Proposal for Expansion of New Jersey's Motus Wildlife Tracking System to Inform Baseline Avian and Bat Population Movements Near Offshore Wind Energy Areas

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I. Motivation/Objective

The New Jersey Offshore Wind Research and Monitoring Initiative (RMI) has identified research priorities to (1) develop baseline estimates of population-level distribution information for birds, focusing on species of concern such as those listed under the Endangered Species Act (ESA) and migratory movements in the New York Bight, and (2) determine the extent of bat activity offshore of New Jersey, particularly the migratory tree bats that are typically more common offshore in the U.S. Atlantic (Hatch et al. 2013, Solick and Newman 2021). Automated radio telemetry via the Motus Wildlife Tracking System ("Motus") can help to address both of these priorities. A strategic and targeted expansion of the Motus network in coastal and offshore areas of New Jersey can help to meet multiple goals of the RMI program, including furthering the scientific understanding of wildlife in these regions, informing risk assessments and other decision making around offshore wind development, and leveraging existing and ongoing research through the international Motus network. Here, we propose to coordinate and conduct deployments of Motus stations in terrestrial and offshore ecosystems. Through careful coordination of these efforts, the research and monitoring goals of Motus stations in the region can be maximized and high priority strategic goals can be emphasized (Motus Wildlife Tracking System 2022).

The Motus Wildlife Tracking System is an international collaborative network for automated radio telemetry that hundreds of researchers are using to track movements of thousands of shorebirds, bats, songbirds, and other animals (www.motus.org). Within the Motus network, partners attach lightweight (>0.2 g) coded radio transmitters to birds and bats and construct automated radio telemetry stations (Motus stations) to monitor movements of tagged animals in regions of interest. When tagged birds and bats fly within the detection range of a Motus station (typically <15 km), the detection is recorded and data are relayed to a centralized Motus database managed by Birds Canada. The database allows researchers and the general public to access tag detection data from Motus stations throughout the network. Motus is one of the largest wildlife movement databases worldwide and currently consists of >1,750 stations and >41,000 animals tagged representing >325 species across >650 projects. The majority of Motus projects occur in the Western Hemisphere, including substantial contributions of tracking data for species of interest in the Atlantic Flyway, including Red Knot (Duijns et al. 2017, Munro 2017, Loring et al. 2018, 2020a), Piping Plover (Loring et al. 2019, 2020b), Roseate Tern (Loring et al. 2019), and bats (McGuire et al. 2012, True et al. 2023).

Much of our historic understanding of the offshore occurrence of individual species has derived anecdotally from sightings from boats and offshore platforms, though the advent of smaller tracking technologies has provided new opportunities to improve our understanding of these movements. We now know that a broad range of diurnal and nocturnal avian migrants use the airspace above the marine environment during migration, including terrestrial songbirds and near-passerines, shorebirds, raptors, wading birds, and bats (Williams et al. submitted). Dokter et al. (2018) estimated autumn migration traffic over the water in the western Atlantic Ocean at >200 million birds each year. Some landbirds appear to be obligate offshore migrants (DeLuca et al., 2019), while others use offshore habitats more facultatively (Shamoun-Baranes and van Gasteren, 2011). Offshore migratory activity tends to occur episodically in relation to conditions conducive to offshore

movements (Van Buskirk et al., 2009; Deppe et al., 2015; La Sorte et al., 2015; Horton et al., 2016; Van Doren and Horton, 2018; Brust et al., 2019; Loring et al., 2020b; Cohen et al., 2021) and is especially prevalent in fall, when many bird species move from breeding grounds in Canada and the northern United States to wintering grounds in the southern United States, Caribbean, Central America, and South America.

In addition to birds, nine species of insectivorous bats occur in the U.S. mid-Atlantic region, and bats have been detected in all offshore areas that have been surveyed in the Gulf of Maine and mid-Atlantic United States (Peterson et al., 2014; Stantec 2016; Solick and Newman, 2021). While the overall activity levels of bats offshore are lower relative to terrestrial settings, the level of exposure and potential collision risk of bats from offshore wind energy development remains uncertain (Hein et al., 2021). In part, this is because it is unclear whether bats will interact with offshore wind turbines in the same manner as with terrestrial wind turbines. Substantial numbers of bats collide with terrestrial turbines, with nearly 80% of reported fatalities belonging to the migratory tree-roosting species (Arnett and Baerwald, 2013; Allison and Butryn, 2020). As the offshore wind energy industry expands rapidly in the U.S. Atlantic, there is a need to better understand the offshore movement ecology of terrestrial aerofauna (birds and bats) to better understand potential risk from offshore wind energy development as well as to inform approaches to avoid and minimize this risk.

Strategic expansion of the Motus Wildlife Tracking Network in coastal and offshore regions of New Jersey will provide valuable data on the distributions and movements of small-bodied bird and bat species that can be difficult to obtain using other methods, and take advantage of a vast existing dataset and international collaboration of researchers focused on incorporating these efforts into the broader Motus network. Movement data collected via Motus is critical to estimating offshore space use and the likelihood of collisions with offshore developments. These data are used to properly site offshore developments and design long-term monitoring and mitigation plans with significant conservation implications for these species. Data provided by the Motus stations established during this project will serve as a baseline characterization of existing movements that can be used to help understand how species' presence and movements may change in relation to offshore wind energy development. The proposed upgrades and expansion of the Motus network of receiver stations along the New Jersey coast and in a "fence" design offshore will greatly improve detection rates of birds and bats tagged with Motus-enabled transmitters that are moving through the region. Establishment of a carefully designed state network will feed into larger regional-scale and international research efforts and will support future research in New Jersey and elsewhere. By contributing infrastructure to this larger research network, migratory birds and bats tagged outside of New Jersey that pass through the state can be detected by the state network, and animals tagged in-state can be detected by receiving stations located elsewhere along the Atlantic coast and around the globe. As a result, more complete and informative data is produced for all collaborators in the Motus network, including data such as spatiotemporal movements, migratory routes, and offshore habitat use of bird and bat species of interest. These data can be used to inform risk assessments and potential avoidance/mitigation measures for offshore wind energy development in New Jersey as well as elsewhere in the U.S. Atlantic region.

