Appendix A to Part 960—Application Information Required

To apply for a license to operate a remote sensing space system under 51 U.S.C. 60101, et seq. and 15 CFR part 960, you must provide:

1. Material Facts: Fully accurate and responsive information to the following prompts under "Description of Licensee" and "Description of System." If a question is not applicable, write "N/A" and explain, if necessary.

2. Affirmation: Confirm by indicating below that there will be, at all times, measures in place to ensure positive control of any spacecraft in the system that have propulsion, if applicable to your system. Such measures include encryption of telemetry, command, and control communications or alternative measures consistent with industry best practice.

3. Your response to each prompt below constitutes a material fact. If any information you submit later becomes inaccurate or incomplete before a license grant or denial, you must promptly contact the Secretary and submit correct and updated information as instructed by the Secretary.

Part A: Description of Applicant (Operator)
1. General Applicant Information

a. Name of Applicant (entity or individual):
University of Georgia

b. Location and address of Applicant:
Athens, GA, 30602

c. Applicant contact information (for example, general corporate or university contact information):

President Jere W. Morehead
220 S. Jackson St.
Athens, GA 30602
706-542-1214
president@uga.edu

Dr. David Lee
Vice President for Research
500 DW Brooks Dr.
Athens, GA 30602
706-542-5969
ovpr@uga.edu

Deepak Mishra
Research Scientist, Principal Investigator
210 Field Street

Athens GA, 30602
dmishra@uga.edu

d. Contact information for a specific individual to serve as the point of contact with Commerce:

For Service of Process:

University of Georgia
Lustrat House
Athens, Georgia 30602

For project-related documents:

Jason Reisfeld
310 E. Campus Rd. Rm 0401
Athens, GA 30602

Deepak Mishra
Research Scientist, Principal Investigator
210 Field Street
Athens GA, 30602
dmishra@uga.edu

Primary Contact

Deepak Mishra
Research Scientist, Principal Investigator
210 Field Street
Athens GA, 30602
dmishra@uga.edu

e. Contact information for a specific individual to serve as the point of contact with Commerce for limited-operations directives, if different than main point of contact, in the event that the applicant will receive a license in Tier 2 or Tier 3:

Deepak Mishra
Research Scientist, Principal Investigator
210 Field Street
Athens GA, 30602
dmishra@uga.edu

f. Place of incorporation and, if incorporated outside the United States, an acknowledgement that you will operate your system within the United States and are therefore subject to the Secretary's jurisdiction under 15 CFR Part 960:

N/A

2. Ownership interests in the Applicant:

a. If there is majority U.S. ownership: report any domestic entity or individual with an ownership interest in the Applicant totaling at least 50 percent:

N/A

b. If there is not majority U.S. ownership: report all foreign entities or individuals whose ownership interest in the Applicant is at least 10 percent:

N/A

c. Report any ownership interest in the Applicant by any foreign entity or individual on the Department of Commerce's Bureau of Industry and Security's Denied Persons List or Entity List or on the Department of the Treasury's Office of Foreign Asset Control's Specially Designated Nationals and Blocked Person List:

N/A

3. Identity of any subsidiaries and affiliates playing a role in the operation of the System, including a brief description of that role:

N/A

Part B: Description of System

1. General System Information

a. Name of system:

MOCI- Multiview Onboard Computational Imager

b. Brief mission description:

The system will use an onboard imager to capture images of land targets to use for an onboard Structure-from-Motion calculation. The satellite will also use the same imager to attempt onboard object recognition of various objects (e.g. ships, bridges, stadiums, etc.). All images will be of the Earth and only of the Earth. This data will be used by the University of Georgia Department of Geography for research purposes.

