

**Department of Commerce
Research Performance Progress Report – Grants Online Electronic Template**

Award Information: Complete Boxes 1 – 23 with the requested information

Box 1. Federal Agency – Department of Commerce/NOAA

Box 2. Federal Award Number – Assigned Award Number for the project

Box 3. Project Title

Launching WebCOOS: Webcams for Coastal Observations and Operational Support

Box 4. Award Period of Performance Start Date

Box 5. Award Period of Performance End Date

August 30, 2023

Box 6. Principal Investigator's Last Name

Hernandez

Box 7. Principal Investigator's (PI) First and Middle Name

Debra

Box 8. PI Job Title

SECOORA Executive Director

Box 9. PI's Email

debra@secoora.org

Box 10. PI's Phone Number

843.906.8686

Box 11. Authorizing Official's (AO) Last Name

Box 12. AO First and Middle Name

Box 13. AO Job Title

Box 14. AO Email

Box 15. Signature of Recipient Authorized Representative – Non Applicable

Box 16. Submission Date and Time Stamp

Box 17. Reporting Period End Date

Box 18. Reporting Frequency – Semi-annual

Box 19. Report Type – Not Final or Final

Not final

Box 20. Recipient Name

SECOORA

Box 21. Recipient Address

Post Office Box 13856, Charleston, SC 29422

Box 22. Recipient DUNS

Box 23. Recipient EIN

Accomplishments: Boxes 24 – 27 are required for the first initial progress report. Subsequent reports will be prepopulated with the information from the previous report and have a limit of 4,000 characters. Comment Box 28 is required but will not be pre-populated in subsequent reports.

Box 24. What were the major goals and objectives of this project?

Box 25. What was accomplished under these goals?

Goal 1) Engage demonstrated webcam operators and other end-users

Obj. 1.1) Identify & engage Tier 1 & 2 users: 75% Complete

- **SECOORA:** WebCOOS funded a camera installation at a new tide station in Charleston, SC and Beaufort, NC in partnership with NOAA COOPS.
- **SECOORA:** Greg Dusek connected the team to USGS to discuss the technical logistics of integration of USGS cameras, which if successful, could expand the network significantly. Work continues to integrate the camera into the system.
- **USC:** Ongoing technical discussions with Volusia Beaches staff (Florida, Chris Dembinsky) regarding their [camera streams on YouTube](#) and possible riptide detection. Helped advise in their recent selection of two cameras to monitor North and South Beach.
- **UNCW:** PI-Long gave a presentation to over 100 participants at the Coastal Imaging Research Network (CIRN) annual bootcamp and research meeting. Meeting follow-up showed significant interest from research in other IOOS regions.

Obj 1.2) Develop, assess and disseminate stakeholder appropriate outreach and education materials: 75% Complete

- USC: In conjunction with the EPA EJ STRONG initiative and the NIEHS Center of Excellence for Oceans and Human Health and Climate Change Interactions, graduate students at USC worked with community members in the Rosemont Community of Charleston, SC to develop a presentation for use by community members highlighting the community's efforts to use science to address quality of life issues.
- USC: On 6 and 7 June 2023 we participated in a community event hosted by the Lowcountry Alliance for Model Communities (LAMC) and the Charleston Community Research to Action Board (CCRAB) to highlight research and practice initiatives involving USC (WebCOOS and the Southeast Water Level Network), College of Charleston, The Citadel, Medical University of South Carolina, City of Charleston, and Charleston County and begin development of a plan for research coordination, data management, and information dissemination. CCRAB will be the lead.

Objective 1.3) Identify testers within the network and conduct survey to assess ease-of-use, utility of various analyses and informational products, and willingness to pay for webcam imagery or downstream product access or customization: 25% Complete

- Recruited additional testers from Sea Grant partners (Ashleigh Palinkas and Nicholas Carver).
- Interface for DroneML (now renamed to RipScout) was updated to include flight planning (setting of waypoints), and actions to take when a rip is spotted (stationary video, or circling videos).