Despite the value of Motus tracking for understanding the movements of small-bodied birds and bats, the technology has limitations relating to the ability to identify three-dimensional locations of tagged animals from station detections. Pairing Motus with other datasets from marine radar, weather surveillance radar, barometric pressure sensors, or other methods can help to overcome some of these limitations. Additionally, recent efforts by project team members, funded by New York State Energy Research and Development Authority (NYSERDA), focused on developing models that use multiple near-simultaneous detections of Motus tags to estimate 3D locations of animals (Carlson et al. 2022, Loring et al. 2023a). These efforts are ongoing with funding from the Department of Energy and Bureau of Ocean Energy Management as part of Project WOW (Wildlife and Offshore Wind; https://offshorewind.env.duke.edu/). WOW Motus efforts (2023-2025) are focused on research and development to further develop location estimation models, explore new approaches for remote data transfer from offshore stations, and other efforts. Aspects of the proposed project in New Jersey, particularly station calibration efforts, would support and provide additional data to feed into these other research activities. We expect that completion of this project will: 1) identify key locations for Motus station coverage in coastal and offshore New Jersey such that expansion of the Motus network in the state is as effective and strategic as possible; 2) greatly expand the coverage of the Motus network in coastal New Jersey as well as adding substantial additional monitoring capacity to detect migratory movements in the offshore environment of the New York Bight; 3) develop a terrestrial calibration protocol for understanding the detection range of stations (which currently does not exist for Motus) and refinement of the recently developed offshore station calibration protocol (Loring et al. 2023a); 4) understand the detection range of both onshore and offshore stations; and 5) identify the factors influencing station ranges in terrestrial and offshore environments, in order to inform the siting of future Motus stations and analysis of data to inform offshore wind energy risk assessments and other decision making.

Designing and implementing an integrated coastal and offshore Motus network will maximize the utility of the additional stations for providing data on coastal and offshore movements of species of interest. The partners on this proposal include the most experienced organizations in the eastern U.S. at deploying Motus stations in both terrestrial and offshore locations, as well as substantial expertise in Motus study design, station calibration, and analysis. The proposal lead, Dr. Adam Smith, is the U.S. Motus Director at American Bird Conservancy (ABC), and Todd Alleger is the Motus Atlantic Flyway Technical Coordinator at ABC. Along with personnel from the Willistown Conservation Trust (WCT), they represent the Northeast Motus Collaboration (NEMC), which has established and maintained more than 130 Motus stations in the Northeast since 2017. Ocean Tech Services (OTS) specializes in marine environmental data collection from buoys and is highly experienced at collecting and delivering bird and bat data at remote offshore locations, including offshore wind development sites. The Biodiversity Research Institute (BRI) has substantial experience in planning wildlife monitoring systems to optimize data collection for offshore wind energy risk assessments and working with Motus systems, and will contribute study design expertise, station calibration support, and guidance and protocol development. BRI, along with Dr. Pamela Loring at the U.S. Fish and Wildlife Service (USFWS) and other partners, recently released a series of guidance documents for automated radio telemetry studies at offshore wind farms (https://motus.org/groups/atlantic-offshore-wind/), and Dr. Loring is serving as a technical advisor to support this project team in completing the proposed work. Collectively, the project team has

unequaled experience in designing Motus arrays, deploying stations in both terrestrial and offshore environments, and collecting automated radio telemetry data. This expertise, along with the integration of the coastal and offshore components of the RFP, will deliver the most effective and well-designed Motus array to New Jersey Department of Environmental Protection (NJDEP).

II. Proposed Research

1. Plan and Rationale

The project team will use the proposed locations as a basis for study design planning and proposal development, but the study plan will be updated to optimize the value of the network to research and monitoring efforts in the region. The current plan will be evaluated across multiple axes: current Motus station locations and their activity status, efficacy of individual stations in detecting tagged individuals, and spatiotemporal coverage of the network and how this supports current research and monitoring efforts. We will assess this plan with a rapid working group approach where the project team will identify key features to plan around, the new options will be developed to support these plans, then study design methods will be implemented to evaluate the strengths and weaknesses of the various approaches. Upon evaluation, the plans will be presented to the project team and key stakeholders outside of the project to determine the best long-term design.

The project team is already strongly engaged with the Regional Wildlife Science Collaborative (RWSC) for Offshore Wind (https://rwsc.org/) and the Motus Atlantic Offshore Wind Group (https://motus.org/groups/atlantic-offshore-wind/), including involvement in the formulation of the Motus Atlantic Offshore Wind Group and development of guidance for offshore Motus deployments, as well as participation in multiple RWSC taxa-based subcommittees. The team will coordinate with the RWSC, Motus, USFWS and Bureau of Ocean Energy Management (BOEM), and other relevant national, state and local research initiatives to ensure that project design and implementation are effectively communicated to external stakeholders and use the best available science.

Component 1 – Coastal Plain land-based Motus station deployment
The project team (specifically, ABC and WCT) will deploy a minimum of nine new Motus receiver stations and upgrade one existing station to create a “fence” of continuous Motus detection coverage across the state’s inland Coastal Plain region from the shore at Island Beach State Park to the Delaware River. We will obtain the prospective station location contact information already established by NJDEP as the first best locations for all nine land-based Motus stations as proposed in Figure 1 of the RFP. The exact location of each station will not be determined until after the group has established contact with landowners, visited the locations and determined that each location is suitable and the best location for a Motus station (landowner permission, radio noise testing, line-of-site for each antenna, power source, cellular service). Final station positions will not be determined until after site visits are conducted. Alternative sites will be assessed as part of the plan in order to efficiently use our time and assure that nine stations can be placed to create a fence across New Jersey and along the coast.

All stations will be dual mode, meaning they will have antennas to receive radio tags on both 166 MHz and 434 MHz. Depending on cellular and local internet service at each specific site, all stations will transmit data directly to motus.org and the health of each station can be monitored remotely through an account with Cellular Tracking Technologies.

The Northeast Motus Collaboration has extensive experience in siting, constructing, deploying and maintaining Motus stations. Our group has installed more than 150 Motus stations throughout the mid-Atlantic and New England (10 states) regions since 2017. Every Motus station is built in a way that is best-suited for each location, requiring knowledge of how best to affix the Motus operating equipment (antennas, receiver unit, etc). Our project team has knowledge to efficiently put Motus equipment in place and has shown that their stations will be strong enough to last for the long term (five years or more).

