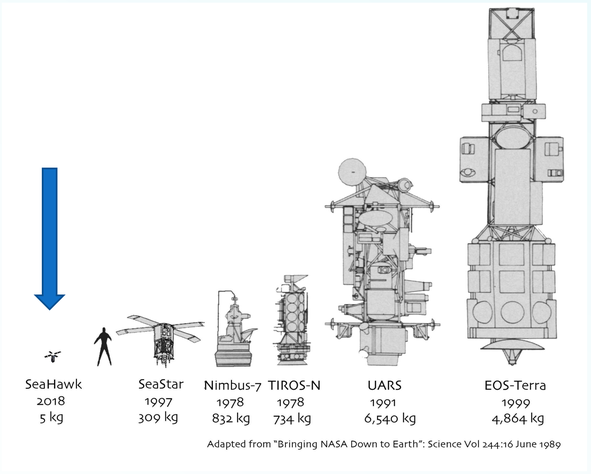
SeaHawk: North Carolina's First Ocean Color CubeSat

Joe Brown, Matt Chmelewski, Colton Daymude, Derek Markey
University of North Carolina Wilmington CubeSat Lab

Mission Parameters

- SeaHawk-1 launched December 3rd, 2018
- Nominal orbital height = 590 km
- Sun-synchronous around 10:30am
- 9-day repeat orbit (one satellite)
- Baseline orbital lifetime of 1-2 years (18-24 month)
- Baseline of 15 scenes per day (200 x 600km of approximately 120 meter resolution - 100MB/scene)
- X-band downlink (Wallops & Alaska) data rate of 6 to 100 mbps
- Weight of instrument: less than 1 kilogram
- Total weight of spacecraft plus instrument less than 5 kilograms
- Off-the-shelf CCD arrays
- Sensitivity comparable to SeaWiFS
- Open intellectual property and knowledge sharing



Size comparison of SeaHawk to previous ocean color satellites.

UNCW CubeSat Lab

Research Goals

- Collaborate with UNCW Satellite Oceanography Lab and NASA Ocean Biology Processing Group on the validation and improvement of biogeochemical algorithms used to process SeaHawk data.
- Analyze 15 years of MODIS Aqua data from NASA to identify "hotspots" for physiochemical or biological variability. The selected "hotspot locations" will be used as target locations for SeaHawk imagery, which will provide 10x higher resolution than MODIS Aqua and will allow for subpixel variability studies.

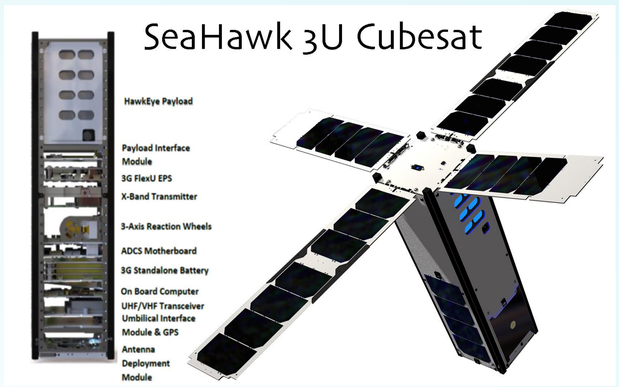
Outreach Goals

- Recruit UNCW graduate and undergraduate students that will use the lab as a hands-on platform to develop new skills and apply knowledge in a practical setting.
- Provide satellite and data science outreach opportunities to schools in the greater Wilmington area.

Abstract

As part of the SOCON project, UNCW developed and launched North Carolina's first ocean color CubeSat (SeaHawk) on December 3rd, 2018. This is a project led by Prof. Morrison and funded by the Gordon and Betty Moore foundation to demonstrate the capability of building a low-cost ocean color satellite using nanosatellite technology. The SeaHawk's payload is a high spatial resolution multispectral ocean color sensor: the HawkEye. Some attractive features of the SeaHawk as compared to a previous ocean color satellite, SeaWiFS: it is 130 times smaller, 45 times lighter, the spatial resolution is 7 to 11 times greater, the signal-to-noise ratio is greater than 50% that of SeaWiFS, and the cost is roughly 10%. Thanks to agreements with NASA and the Moore Foundation, all the image data will be freely accessible. In addition, the plans and specifications for the sensor and satellite will be made freely available so that others may create their own versions. The data could provide significant information regarding the highly variable coastal regions of the world.