Goal 2) Operationalize the WebCAT system to a national webcam data management network

Obj 2.1) Select camera providers and maintain webcams: 97% Complete

- **SECOORA:** Five new WebCOOS funded webcams installed: the Beachfront at Cocoa Beach; Masonboro Inlet, NC; Charleston, SC; Walton Lighthouse in Santa Cruz, CA, and one at the LAMC (LowCountry Alliance for Model Communities), Dorchester Street, Charleston, SC.
- **SECOORA:** We also have two new cameras of opportunity in the works, a USGS webcam on Madeira Beach and one near Port Aransas, TX, which is now available on the [WebCOOS website](#).
- UCSC: Updated seal detection app with additional training data and new class for rocks to improve seal detection accuracy. Rip detection code for Currituck and Holland Beach were provided to Axiom. Collecting more data for Walton Lighthouse camera – progress is slower this time of year since there is not much swell/rip action.
- USC: LAMC (Lowcountry Alliance for Model Communities), Dorchester Street, Charleston, SC camera installed and follow-up visit to repair. Rosemont Community: Camera installed at Whaley Way cul-de-sac to monitor flooding in that area. Rosemont Community: Remote solar-panel camera setup installed in marsh area, adjacent to water level sensor, focused on tide and flood level at Austin Avenue bridge. Rosemont Community: Camera power cord repaired at Peace Street and camera equipment removed at Peonie Street. Folly 6th Ave: Camera connectivity fixed and camera post repositioned further back after November 2022 storms dune erosion. South Carolina Maritime Museum: Camera install and second trial of Reolink E1 outdoor model for problem with blurry image but same problem occurred - third camera install of Reolink model RLC-510A, a dual fixed-focus camera which provides a doubled field of view.

- UNCW: Shipped a camera and installation/setup instructions to a homeowner on the East coast of Florida. They were able to install the camera and work with the project data manager to ingest the stream and post it online.

Obj 2.2) Develop interactive web portal to access live webcam feeds, historical archive footage, and webcam products: 97% Complete

- Maintained WebCOOS portal and access to all webcams.
- Created temporary links for Walton lighthouse webcam, and seal detection at the marine mammal center while awaiting Axiom to incorporate these into webcoos.org.

<https://users.soe.ucsc.edu/~fkhan4/ipcam.html>

https://users.soe.ucsc.edu/~fkhan4/point_reyes.html

Obj 2.3) Standardize webcam imagery and metadata documentation and delivery: 100% Complete

- Maintained a continuous iteration of schema-based webcam metadata profile; Display of standard image products: Live video, 10 minute clips, and stills available on individual webcam pages.

Obj 2.4) Develop end-to-end data management workflow integration: 85% Complete

- Provided software engineering and cyberinfrastructure support for the data management and analysis system.
- Data management workflow is completely documented and available via the [WebCOOS website](#). Each webcam can be a bit unique so each ingestion involves hands-on support from Axiom staff and will lead to updates in the documentation as more is learned about these webcam systems.
- Continue testing and operationalizing of the ingestion process for additional data products including code, time series data, and georectified imagery.
- USC: Worked with Axiom staff to access imagery via Amazon 'Rekognition' type service for future object detection processing. Discussed API usage for summary totals with Axiom staff.

Obj. 2.5) Integrate quality assurance and quality control (QA/QC) mechanisms: 50% Complete

- Continue to collect data and retraining ML models to improve model accuracy.
- UNCW - compared automated shoreline detection algorithms to manual QA/QC to detect at 55% accuracy in identifying suitable shorelines at the Oak Island camera.

Goal 3) Automate and validate downstream processing of webcam data;

Obj 3.1 Further develop detection algorithms: 90% Complete

- Developing pathway to run rip models on Currituck and Holland Beach in order to evaluate model accuracy.
- UNCW: Ran shoreline detection algorithms at four sites with more than 1-year of data at each site for QA/QC purposes.

Obj 3.2) Develop operational prototype products: 75% Complete

- USC: Worked with UCSC to define a webpage user interface to set notifications on riptide detections.
- UNCW: Undergraduate REU student worked for 10 weeks on developing boat detection algorithms for cameras in the intracoastal waterway.