Component 2 – Offshore Motus station deployment on buoys

A minimum of nine additional Motus stations will be provided and installed by the project team (specifically Ocean Tech Services, OTS) at offshore locations based on the study design planning process. It is expected that the array will extend in a linear or saw-tooth form beginning nearshore and running approximately 32 miles toward the east.

The OTS Motus buoys (similar buoy illustrated in Figure 1) operate without user intervention to detect and record the presence of tagged birds and bats at the 166 MHz and 434 MHz frequencies. Each floating buoy (Sealite Poseidon-1750) is held in position by a mooring system which includes chain, an anchor, and various hardware components. Tag detections in the 434 MHz frequency, along with buoy health status data are transmitted daily via satellite to a shore-based server. Maintenance is performed at 6-month intervals to download all stored data (including 166 MHz detections) and to service other components of the system.

Figure 1. OTS bio-sensing buoy offshore Ocean City, MD, August 2023

Solar charged batteries provide power to the internal detection and data transmission systems. Because of physical space limitations on the buoy it is not possible to install the array of Yagi antennas provided with shore-based stations. Rather, two omnidirectional antennas are mounted high on the buoy to maximize detection range, one tuned to each detection frequency.

Build out and testing of the buoys will occur at the OTS offshore operations facility located within the Avalon Marine Center in Avalon, NJ. Deployments will also be staged from this facility utilizing vessels provided by Northstar Marine (Clermont, NJ). It is anticipated that all buoys will be installed during a three to five-day continuous effort in Spring 2024.

The installation of equipment in the ocean environment, such as Motus buoys, will require authorizations from the U.S. Coast Guard (District 5) and U.S. Army Corps of Engineers (Philadelphia District). USCG will require a Private Aid to Navigation permit for each site, while the USACE will likely grant an “envelope permit” addressing all deployments within a localized program. Additionally, for locations within New Jersey State waters, authorization is typically required from the State Department of Environmental Protection. OTS is thoroughly familiar with the permitting processes and will apply for and obtain all required regulatory authorizations required for the installations.

2. Methodology

The project will be led by Dr. Adam Smith, U.S. Motus Director at American Bird Conservancy (ABC). Project coordination will also be facilitated by the Biodiversity Research Institute (BRI). Component 1 (coastal plain land-based Motus station deployment) will be led by Northeast Motus Collaboration (ABC and Willistown Conservation Trust, WCT), with support from Biodiversity Research Institute. Component 2 (offshore Motus station deployment on buoys) will be led by Ocean Tech Services (OTS), with support from ABC and BRI. USFWS will provide advisory support for all aspects of the project, with a particular focus on study design (Task 1). Additional information on the project team and individual project roles is included in Section IV.

Task 1. Review and assess the study plan. The project team will review the proposed plan for Motus station deployments included in the RFP, consider landscape-scale study design and feasibility/logistics, and recommend a final deployment plan that 1) maximizes collection of quality data regarding the use of offshore airspace by key birds and bat species in the region, and 2) can be accomplished within the allotted budget and timeline. This proposed study plan will include detailed experimental design, methods, staffing, and schedule, and discuss feasibility/logistical constraints that will influence the final proposed design. The development of the proposed study plan will be supported by combining new studies on Motus station calibration and study design simulation tools into the planning process. By working with both the terrestrial and offshore components of the project, we will jointly design both studies to maximize the value of each deployment and the efficiency of the New Jersey array overall.

Using IDIOMS, a new tool for designing Motus deployments, we can assess the expected detection range of offshore deployments and the theoretical range of the terrestrial deployments. This will allow the team to assess a 360-degree view of the topography based on expected antenna range and height of the antennas. By incorporating land cover and landform information from the terrestrial sites, paired with experience deploying these stations, the overall study plan will be assessed for coverage. Next, alternative plans will be designed that are optimized for assessing different conditions to favor different research or monitoring goals (e.g., coastal coverage, interior coverage, overlap of multiple stations). For example, clustering several terrestrial stations around an area of ecological importance would allow receiver patterns to overlap and could provide simultaneous or near simultaneous detections of tagged animals from multiple stations. This subclass of detections, coupled with current tracking methods being developed under Project WOW, will enable three-dimensional position estimation of tagged animals on the order of tens of meters. Locations and retrieval timelines for existing buoys must also be considered; for example, the currently deployed buoy at the end of the "fence" line of buoy locations in Figure 1 of the RFP is planned for removal in June of 2024.

Real and simulated animal movement data will be used to assess the value of these different study plans and determine the strengths and weaknesses of the approaches. Finally, we will consider other sources of data on bird movements (e.g.,Next Generation Weather Radar [NEXRAD] coverage or long-term migration monitoring stations) and how they overlap with the different study designs.

Following review by the RMI team and other expert stakeholders (expected to be drawn from the RWSC bird and bat subcommittee, and coordinated by committee members at BRI and USFWS), the project team will produce a final project plan. Additionally, the project team will coordinate proposed station locations with the Motus Atlantic Offshore Wind Group via USFWS collaborator Pam Loring.

Site Selection

After terrestrial site selection is refined through the study plan assessment process, the project team will review the 9-10 proposed land-based locations using ArcGIS software to determine exact positions based on the requirements of the RFP, topography, and viewsheds. Using the software, three locations will initially be selected in each of the nine potential areas to maximize the team's time and give them the ability to choose the best site possible. Each potential site will be chosen based on the topography, selecting a higher elevation site to give the antennas line-of-sight; looking for an area that is clear of trees for a free-standing station, or an existing structure that may have potential to place the antennas or possibly provide power and/or WiFi or ethernet internet access. These parameters can only be confirmed after a site visit and contact with the landowner.

The refined marine sites will also be evaluated for buoy deployment by assessing the spatial conflicts, environmental conditions and additional buoy deployments in the area. For each selected location variables such as water depth and seabed type will be considered during the mooring systems and anchoring design. Expected wind and wave conditions at the site are considered when selecting the appropriate buoy hull for each location. Regulatory agencies processing permit

applications will take into consideration potential impacts to the seabed from the presence of the anchor and chain, the presence of other buoys in the area, and the potential for conflict with recreational and commercial vessel travel routes. Other potential permitting issues will be assessed in the deployment planning phase of the project.