2. Remote Sensing Instrument(s):

a. Sensor type (Electro Optical, Multi-Spectral (MSI), Hyperspectral (HSI), Synthetic Aperture Radar (SAR), Light Detection and Ranging (LIDAR), Thermal Infrared (TIR), etc.):

Primary – CMOS sensor – 400-900nm Monochrome, Imperx (12k, 4096 x 3072, 12MP, Mono, F-Mount, U3V, U3V-C4180M-RF00)

Secondary – CMOS sensor – 400-1000 nm RGB, FLIR Systems BlackFly (BFLY-U3-23S6C-C: 2.3 MP, Color, 41 FPS, - Sony IMX249CMOS sensor)

b. Imaging/frame rate in Hertz; pulse repetition frequency for SAR or LIDAR:

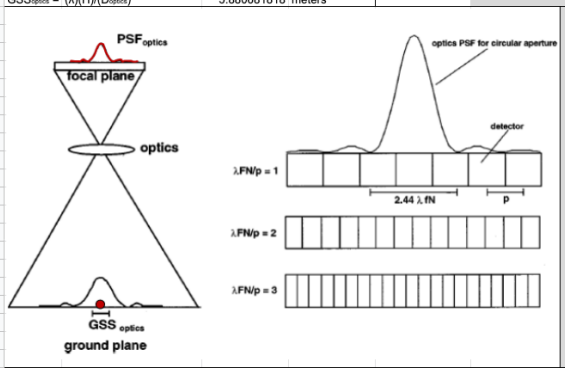
N/A

c. Spatial resolution in meters (show calculation for the anticipated finest ground spatial distance (GSD), impulse response (IPR), or other relevant appropriate unit of resolution):

For Primary Sensor:

- **7.5 m GSD (at 450 km)**

Value	Definition	Explanation					
GRD	Ground Resolved Distance	The theoretical resolution of an imager					
GSD	Ground Sampling Distance	The projection of a pixel to the ground					
p	Pixel Pitch	The linear dimension of a focal plane pixel					
D_{optics}	Diameter	The diameter of the primary telescope aperture					
f	Focal Length	The focal length of the telescope					
FN	Focal Number	The f-number of the telescope, i.e., the ratio of f/D_{optics}					
λ	Mean Wavelength	The mean detected wavelength by the focal plane pixels					
Q	Quality Factor	The ratio of the detector sampling frequency to the optical bandpass limit					
H	Mean Altitude	The satellite's mean altitude					
PSF_{optics}	Point Spread Function	The point spread function of the optical system					
GSS_{optics}	Ground Spot Size	The "ground spot size" related to the GRD (i.e, related to the projection of the PSF_{optics} to the ground)					
Value	**Known**	**Units**	**Notes**				
p =	0.0000045	meters					
D_{optics} =	0.044	meters					
λ =	0.000000575	meters					
H =	450000	meters					
PSF_{optics} =	?						
Value	**Calculation**	**Result**	**Units**	**Notes**			
f =		0.27	meters				
FN =	$(f)/(D_{optics})$	6.136363636	none (ratio)				
Q =	$(λ)(FN)/(p)$	0.7840909091	none (ratio)				
GRD =	$(1.22)(λ)(H)/(D_{optics})$	7.174431818	meters				
GSD =	$(p)(H)/(f)$	7.5	meters				
GSS_{optics} =	$(λ)(H)/(D_{optics})$	5.880681818	meters				



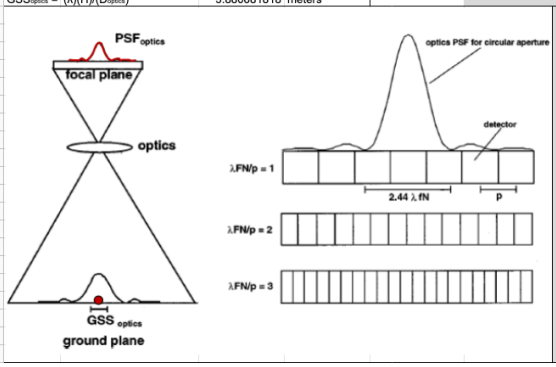
For Secondary Sensor:

