Applicant: University of Georgia
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1. Narrative Statement

MOCI (Multi-view Onboard Computational Imager) is a 6U satellite designed to create 3D models of structures using SfM calculations. The satellite is built and operated by undergraduate students at the University of Georgia (UGA) who are directly involved in K-12 outreach within the community. The MOCI mission will acquire imagery of the Earth's surface from (Low Earth Orbit (LEO) and perform near real time Structure from Motion (SfM) at a landscape scale using custom algorithms and off the shelf, high-performance computational units. The MOCI mission will also identify and map or image surface objects, including but not limited to coastal environment phenomena, while training students in STEM-related fields. Efficient data compression, feature detection, feature matching, and SfM processing techniques of space-based imagery will be performed on board the spacecraft as a proof-of-concept of high performance, onboard processing capabilities. 3D models produced by the MOCI satellite will take the form of Digital Surface Models (DSM) as their end product for quick data downlink. The secondary goals of the project will be to lay the foundations for a self-sustaining Small Satellite Research Laboratory (SSRL) at UGA involving numerous students at the University and creating a free repository of imagery. In addition, the SSRL will engage with the public through guest lectures and the development of outreach programs such as workshops, instructional YouTube videos, educational podcasts, and performing guest lectures at local schools and events.

For the current mission MOCI shall:

1. Run on-board Structure from Motion (SfM) of target areas and transmit the processed data using customized compression techniques;
2. Identify algal blooms and sediment plumes in order to track their growth, size, and location;
3. Map the coastal regions of the Eastern United States for marsh phenology, land use, and off coast water quality;
4. Train students in STEM related fields by having them investigate optimal data transmission techniques, georeference imagery for mapping, conduct photogrammetric processing of images acquired from the satellite, develop community outreach programs, and learn general aerospace manufacturing/testing/designing

The UGA SSRL is a student-run research lab, with oversight from a faculty support group. Apart from requirements, which are formulated in collaboration with faculty, the undergraduate team conducts all design decisions, reviews, and also, in the case of the author of this document, handles the licensing process. Members are taught the full engineering process, from requirements development to the delivery of a final design and launch-ready satellite. Once the satellite is in orbit, the UGASSRL Mission Operations team members, all undergraduates and all amateur radio operators, will command and control the satellite.

The science data collected by the mission operators will undergo processing, and then be stored for use by anyone who requests access. The UGA Geography Department will analyze it and use it in the classroom and for local outreach events. In addition to the space-oriented portion of the mission,

the UGA undergraduate team has also built the Center for Orbital Satellite Mission Operations (COSMO), to communicate with space stations. This endeavor was funded by the Center for Teaching and Learning at UGA and the Parents and Families Outreach Program at UGA, with the intention to provide licensed students access to high-quality radio equipment. These students will be rigorously trained to operate spacecraft.

In summary, this project is an educational and scientific mission to allow students hands-on experience with the breadth of satellite development. This includes the training of students to 1) design and build spacecraft, 2) operate spacecraft, and 3) to interact with the local community as they fulfil the mission success criteria. To the community at large, we will offer a platform to listen to spacecraft, process specialized imaging products, hold outreach events, and use the satellite as a repeater. The telecommand and telemetry beacon will operate on the UHF band, while science data will downlink on the S band. Specifically, the frequencies are as follows: 437.35 MHz (UHF), 2.4105 GHz (S-band)

2. Justification for 5-year license

A 5-year license is requested primary since the current mission has a lifetime of 2.5 years and is not due for launch for another year at the time of this application.

3. Relation to 0311-EX-CN-2019

This experiment performed as part of is **0577-EX-CN-2020** not related to experiment **0311-EX-CN-2019**. While the two experiments are operated by the same group and use the same ground station their science objectives are very different.