Opportunity for additional data collection

Motus station deployments can also provide an opportunity for additional monitoring for birds and bats. We suggest using the proposed buoy array as platforms for other offshore environmental monitoring, including weather stations, above-water passive acoustic monitoring for birds and bats, and below-water acoustic telemetry receivers to detect tagged aquatic animals. These additions would allow passive monitoring of fish and wildlife using the area and will provide additional context for animal space use in the nearshore marine environment. The addition of these sensors on buoys is not included in the main project scope, but are mentioned for NJDEP's consideration. Further, additional sources of remotely sensed data will be incorporated into the site selection process. Data collection from weather surveillance radar stations, existing weather stations, other ocean buoys, and other related data streams that overlap with Motus station coverage can greatly enhance the amount of information that can be produced from this project.

Timeline: October 2023 - March 2024

Deliverables:

- Identify potential sites for 9-10 new onshore and 10 new offshore Motus stations to be installed by fall 2024.
- Draft project study plan.
- Finalize project study plan.
- Begin procurement of equipment and supplies for offshore stations and initiate buoy systems build-out.

Task 2. Coordinate outreach to landowners, lease holders, and land managers for Motus station deployments. This will include initial site visitation and review, creating agreements with landowners and managers for station deployment, data retrieval, and maintenance at all proposed land-based deployment sites, as well as acquiring permits (where relevant) for station deployment at both offshore and onshore locations.

The project team will work with NJDEP Office of Permitting and Project Navigation to ensure all proper permits and agreements are in place for each site before any stations are deployed.

Each offshore buoy will require an individual Private Aid to Navigation (PATON), issued by the U.S. Coast Guard (USCG). Applications for each buoy will be submitted to the USCG District 5 coordinator once all site locations and an approximate deployment date are confirmed. It is expected to take four to eight weeks to receive approval.

The land-based project team will coordinate with landowners and/or managers to visit each identified potential station. Each site visit will include:

a. An in-person view of the site and surroundings
b. Testing for radio interference and tags
c. Assessing site for solar and/or power source
d. Assessment of type of tower and equipment needed; whether the site will need a free-standing guyed tower base or can use existing structures.
e. Assessing cellular signal or potential for wi-Fi/ethernet for remote station health checks and data uploads
f. Considering the vicinity of offshore Motus stations
g. Considering the vicinity of NEXRAD stations.

A Motus system itself consists of four to eight antennas (two to four at each frequency) from four to nine feet long that are attached to a mast, a cable from each antenna that connects to the operating system that can be stored in a waterproof container. The system can be assembled in a variety of ways depending on the installation situation and existing infrastructure, from a guyed tower (20-40 feet high) in a field, to attaching mast and antennas to an existing structure like fire towers or rooftops, or securely bracketing a tower to a building. A station can also be operated by solar or a standard power source, depending on availability. The team will assess the appropriate build for each selected installation location on a case-by-case basis.

Timeline: October 2023 - September 2024
Deliverables:

- For terrestrial stations, coordinate with landowners, land managers, and subcontractors to conduct site visits at potential station locations identified in Task 1.
- For offshore stations, conduct permit pre-application meetings with regulatory agencies.
- Submit permit applications.
- Finalize landowner agreements and receive all required permits and authorizations.
- Determine installation schedule and training schedules.

Task 3. Establish Motus stations at agreed-upon locations. The project team will deploy or upgrade up to 20 Motus stations according to the locations and deployment plans outlined in the final project plan. All stations will be dual-mode, capable of receiving data from both 166.380 MHz and 434 MHz transmitters. Buoy stations will include an omnidirectional antenna for each of the two frequencies, while land-based stations will include two to four Yagi antennas at each frequency, depending on infrastructure capacity and study plan. We will also consider the use of an omnidirectional antenna at each frequency on land-based stations as necessary to better monitor the airspace directly over the station. The exact number of antennas per frequency, antenna configuration, and design of each station will be determined in the final project plan, following site visits to the land-based deployment locations, but all stations will conform with current guidance and standards. Stations will transmit system health data and detection data, where possible, via either GSM (cellular network), satellite (Iridium), or Wi-Fi/ethernet (for land-based stations) where possible. All detection data will be publicly available on www.motus.org. Land-based stations will be

marked with informational signage explaining the purpose of the equipment and directing the public to available detection data and more information where necessary.

Deployments are expected to include 1) upgrading at least one existing terrestrial Motus station; 2) establishing at least nine new land-based Motus stations; and 3) establishing 10 buoy-based Motus stations offshore of New Jersey. As noted above, deployments could be modified in the future to include the co-location of other environmental monitoring equipment on existing/planned buoys, if available and well-positioned to meet bird and bat monitoring goals.

Timeline: April - October 2024
Deliverables:

- Order remaining supplies for station installations and upgrades.
- Complete buoy systems build out and conduct pre-deployment buoy testing.
- Coordinate deployment of 10 offshore buoys and Motus stations.
- Coordinate 1 land-based station upgrade with subcontractors and landowners.
- Coordinate installation of 9 land-based stations with subcontractors and landowners.

Task 4. Maintain and assess detection ranges of stations.
In the second year of project activities, stations deployed in Task 3 will be maintained according to established protocols. This will include maintenance trips for the buoys every six months, unless system health data being received remotely suggests that a Motus station has stopped working. Working stations will be visited for regular maintenance by trained technicians at least twice a year to ensure safety and operation. Local data will be downloaded with each maintenance visit and the results will be uploaded to the Motus network.

