Asphere		41.717 V	5.000			
6	Even Asphere		-49.213 V	7.500	1.50,0.0 M		
7	Standard		86.212 V	10.000			
8	Standard		-287.000	5.000	3.85,-0.1 V		
9	Standard		-37.962	5.000	4.51,-1033.4 V		
10	Standard		-85.057	50.098 V			
11	IM	Standard	Infinity				

Seidel Diagram



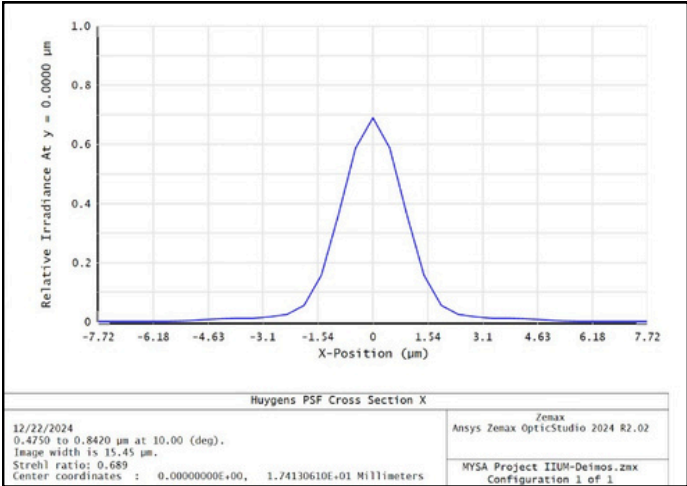
- Spherical aberrations and distortions** are significantly reduced
- Coma and astigmatism** are more evenly distributed, **improving optical symmetry**
- Reduced aberrations** indicating improved system uniformity

Relative Illumination



- Significant Drop:** Reduced uniformity after optimization
- Gradual Decline:** Decreased consistency
- Retained Illumination:** Maintains over half of its maximum illumination

Huygens PSF Cross Section



- Sharp peak with **Strehl Ratio of 0.689**
- Good focus and performance** with **minor aberrations**

DESIGN SPECIFICATION

Lens Materials:

- N-BK7 ($n \approx 1.5$)
- Gallium Arsenide ($n \approx 3.8$)
- Germanium ($n \approx 4.5$)

Lens Thickness: 5-25 mm

Operating Temperature:

-20°C to -30°C

Transmission Range:

- N-BK7: 350 nm to 2.5 μ m
- Gallium Arsenide: 0.9 μ m to 16 μ m
- Germanium: 2 μ m to 12 μ m

Weight of system: 247.5276 g

GSD: 10.069 m

Operation altitude:

700 km

Pixel size: 1.4 μ m

Focal length: 98 mm

FOV: 20°

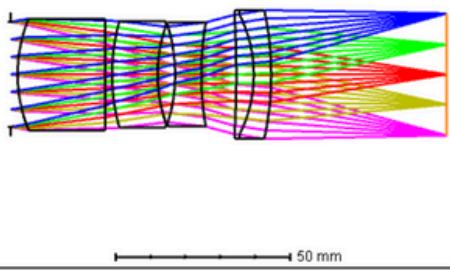
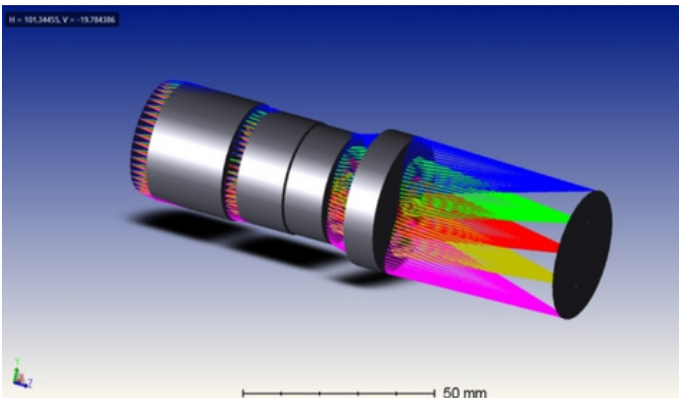
EFFL: 97.3312

WFNO: 3.24356

ENPD: 30

TOTR: 124.598 m

FINAL DESIGN



Application: 2U CubeSat for Flood Detection