Obj 3.3) Validation of prototype: 50% Complete

- USC: Ran and provided some [example detection](#) from beach drone footage

Obj. 3.4) Operationalization of approach and resultant output: 10% Complete

- Nothing to report

Goal 4) Package image products into geographically and thematically transferable decision-support tools.

Obj 4.1) Develop, validate and operationalize a ‘situational monitoring and reporting’ tool: 75% Complete

- USC: An ASPH MPH student (Samantha Hulette) has begun an Integrated Learning Experience focusing on the variety of data that are being collected in the Rosemont Community and identifying community-identified products and modes of distribution.

Box 26. What opportunities for training and professional development has the project provided?

- UCSC Phd student Akila de Silva expected to defend his dissertation in Fall 2023. He will be joining San Francisco State University as an Assistant Professor starting January 2024.
- UCSC MS students Nicholas Tee and Omkar Ghanekar are working with Akila to extend results of RipViz to more generalized flows, specifically vortex boundary detection.
- UCSC Phd student Fahim Khan is working with undergrads Chinmay Gowdru and Kevin Young on data labeling, Elmer Vasquez on data augmentation, and 5 high school students through the Science Internship program to provide additional use cases for SmartCS.
- USC: We are engaging graduate students in our ASPH MPH Program and the Masters in Earth and Environmental Management (MEERM) program in community engagement and science translation.

- UNCW: Masters students Jeremy Braun defended his thesis and is now a data manager with the US Army Corps of Engineers Field Research Facility.

Box 27. How were the results disseminated to communities of interest?

- Resubmitted papers on RipScout (formerly DroneML) to Coastal Engineering, SmartCS to Citizen Science Journal, and working on a new paper on vortex boundary detection (offshoot of work on RipViz). Obtained grant to develop RipFinder (phone based app) from SeaGrant, and coastline monitoring for beach safety from UCSC Center for Coastal Climate Resilience.

Box 28. What do you plan to do during the next reporting period to accomplish the goals and objectives?

Objective 1.1) Identify and engage Tier 1 and 2 users

- We expect to continue product development and will engage with more users as testers of these products during the next reporting period.

Objective 2.1) Engage with identified cameras of opportunity

- **SECOORA:** New camera of opportunity in the works with USGS on Madeira Beach. Work continues to integrate USGS cameras into the system, which if successful, could expand the network significantly.

Objective 2.2) Develop interactive web portal to access live webcam feeds, historical archive footage, and webcam products

- Maintain WebCOOS portal and make requested updates and changes.
- Add time series data products to camera pages

Objective 2.3) Standardize webcam imagery and metadata documentation and delivery

- Maintain WebCOOS system documentation on the WebCOOS website, making updates as needed

Objective 2.4) Develop end-to-end data management workflow integration

- Maintain data management workflow.
- Maintain data products developed by science PIs and continue to iterate for improved visualization and use.

Obj 2.5) Integrate quality assurance and quality control (QA/QC) mechanisms

- We expect to further evaluate and develop QA/QC protocols for camera streams & detection algorithms.

Objective 3.1) Further develop detection algorithms

- UNCW: Continue work of storm-related dune impacts using shoreline detection methods.

Objective 3.2) Develop operational prototype products

- USC: Work towards using Amazon Rekognition service for object detection labeling of images

Objective 4.1) Develop, validate and operationalize a ‘situational monitoring and reporting’ tool

- USC: We will continue to work with our community partners and engaged organizations to define and refine data and derived information needs including methods of information dissemination.
- UNCW: Finalize QA/QC of shoreline projects at four cameras for suitable shoreline detection.

Products: Comments are required in Boxes 29 – 32 are required the first initial progress report. Subsequent reports will be prepopulated with the information from the previous report and have a limit of 4,000 characters. If the comment is blank, the “Nothing to Report” checkbox must be checked.