Additionally, we propose conducting calibration activities to assess the effective detection range of stations at different flight heights, determine the influence of background radio interference on these ranges, and inform an assessment of the effectiveness of the study design in providing comprehensive coverage of the New Jersey coastal and offshore areas of interest. There is an established calibration protocol for offshore Motus stations that includes attaching a test tag to a GPS receiver and deploying it from a boat, drone, or airplane (Loring et al. 2023a). However, there is no standard protocol for calibrating terrestrial stations, and there would be great value in developing a protocol that could be broadly shared and applied across the terrestrial range of the Motus Network. Thus, we propose to 1) develop and test a land-based station calibration protocol, based on the tools and protocols already developed for offshore sites; 2) implement calibration protocols to assess detection range for the land-based and offshore stations deployed in Task 3; 3) compare estimated and actual detection ranges for newly deployed stations to assess the effectiveness of the study design in providing comprehensive coverage of the New Jersey coastal and offshore areas of interest; and 4) analyze data on background noise from pre-deployment site assessments, calibrated detection ranges, and detection data from Year 2 of the project to explore the effect of background noise levels on station ranges and ratios of true to false detections. This calibration approach will allow us to evaluate what noise levels and conditions influence station detection range and success, anticipate potential rates of false positives (particularly at the 166 MHz frequency), and thus advise on pre-siting noise measurements that may allow users to

evaluate the potential suitability of a site for a Motus station prior to installation, a need that is currently lacking. For example, some existing Motus stations are completely ineffective due to noise. We may supplement with pre-siting data measured elsewhere (e.g., other planned ABC Motus station installations) to increase sample size and provide more informative guidance.

Further, the finalized study design will be assessed using a post-construction calibration study. This calibration study will accomplish two main objectives. First, we will design a tool for calibrating land-based Motus stations. This tool will be developed from calibration methods developed for offshore turbines (Carlson et al. 2022). This tool will use idealized antenna detection patterns, local geography and local road maps to identify locations in which unmanned aerial system calibration studies should be conducted to gain the most information about a station's performance. This tool will be incorporated into the existing calibration report generator (motus-calibration.com). Secondly, using methods developed under the first objective, we will assess each of the terrestrially deployed Motus stations to determine their realized capacity for detections. By using unmanned aerial vehicles and active Motus tags co-located with a barometer equipped GPS device, we will assess a standardized airspace and determine the detection volume for the Motus stations. The volumes identified by each calibration study will help determine the efficacy of the deployed locations. For example, stations with volumes that overlap with neighboring station volumes will allow for detailed tracking while stations without overlap will be targeted at passage rates and presence and absence surveys. By comparing back to the IDIOMS pre-deployment assessment, and the terrestrial calibration tool, we can determine the realized strengths and weaknesses of the study design and use these data to continue to improve IDIOMS as a design tool.

Timeline: September 2024 - September 2025
Deliverables:

- Oversee data uploads from installed receiving stations and ensure they are working properly; provide technical support for installed towers as needed.
- Coordinate station maintenance with landowners and subcontractors.
- Maintain stations.
- Develop terrestrial station calibration tool.
- Develop final calibration protocol for terrestrial and offshore stations.
- Conduct calibration of station detection ranges.

Task 5. Identify maintenance costs beyond the project end date. The project team will develop a budget for annual Motus station maintenance and data retrieval for the stations deployed in Task 3. This will include regular station maintenance and repair, data plans, and data retrieval. This will include separate budgets for annual maintenance and data retrieval for bird/bat passive acoustic and acoustic telemetry components suggested as add-ons for buoy deployments.

Estimating ongoing maintenance costs for terrestrial and marine stations is challenging, but our team expects that annual maintenance costs for 10 terrestrial stations will likely cost in the range of $20,000 - $25,000 per year to cover personnel time and travel, data fees, and replacement equipment. For buoy-based stations, annual maintenance costs are expected to be higher due to more costly transportation expenses and data transfer fees, and the harsher environment. Our team

expects annual maintenance costs for 10 buoy-based stations to cost $110,000 - $125,000 per year.

Timeline: April 2025 - June 2025
Deliverables:

- Annual maintenance & data retrieval plan and associated budget for all land-based stations and offshore stations/buoys.

Task 6. Project coordination and reporting

This task includes coordination of offshore and onshore project components, administration of subcontracts, and project reporting, including the development of Quarterly Performance and Financial Reports, a Quality Assurance Project Plan (QAPP), a Health and Safety Plan, and the Final Report. This task also includes coordination with regional science entities and other regional coordination platforms that is not discussed in the above tasks (e.g., sharing the final report and other data). BRI already participates in the Regional Wildlife Science Collaborative (RWSC) for Offshore Wind's Bird and Bat Subcommittee meetings, and will continue to do so to ensure regional coordination and collaboration. Additionally, the project team will coordinate proposed station locations with the Motus Atlantic Offshore Wind Group via USFWS collaborator Pam Loring.

The project team will meet regularly to ensure coordination of efforts among the two main project components (Component 1, coastal plain land-based Motus station deployment, and Component 2, offshore Motus station deployment on buoys), as well as to coordinate efforts by project partners within each component. Quarterly performance and financial reporting will include a summary of progress, issues and how they have been addressed, plans for the next budget period, and an expenditure report, among other information.

The QAPP and Health and Safety Plan will build from existing standard operating procedures (SOPs) that have already been developed and implemented by project partners, including "Monitoring Protocols and Guidance for Automated Radio Telemetry Studies at Offshore Wind Farms" (https://motus.org/groups/atlantic-offshore-wind/), organizational health and safety plans, and OTS' Risk Assessment and Methods Statement (RAMS) and emergency response plan, both of which will be developed for offshore activities for the project. The QAPP will outline key deliverables and metrics for evaluation of project success, as well as potential fail points and intended approaches to address these issues. The project Health and Safety Plan will describe how the health and safety of field personnel will be safeguarded during project activities, including identification of risks, training, protective gear, communications protocols, and emergency response. The RAMS will address marine operations to describe in detail the operational procedures to be followed, the qualifications of personnel participating in offshore activities, identification of risks to personnel and/or equipment, and implemented mitigation measures to reduce these risks.

The final report will include:

- Final Station Map and associated station metadata (station energy sources, data retrieval mechanism, etc.)

- Maintenance protocols
- Future maintenance plans and estimated budget
- Terrestrial calibration protocol
- Updated offshore calibration protocol
- Calibration report: station detection ranges
- Assessment of factors influencing station detection range
- Data summary report: Motus detections

Timeline: October 2023 - September 2025
Deliverables:

- Health and Safety Plan
- Quality Assurance Plan
- Quarterly technical performance reports
- Quarterly financial reports
- Draft final report
- Updated final report

3. Schedule of Activities

We anticipate a two-year project duration (Table 1). The first year of project activities will focus on Tasks 1-3, and the second year our focus will be on Tasks 4-5. Project administration and reporting (Task 6) will continue throughout the project period. Station deployment will, to the greatest extent possible, be completed by the autumn of 2024 to allow for the collection of as much pre-construction data as possible prior to the anticipated start of commercial operations of Ørsted's Ocean Wind 1 Project.