- **9.77 m GSD (at 450km)**

Value	Definition	Explanation
GRD	Ground Resolved Distance	The theoretical resolution of an imager
GSD	Ground Sampling Distance	The projection of a pixel to the ground
p	Pixel Pitch	The linear dimension of a focal plane pixel
D_{optics}	Diameter	The diameter of the primary telescope aperture
f	Focal Length	The focal length of the telescope
FN	Focal Number	The f-number of the telescope, i.e., the ratio of f/D_{optics}
λ	Mean Wavelength	The mean detected wavelength by the focal plane pixels
Q	Quality Factor	The ratio of the detector sampling frequency to the optical bandpass limit
H	Mean Altitude	The satellite's mean altitude
PSF_{optics}	Point Spread Function	The point spread function of the optical system
GSS_{optics}	Ground Spot Size	The "ground spot size" related to the GRD (i.e, related to the projection of the PSF_{optics} to the ground)

Value	Known	Units	Notes
p =	0.00000586	meters	
D_{optics} =	0.044	meters	
λ =	0.000000575	meters	
H =	450000	meters	
PSF_{optics} =	?		

Value	Calculation	Result	Units	Notes
f =		0.27	meters	
FN =	(f)/(D_{optics})	6.136363636	none (ratio)	
Q =	(λ)(FN)/(p)	0.6021175923	none (ratio)	
GRD =	(1.22)(λ)(H)/(D_{optics})	7.174431818	meters	
GSD =	(p)(H)/(f)	9.766666667	meters	
GSS_{optics} =	(λ)(H)/(D_{optics})	5.880681818	meters	



d. Spectral range in nanometers:

Primary Sensor: 400-900nm

Secondary Sensor: 400-1000nm

e. Collection volume in area per unit time per spacecraft: provide an estimate of the maximum number of square kilometers of which the system can provide data/imagery per hour or per minute. If this is a fast-framing system, consider each recorded frame as a separate image collected:

Our system can image 7077.88km2 per minute, but we can only store a max of ~15 minutes worth of data on board

f. Ability of the remote sensing instrument to slew, point, or digitally look off-axis from the x, y, and z axes of travel:

N/A

3. If any entity or individual other than the Applicant will own, control, or manage any *remote sensing instrument* in the System:

N/A

a. Identity and contact information of that entity or individual:

N/A

b. Relationship to Applicant (i.e., operating under Applicant's instructions under a contract):

N/A

4. Spacecraft Upon Which the Remote Sensing Instrument(s) is (are) Carried

a. Description:

MOCI (Multiview Onboard Computational Imager), a 6U CubeSat.

b. Estimated launch date(s) in calendar quarter:

Last Quarter 2021 or first Quarter 2022

c. Number of spacecraft (system total and maximum in-orbit at one time):

Total: 1
Maximum: 1

d. For each spacecraft, provide the following (or if an entire constellation will have substantially the same orbital characteristics, provide these values for the entire constellation and note whether or not all spacecraft will be evenly spaced)

i. Altitude range in kilometers:

500km

ii. Inclination range in degrees:

45 degrees

iii. Period (time of a single orbit):

~95 minutes

iv. Longitude of the ascending node:

113.0 deg

v. Eccentricity:

~0.0

vi. Argument of perigee:

179.113 deg

vii. Propulsion (yes/no). (If "yes," you must complete question #2, the affirmation, in the beginning of this application):

No

viii. Ability of the spacecraft to slew, point, or digitally look off-axis from the x, y, and z axes of travel:

MOCI will have an Attitude Determination and Control System (ADCS) that will be capable of precision slews along all axes for imaging, downlinking, and general detumbling.

5. If any entity or individual other than the Applicant will own, control, or manage any *spacecraft* in the System

a. Identity and contact information of that entity or individual:
N/A

b. Whether that entity or individual is a U.S. person:
N/A

c. Relationship to Applicant (i.e., operating under Applicant's instructions under a contract):
N/A

6. Ground Components

a. Location of Mission Control Center(s) with the ability to operate the system, including where commands are generated:
210 Field St., Athens, GA 30602

b. Location of other Ground Station components of the system, meaning facilities that communicate commands to the instrument or receive unenhanced data from it, and facilities that conduct data preprocessing:
N/A

