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OCULUS-ASR SPACECRAFT SUMMARY

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REVISION HISTORY

Revision	Revised By:	Revised On	Changes
-	Anthony Sirotti	02/17/2014	Initial Release
01	Andrew Conley	01/29/2016	Updated orbit parameters; Downlink freq. to 437.200 MHz
02	Andrew Conley	04/12/2016	Updated uplink freq. info; added funding overview

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ABSTRACT

This document is to provide an overview of the Oculus-ASR spacecraft and mission as part of the FCC licensing process.

MISSION OVERVIEW

The Oculus-ASR is a nanosatellite being developed through collaboration between Michigan Technological University (MTU) and the Air Force Research Laboratory (AFRL) by MTU undergraduate students. The Oculus-ASR's mission is to provide calibration opportunities for ground-based observers attempting to validate and/or anchor algorithms capable of determining spacecraft attitude and configuration using unresolved optical imagery. The mission is expected to be completed in fewer than 12 months.

The optical signature of the vehicle will be extensively characterized in ground facilities before launch. Once in orbit, the Oculus-ASR will serve as a cooperative imaging target for ground-based telescopes at Advanced Maui Optical Supercomputing Observatory (AMOS). Ground controllers in MTU will command the vehicle to perform various attitude-based maneuvers during flights over these telescopes. After each ground-viewing opportunity, the MTU team will provide attitude truth history to the telescope observers at Maui for comparison with their findings.

The Oculus-ASR is scheduled to launch in early 2017 as part of the STP-2 mission. The spacecraft will be in an 860x300km orbit at an inclination of 28.5°.

SPACECRAFT OVERVIEW

Oculus-ASR is a 70-kg Nano satellite which consists of two modules that are permanently attached. An octagonal module, referred to as the Oculus module, sits atop a square module, known as the ASR module. Figure 1 shows the assembled vehicle and identifies the major features on the exterior of the satellite. Each of the four sides on the ASR module has a deployable panel. Three of these panels are covered in solar cells. The fourth is covered in Duraflect material. Duraflect is a highly reflective, diffuse, white coating used as an optical standard for characterization and calibration measurements.

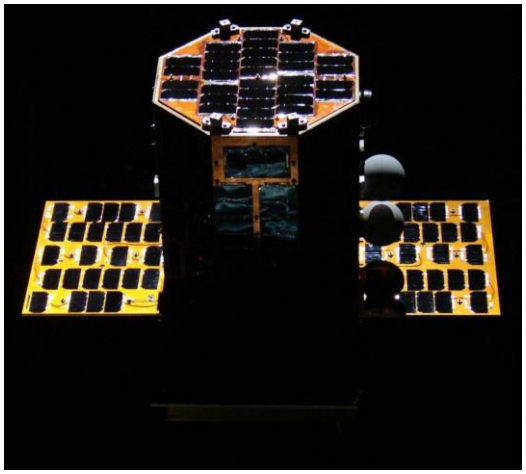

Figure 1. Oculus-ASR

COMMUNICATION SYSTEM OVERVIEW

The Oculus-ASR is equipped with an Astrodev He-100 transceiver. The radio operates in the 2m band for uplink and the 70cm band for downlink. The spacecraft is equipped with two Spacequest ANT-100 ¼-wave monopole antennas. Table 1 contains the exact specifications of the Oculus-ASR communications system.

Downlink Frequency	**437.200 MHz**
Data Rate	9600 baud
Modulation	GMSK
Transmit Power	4W
Uplink Frequency	**120-150 MHz**
Data Rate	9600 baud
Modulation	GMSK
Ground Station Location	Ann Arbor, MI – University of Michigan

FUNDING OVERVIEW

The Aerospace Enterprise at Michigan Tech received funding by the University Nanosatellite Program of the Air Force Research Laboratory to develop an educational program. The UNP/AFRL provides technical and managerial guidance to the project, but is limited to providing $100,000 for development efforts and an additional $100,000 to a single University to develop a flight vehicle. The funding covers administrative and facility costs, and basic spacecraft hardware. All other funds are provided by Michigan Technological University through tuition, student lab fees, and donations. The primary purpose of all projects entered in the UNP is to train future aerospace engineers through hands-on systems engineering experience. It is important to note that although the AFRL and UNP office does provide technical support ranging from system development, design, and testing, they have explicitly expressed their inability to 'sponsor' our application for a FCC license. Their funding is limited to providing an educational experience which, therefore, passes the financial burden of spacecraft construction and licensing to the University.