Table 1. Gantt chart indicating the timeline of project activities.

		2023	2024				2025		
Task	Description	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
1	Review and assess the study plan								
2	Coordinate outreach to landowners, lease holders, and land managers								
3	Establish Motus stations at selected locations								
4	Maintain and assess detection ranges of stations								
5	Identify ongoing maintenance costs beyond project end date								
6	Project coordination and reporting								

4. Expected Outcomes

The proposed work will be evaluated via the successful delivery of the following products:

- Quarterly Performance and Financial Reports. These reports will provide interim updates on project progress and status, as described in the RFP.
- Quality Assurance Project Plan (QAPP). The QAPP will cover all aspects of the project and identify success metrics, sources of error/uncertainty and how they may affect results; standard operating procedures and other protocols for field work and data collection, and plans for data analysis to assess station detection ranges relative to radio noise and other site-level factors.
- Health and Safety Plan. The Plan will describe potential risks to personnel carrying out project activities and how risks will be reduced and controlled, including safety protocols, personnel education/training, communication with field staff (especially those on the water), emergency response, and personal protective equipment.
- Final Study Plan. The project plan will provide 1) a detailed description of considerations that contributed to the final site selection for Motus stations, including feasibility, experimental design, and stakeholder outreach, and 2) an outline of planned work, including methods, staffing, schedule, station locations, etc. Once Motus stations are operational, data will be either manually downloaded from stations or will be sent remotely (via cellular network or Iridium) and shared directly with the Motus Wildlife tracking System. Following basic QA/QC checks by the Motus System staff, these data are made publicly available on their website and can be accessed, downloaded, and filtered, and analyzed using Motus tools and software.
- Deployment and commencement of operations of up to 20 new or upgraded Motus stations. Photos and metadata will be provided for all stations as documentation for commencement of operations.
- Maintenance of all stations as needed in the second year of the project to maintain operations. Maintenance activities will be documented in quarterly and final reports.
- Terrestrial calibration protocol to assess station detection ranges for terrestrial stations.
- Calibration of detection ranges of all stations. Calibration data will be shared with NJ DEP.
- Final Report that includes a final station map, associated station metadata (station energy sources, data retrieval mechanism, etc.), maintenance protocols, future maintenance plans and estimated budget, terrestrial calibration protocol, updated offshore calibration protocol, station detection ranges, assessment of factors influencing station detection range, and summary of Motus detections at the stations to date.

The deployment of up to 20 new or upgraded coastal and offshore stations in New Jersey will greatly enhance New Jersey's role in the larger network of the Motus Wildlife Tracking System, provide essential movement data on a wide range of taxa, including listed and non-listed species, and provide an excellent baseline against which future deployments of turbine-based Motus stations (by Ocean Wind 1 and other developers) can be compared, and will further our understanding of coastal and offshore movements by migratory animals.

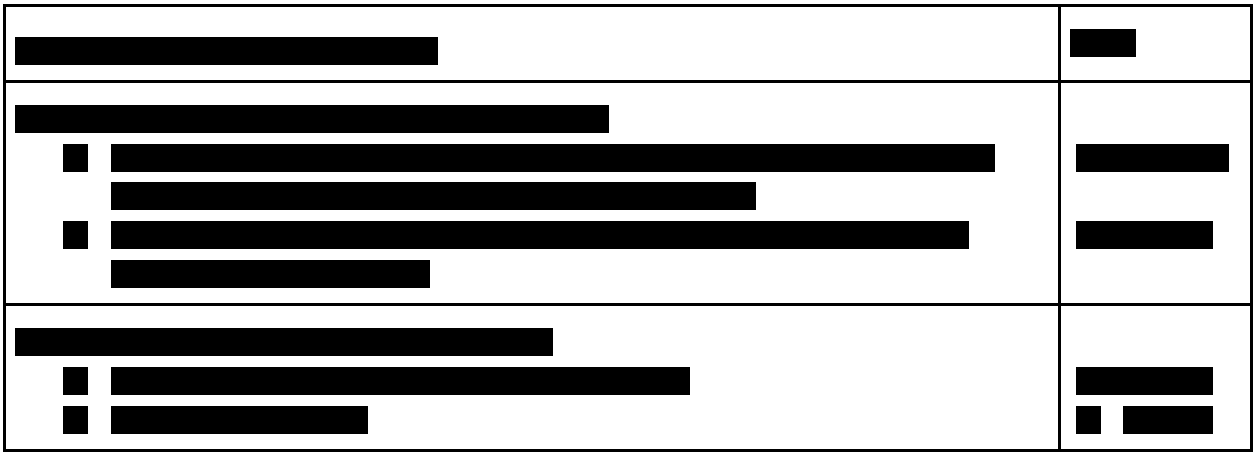
There are several limitations with the proposed project. Most importantly, Motus stations are only useful if sufficient numbers of tags are being deployed on the network for species of interest; both stations and tags must be deployed in order to acquire the desired data. Offshore wind developers and a range of other funders are focused on deploying tags on a range of species, though these are not all Motus tags. Strategic Motus tag deployments on species of interest relative to offshore wind (perhaps coordinated via the RWSC, as was suggested in Loring et al. 2023b) would help to address this need. Guidance on selection of focal species, sample sizes, deployment locations, and other study design considerations is provided in Loring et al. (2023b).

Additionally, past experience by project partners has suggested that it can be difficult to obtain landowner permissions to erect terrestrial Motus stations in New Jersey. Having NJDEP as the funder and as a partner on this project will hopefully alleviate some of these difficulties, as the agency may be able to facilitate site selection and permitting.

Finally, offshore stations (with only omnidirectional antennas) have a limited range, ensuring that the range of buoy-based stations for this project are unlikely to overlap, and that tagged animals could potentially move through marine waters of the New York Bight between these detection zones during migration without being detected. While the new station array developed by this project will not detect all animals migrating through the region, it will be a very substantial improvement over the paucity of stations currently present and will provide essential data on the offshore habitat use of small-bodied aerofauna in this region. Likewise, though current Motus technology can't provide accurate location or flight height data from tag detections, this project will provide important station calibration data to inform the ongoing development of models to estimate 3D locations of animals (Carlson et al. 2022, Loring et al. 2023a) as part of Project WOW.