Type	Operator Name and Address	Coordinates
MCC	University of Georgia Small Satellite Research Laboratory Ground Station 210 Field St., Athens, GA 30602	33.94873, -83.37548
Domestic		
Foreign		

c. If any entity or individual other than the Applicant will own, control, or manage any *mission control center(s)* with the ability to operate the System

Alexandria Lin, W. Conor McFerren. Both Alexandria and Conor will be ground station authorities and supervisors, present at all uplink and downlink events. Alexandria and Conor will be operators in charge of downlink from MOCI and uplink to MOCI. Along with these responsibilities, the two will lead maintenance and sustainability of the ground station.

- **Alexandria Lin (KM4MJP) - MOCI Systems Engineer**
- **W. Conor McFerren (KN4SIT) - MOCI Mission Operations Team Lead**

i. Identity and contact information of that entity or individual:

Alexandria Lin
alexandria.lin@uga.edu
404-662-9399

W. Conor McFerren
cnmcferren@gmail.com
770-362-7341

ii. Relationship to Applicant (i.e., operating under Applicant's instructions under a contract):

Student Leads under Deepak Mishra, Principal Investigator

7. Information Applicable to Multi-Spectral Imaging (MSI) and/or Hyper-Spectral Imaging (HSI). Applicants must complete this section only if the response in Part B section 2.a. is "MSI" and/or "HSI."

a. Number of spectral bands: **N/A**

b. Individual spectral bandwidths (to include range of the upper and lower ends of each spectral band in nanometers): **N/A**

8. Noise Equivalent Target (NET). Applicants must complete this section only if the response in Part B 2.c. is 5 meters or less, and the answer in Part B section 2.a. is neither "SAR" nor "LIDAR." NET is the primary parameter used by the U.S. Government to describe an Electro Optical sensor's light sensitivity performance for a target at the same distance from the sensor as is specified as the minimum operating altitude in Part B section 4.d.i. If NET cannot be calculated, simply report the expected minimum detectable ground target radiance in watts:

N/A

9. Information Applicable to Light Detection and Ranging (LIDAR) if used for remote sensing. Responses should include the calculations used to derive the reported parameters. Applicants must complete this section only if the response in Part B section 2.a. is "LIDAR."

a. Type (linear scanning or flash LIDAR (Geiger)):

N/A

b. Laser wavelength and pulse frequency:

N/A

c. Laser pulse width:

N/A

d. Spectral linewidth:

N/A

e. Z/Elevation accuracy in meters:

N/A

10. Information Applicable to Synthetic Aperture Radar (SAR). Applicants must complete this section only if the response in Part B section 2.a. is "SAR."

a. Azimuth resolution (ground plane):

N/A

b. Range resolution (ground plane):

N/A

c. SAR Signal-To-Noise Ratio (SNR):

N/A

d. Polarization Capability (i.e. dual polarization, quad polarization):