Box 29. Publications, conferences papers and presentations

- We submitted a paper entitled: “RipFinder: Real time Rip Current Detection on Mobile Devices” to AAAI track on: AI for Social Impact [August 15, 2023; under review]
- We submitted a revised version of earlier work on DroneML entitled: “RipScout: Realtime ML-Assisted Rip Current Detection and Automated Data Collection using UAVs” to Coastal Engineering [July 20, 2023; under review]
- We submitted a revised version of earlier work on SmartCS entitled: “SmartCS: Enabling the Creation of ML Powered Computer Vision Mobile Apps for Citizen Science Applications without Coding” to Citizen Science Journal [May 20, 2023; under review]
- Altman, K., B. Yelton, JR Viado, Z. Hart, L. Schandera, M. Carson, R.H. Kelsey, D.E. Porter, and D.B. Friedman. 2023. A Trio of Studies Examining Benefits of Partner-Engaged Qualitative Research with Environmental Health Researchers and Stakeholders to Improve Science Communication and Research Translation. Joint Oceans and Human Health Meeting, Ft. Myers, FL. Presentation. May 9-12, 2023.
- Altman, K., R.H. Kelsey, S. Libes, G.I. Scott, B. Kloot, D.E. Porter. 2023. Coastal Community Communication Structure to Share Socio-Environmental Information. Joint Oceans and Human Health Meeting, Ft. Myers, FL. Presentation. May 9-12, 2023.
- Porter, D.E., E. Altman, J. Cothran, H.R. Kelsey, P. Sandifer, and N. Miller. 2023. OHHC2I Community Engagement Core and EJ STRONG: Empowering communities to “use data and

sound science to make noise!”. Joint Oceans and Human Health Meeting, Ft. Myers, FL. Presentation. May 9-12, 2023.

- Porter, D.E., E. Altman, J. Cothran, H.R. Kelsey, P. Sandifer, and N. Miller. 2023. OHHC2I Community Engagement Core and EJ STRONG: Empowering communities to “use data and sound science to make noise!”. Environmental Justice and Equity MAP Webinar. March 2023. Invited virtual presentation.

Box 30. Technologies or technique

- Nothing to report

Box 31. Inventions, patent applications, and/or licenses

- Nothing to report

Box 32. Other products

- USC: We have continued to collaborate with the EPA EJ STRONG initiative and the NIEHS Center of Excellence for Oceans and Human Health and Climate Change Interactions and during this reporting period established a collaboration with the EPA Environmental Justice Thriving Communities Technical Assistance Centers (EJ TCTAC) Program (Porter has been appointed to the EPA Region 4 Community Advisory Board) to highlight the value of community-based environmental monitoring and reporting systems. These ‘systems’ which are geographically and thematically transfer demonstrate the value of community-led collaborations as we integrate monitoring activities supported by the SECOORA WebCOOS and Southeast Water Level Network with efforts supported by the EPA and NIEHS. These engagements have led to several proposals have been developed by community organizations to establish and maintain community environmental monitoring and notification systems.

Participants & Other Collaborating Organizations – Note that all comments boxes are required and the first report will always be blank. For comments boxes 33, 35 &36 subsequent reports will be pre-populated with the information from the previous report. Comments boxes have a limit of 4,000 characters. For comments boxes 34 – 36, if the comment box is blank, the “Nothing to Report” checkbox must be checked.

Box 33. What individuals have worked on this project?

PI: Debra Hernandez, SECOORA Executive Director

Lead Science PI: Dwayne Porter, Univ. SC

USC Graduate Student: Louisa Schandera

Senior Software Developer: Jeremy Cothran

Co-PI: Joseph Long, Univ. NC Wilmington

UNC Undergraduate Student: Kelsea Edwing, Summer Banning, and Drew Davey

UNCW Graduate Student: Jeremy Braun

Co-PI: Alex Pang, Univ. California Santa Cruz

UCSC Graduate Students: Akila de Silva, Fahim Khan, Omkar Ghanekar, and Nicholas Tee

UCSC Undergraduate Student: Mona Zhao, Elmer Vasquez, Kevin Young, Chinmay Gowdru

Co-PI: Kyle Wilcox, Axiom Data Science

Axiom Project Manager: Lauren Showalter

Box 34. Has there been a change in the active other support of the Project Director/Project Investigator(s) or senior/key personnel since the reporting period?