III. Budget

1. Budget Table for ABC



[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
[redacted]	[redacted]
Total Project Costs (Total Direct Costs + Indirect Costs)	$1,300,077

2. Budget Justification

Hourly personnel rates and number of hours per researcher are listed in Section III, Budget Table for ABC above. A[redacted]COLA (cost of living increase) is included in ABC personnel rates for the second year of the project.

Personnel

- [redacted] is requested to support an Atlantic Flyway Motus Technical Coordinator (Todd Alleger) full-time for Year 1 ([redacted]) and at [redacted] time in Year 2 ([redacted]). The Motus Technical Coordinator is critical to the success of this project as Mr. Alleger will (1) oversee ABC and WCT's project efforts for the terrestrial Motus station installations and maintenance, (2) advise, support, and coordinate with BRI's project efforts, (3) source, purchase, and ensure delivery of equipment and supplies for ABC, WCT, and OTS's project efforts, and (4) lead in the achievement and reporting of project deliverables.
- [redacted] is requested to support 200 hours in Year 1 [redacted]) and Year 2 [redacted]) of the ABC U.S. Motus Director's (Adam Smith) salary. Dr. Smith will lead the administration of WCT, BRI, and OTS subawards, equipment and supplies purchasing for ABC, WCT, and OTS project components; advise and support the ABC, WCT, and BRI project efforts; and support the achievement and reporting of project deliverables.

Fringe Benefits: Fringe benefits are budgeted at [redacted] for full-time employees. Fringe is requested for Atlantic Flyway Motus Technical Coordinator ([redacted]) and U.S. Motus Director ([redacted]).

Travel:

- [redacted] is requested to support Atlantic Flyway Technical Coordinator lodging ([redacted]) and per diem ([redacted]) for 30 travel days over the grant period, most of which are expected to occur in Year 1.
- [redacted] is requested to support truck rental and fuel costs [redacted]) to visit and test potential sites, install, maintain, and repair Motus stations in NJ.

Equipment: [redacted] is requested to purchase 10 buoy hulls for offshore Motus stations at [redacted]

Supplies: [redacted] is requested for various supplies for terrestrial and offshore, buoy-based Motus stations. Terrestrial Motus station supplies will be delivered to WCT and include the following: [redacted] for 10 receiving units (SensorStations) and associated accessories (e.g., weatherproof cases, connections, etc.); [redacted] for the antennas necessary for 10 dual-mode stations, with at least six antennas per station); [redacted] for the coaxial cable needs for 10 stations; [redacted] for the necessary structural components (e.g., tower components; masts; grounding supplies; concrete) for 10 stations; [redacted] for power supply components (e.g., solar panel; battery; charge controllers; etc.) necessary for 10 stations; [redacted] for cellular data transfer fees of Motus detection data for 10 stations for the two years of the grant period; [redacted] for anticipated fees (estimated at [redacted] per

station on average) for permitting installed Motus stations with the state of NJ; and [redacted] for any necessary equipment rental for station installations (e.g., lift; concrete mixed; etc). Offshore, buoy-based Motus station supplies will be delivered to OTS and include the following: [redacted] for the anchor component of 10 deepwater buoy mooring systems; [redacted] for the chain components (e.g., chain; bridles; mooring rodes; etc) of 10 deepwater buoy mooring systems; [redacted] for hardware (e.g., swivels; links; shackles) components of 10 deepwater buoy mooring systems; [redacted] for the electronic receiving and control units for 10 buoy-based stations; [redacted] for the solar power systems and control modules for 10 buoy-based stations; [redacted] for custom electronics enclosures for 10 buoy-based systems; and [redacted] for the 20 omnidirectional antennas required for 10 dual-mode buoy-based stations.

Contractual: Three subawards will be established: [redacted] with Ocean Tech Services LLC, [redacted] with Willistown Conservation Trust; and [redacted] with Biodiversity Research Institute. The justification for the budget of each subcontract is described in subsection 3, Contractual Costs, below.

Indirect Charges: We request indirect costs at a rate of [redacted] on modified total direct costs (MTDC) of [redacted] which excludes all costs for capital equipment and includes only the first [redacted] of direct costs for the three subawards. ABC's total requested indirect costs are [redacted].

3. Contractual Costs

<u>Subcontract to Ocean Tech Services, LLC</u>

Ocean Tech Services, LLC (OTS) is a commercial enterprise offering services at fixed labor rates. These commercial rates include employee compensation and benefits, as well as overhead. Rates offered are consistent with those used and approved on ongoing contracts with the US Government and State entities.

Personnel

- [redacted] is requested for 160 hours of Project Management and Senior Engineering support (S. OMalley) @ fully-loaded rate of [redacted] The PM will direct all activities, technical and administrative, and oversee the design and execution of the project.
- [redacted] is requested for 400 hours of Engineering support (C. Johnsen) @ fully-loaded rate of [redacted] to procure, integrate and test all components required to prepare the (10) offshore Motus buoys required.
- [redacted] is requested for 160 hours Technician support (E. Halbruner) @ fully-loaded rate of [redacted] The technician will assist the Engineer in the preparation and building of buoys. The technician will also participate in buoy installations.
- [redacted] is requested for 240 hours support of the Marine Operations Supervisor (B. Riker) @ fully-loaded rate of [redacted]. The MOS will specify, design and procure all mooring systems, coordinate all vessel logistics and directly supervise all offshore activities. The MOS is also responsible for HSE program compliance and adherence.
- [redacted] is requested for 160 hours Administrative support (Susan O.) @ fully-loaded rate of [redacted] The Administrator will track project financial status, manage invoicing and payments,

ensure that personnel are supported and serve as the primary administrative interface to the client.

Travel: [redacted] is requested during buoy pre-deployment and deployment periods for transportation of personnel and equipment between the OTS Massachusetts and New Jersey offices. This budget will provide for vehicle use, tolls and per diem charges for two personnel.