SeaHawk CubeSat Concept Design

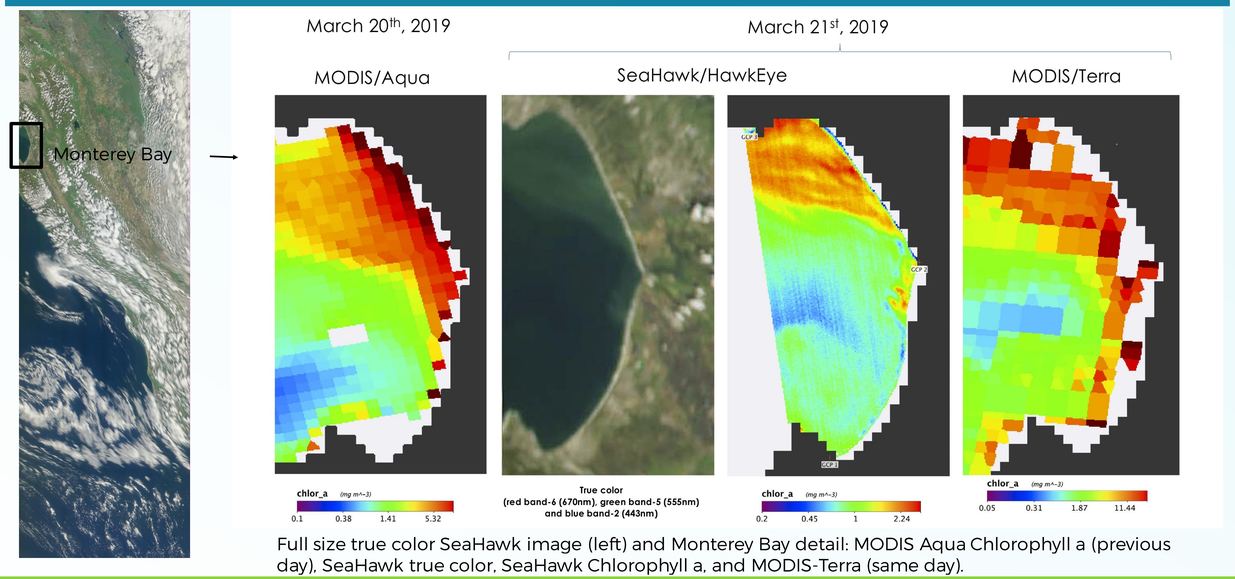


Overview of the design and layout of SeaHawk

First Test Image from SeaHawk

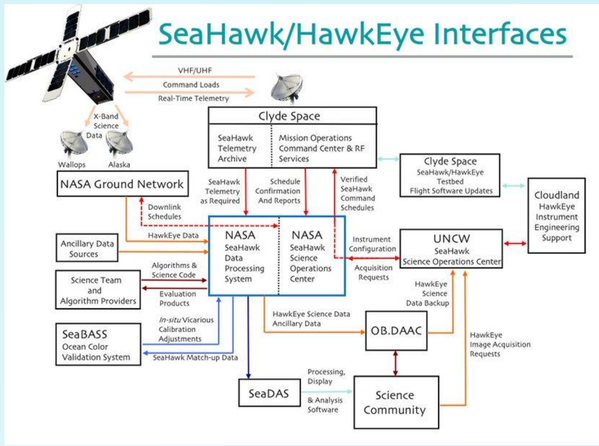
First Engineering Test Image taken by the SeaHawk/ HawkEye instrument on March 21st, 2019 from an altitude of 588 km and superimposed on Google Map data © 2019 Google, INEGI.

Spatial Resolution of SeaHawk versus MODIS satellites



Full size true color SeaHawk image (left) and Monterey Bay detail: MODIS Aqua Chlorophyll a (previous day), SeaHawk true color, SeaHawk Chlorophyll a, and MODIS-Terra (same day).

Data Distribution



Schematic of how SeaHawk data is downlinked, processed and distributed.

Partners

This project is funded by the Gordon and Betty Moore Foundation through Grant GBMF4526 to UNCW at Wilmington, Department of Physics and Physical Oceanography and Space Act Agreement 450-AGMT-0149 between NASA and UNCW.

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