- Axiom: Technical Project Lead and PI for Axiom Data Science, Kyle Wilcox, resigned from Axiom in June. Axiom is filling the gaps with other technical experts.
- SECOORA: Project Manager Megan Trembl's contract ended with SECOORA in August 2023. There is funding for a full time manager with the new OTT funding to transition WebCOOS to a national effort, and that person will also handle the final year of this project.

Box 35. What other organizations have been involved as partners?

- Working with Sea Grant office (Ashleigh Palinkas) on RipFinder. Will commence working with Borja Reguero (UCSC Institute of Marine Science), Jonathan Warrick (USGS), and David Gutierrez (SandS) on shoreline monitoring and beach safety.

Box 36. Have other collaborators or contracts been involved?

- We have established and maintained collaborations with a growing number of organizations including:
 - Lowcountry Alliance for Model Communities (LAMC)
 - Charleston Community Research to Action Board (CCRAB)
 - EPA's Environmental Justice Thriving Communities Technical Assistance Centers (EJ TCTAC) Program and EJ STRONG initiative
 - NIEHS Center of Excellence for Oceans and Human Health and Climate Change Interactions
 - SC Maritime Museum
 - Near Center for Climate Studies
 - In-Situ

Impact – Note that all comments boxes are required and the first report will always be blank. For comments boxes 37 - 43 subsequent reports will be pre-populated with the information from the previous report. Comments boxes have a limit of 4,000 characters. For comments boxes 37 - 43, if the comment box is blank, the "Nothing to Report" checkbox must be checked. For comment box 44, only the percent is required (even if it is a zero), the explanation is not required.

Box 37. What was the impact on the development at the principal discipline(s) of the project?

Box 38. What was the impact on other disciplines?

- Nothing to report

Box 39. What was the impact on the development of human resources?

- USC: We currently have two graduate students and one undergraduate student engaged in our WebCOOS activities.

Box 40. What was the impact on teaching and educational experiences?

- UCSC is offering a new class on Augmented Reality and Virtual Reality. Originally scheduled for Fall 2023, but will likely be moved to Winter 2024. The phone based apps that Fahim is developing are examples of AR.

Box 41. What was the impact on physical institutional and information resources that form infrastructure?

- Nothing to report

Box 42. What was the impact on technology transfer?

- Nothing to report

Box 43. What was the impact on society beyond science and technology?

- A community-based environmental monitoring and notification system consisting of a water level sensor and a webcam was installed in June in the marsh adjacent to the Austen Avenue bridge in the Rosemont Community of Charleston. The purpose of the system is to monitor water levels and document flooding and drying of the bridge to inform community members as to conditions rendering the bridge unsafe for vehicular and pedestrian traffic.
- The City of Georgetown (SC) Police Department are using the WebCOOS webcam, installed at the SC Maritime Museum to monitor river and riverfront activities and flooding, to monitor for public safety.
- Rosemont Community members (Ms. Cora initiated) were monitoring the flooding that took place on Sunday, 17 September 2023, and contacted USC (Jeremy Cothran) to make sure the Peace Street WebCOOS camera was activated to document flooding (<https://webcoos.org/cameras/rosemontpeace/?gallery=rosemontpeace-10-minute-stills-s3>).

Box 44. What percentage of the award is budget was spent on foreign countries?

Enter Percent: 0%

Changes/Problems – Note that all comment boxes are required fields and have a limit of 4,000 characters. If the comment box is blank, the “Nothing to Report” checkbox must be checked.

Box 45. Changes in approach and reason for change

Box 46. Actual or anticipated problems or delays and actions or plans to resolve them

- Nothing to report

Box 47. Changes that had a significant impact on expenditures

- Nothing to report

Box 48. Significant changes in use or care of human subjects, vertebrate animals, biohazards, and/or select agents

Not Applicable.

Box 49. Change of primary performance site location from that originally proposed