N/A

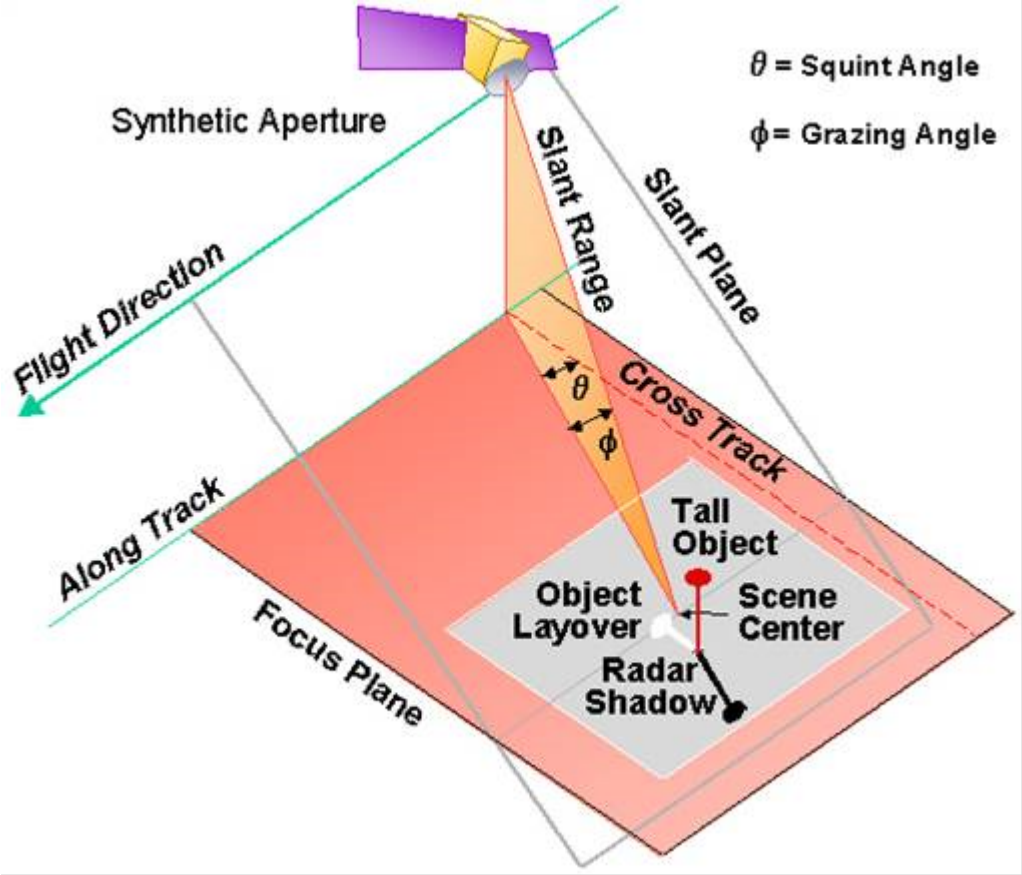
e. Complex data: Preservation of phase history data in standard format? (yes/no):

N/A

f. Center frequency: **N/A**

g. Squint and Graze angles (include maximum and minimum), or other parameters that determine the size and shape of the area of regard of the sensor collection footprint at the ground:

N/A



11. Information Applicable to Thermal Infrared (TIR). TIR is defined as collecting in the spectral range of 3.0–5.0 and/or 8.0-12.0-micrometers. Applicants must complete this section only if the response in Part B section 2.a. is "TIR."

a. Estimated relative thermometric accuracy in degrees Kelvin (+/- x degrees of actual):

N/A

b. Noise Equivalent Differential Temperature (NEDT), or if NEDT cannot be calculated, simply provide the expected temperature sensitivity in terms of minimum resolvable temperature difference in degrees:

N/A

Part C: Requests for Standard License Condition Waivers or Adjustments

Standard license conditions are listed at 15 CFR 960.8. 960.9, and 960.10 for Tier 1, Tier 2, and Tier 3 systems, respectively. If requesting that any of these be waived or adjusted, please identify the specific standard license condition and explain why one of the following circumstances applies:

1. The requirement is not applicable due to the nature of the Applicant or the proposed system;

2. The Applicant will achieve the goal in a different way; or

3. There is other good cause to waive or adjust the condition.

OPTIONAL:
You may submit evidence of the availability of unenhanced data that is substantially the same as unenhanced data you propose to produce with your system. The Secretary will take any such evidence into account, in addition to other evidence of availability, when determining the appropriate tier for your system under § 960.6.

Appendix B to Part 960—Application Submission Instructions
A person may apply to operate a private remote sensing space system by submitting the information to the Secretary as described in Appendix A of this part. This information can be submitted in one of three ways:

1. Complete the fillable form at the Secretary's designated website, presently at www.nesdis.noaa.gov/crsra.

2. Respond to the prompts in Appendix A of this part and email your responses to crsra@noaa.gov.

3. Respond to the prompts in Appendix A of this part and mail your responses to: Commercial Remote Sensing Regulatory Affairs, 1335 East-West Highway SSMC-1/G-101, Silver Spring, MD 20910.