Contractual: Services which OTS will subcontract to well-known contractors in performance of the program are as follows:

- *Permitting*: During Year 1, [redacted] is requested to secure the required authorizations for the installation of buoys in State and Federal water (permits). A subcontract for this service will be issued to WSP Environmental (Princeton, NJ). For each installation a Private Aid to Navigation Permit for each buoy will be required by the U.S. Coast Guard. The U.S. Army Corps of Engineers will require a Nationwide Permit 5 for the installations. Pre-application discussions have yielded information that indicates all buoys may be permitted within a single "envelope" authorization.
- *Trucking:* [redacted]s requested for truck transportation of equipment between the OTS MA and NJ offices. Equipment may include buoy or mooring systems components, Motus station electronics, or any OTS owned specialized equipment required to perform the offshore installations.
- *Installation Vessel*: [redacted] is requested for securing an appropriate vessel for the buoy installations. OTS is likely to utilize one of the vessels available from Northstar Marine (Clermont, NJ) with which we are familiar. It is expected that three days of vessel time will be required for the loading, performance of the installations and then demobilizing the vessel.
- *Data Communications*: [redacted] is requested to subscribe to the satellite service for provision of data transmission of Motus detection data and buoy health metrics for one year.
- *6-month Maintenance Check*: [redacted] is requested to conduct an initial maintenance check on all 10 deployed buoy-based Motus stations, six months after deployment. This subcontract will cover the vessel rental and all subcontracted services necessary to complete this initial maintenance check.

Supplies: All supplies to be provided by ABC.

Indirect Charges: OTS uses fully-loaded commercial rates that include fringe and indirect costs, so no separate indirect costs are requested.

Table 2. Budget for OTS subcontract

	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]			[redacted]
[redacted]	[redacted]			[redacted]
[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]			[redacted]
	[redacted]	[redacted]		[redacted]
	[redacted]	[redacted]		[redacted]
	[redacted]	[redacted]		[redacted]
	[redacted]	[redacted]		[redacted]
	[redacted]	[redacted]		[redacted]
[redacted]	[redacted]			[redacted]
[redacted]	[redacted]			[redacted]

Subcontract to Willistown Conservation Trust

Hourly personnel rates and number of hours per researcher are listed in Table 3, below. WCT personnel time includes the following:

Personnel

- [redacted] is requested to support the Project Manager (Lisa Kiziuk) for 140 hours (Year 1:102 hours, Year 2: 38 hours) at [redacted] to oversee WCT's installation program for a minimum of nine terrestrial Motus station installations and one Motus station upgrade, and assist with developing a maintenance plan for the network.
- [redacted] is requested to support 390 hours of the WCT Motus Site Selection Manager (Alison Fetterman) salary at [redacted]. Fetterman will oversee WCT Motus station installation efforts by coordinating site visits, securing permits and landowner permissions, and coordinating landowner management guidelines throughout the duration of this project. Alison will also assist with developing a maintenance plan for the network.
- [redacted] is requested to support the WCT Motus Technical Manager (Aaron Coolman) salary for 1250 hours (Year 1: 1100 hours, Year 2: 150 hours) at [redacted]. Coolman will visit sites to assess station integrity, conduct testing at potential sites for noise, and conduct on-site repairs as needed to ensure their operation throughout the duration of this project. Coolman is primarily responsible for the installation of nine new Motus stations and one upgraded station and will be on-site during all site visits and installations. He will manage

the WCT Motus Seasonal Technician during installations and maintenance visits. He will document necessary repairs and assist the WCT Motus Site Selection Coordinator with these repairs on subsequent visits.

- [redacted] is requested to support 755 hours at [redacted] for the installation of the nine Motus receiving stations of the WCT Motus Seasonal Technician-TBD). We require a minimum of two Motus technicians on every installation for health.

Fringe Benefits: Fringe benefits are budgeted at [redacted] for full-time employees. Fringe is requested for WCT Motus Technical Manager (Aaron Coolman) and the WCT Motus Site Selection Manager (Alison Fetterman) is [redacted].

Travel

- [redacted] is requested to support truck usage costs ([redacted]) to visit and test potential sites, install, maintain, and repair Motus stations in New Jersey. Matching funds of [redacted] provided for lodging [redacted].
- [redacted] is requested to support per diem expenses for gas and food expenses [redacted]) to visit and test potential sites, install, and maintain Motus stations in New Jersey.

Supplies: All supplies to be provided by ABC.

Indirect Charges: WCT is requesting support of [redacted] of indirect costs, totaling [redacted]

Table 3. Budget for WCT subcontract

[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]					[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]					[redacted]
[redacted]	[redacted]					[redacted]

	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
	[redacted]	[redacted]		[redacted]		[redacted]
[redacted]	[redacted]			[redacted]		[redacted]
[redacted]						[redacted]

Subcontract to Biodiversity Research Institute

Hourly personnel rates and number of hours per researcher are listed in Table X, below. A [redacted] COLA (cost of living increase) is included in rates for the second year of the project.

Personnel

- [redacted] is requested to support the Senior Quantitative Ecologist (Evan Adams) for 302 hours ([redacted]) to oversee all quantitative study design support (including testing of existing study design support tools, development and assessment of alternative designs using existing movement data and data simulations, and organization of stakeholder workshops to obtain feedback on study design scenarios), support development of the study design, help develop calibration protocols, support station calibrations, conduct a post-deployment study evaluation, attend weekly project meetings, and support development of quarterly and final reports and other deliverables.
- [redacted] is requested to support the Offshore Wind Center Director/Project Manager (Kate Williams) for 184 hours ([redacted] to support development of the study design (including organizing workshops to get targeted stakeholder feedback on the draft study design), help develop calibration protocols, support station deployment and maintenance, support station calibrations, attend weekly project meetings, manage subcontracts, identify long-term maintenance costs, coordinate and share updates on the project with the RWSC bird and bat subcommittee and other groups as needed, and support development of quarterly and final reports and other deliverables.
- [redacted] is requested to support the Technology Director (Andrew Gilbert) for 100 hours ([redacted]) to help provide quantitative study design support, support land-based station deployments, and identify long-term maintenance costs, and provide limited support for development of quarterly and final reports and other deliverables.
- [redacted] is requested to support the Drone Operator (Julia Stepanuk) for 263 hours ([redacted]) to help develop the calibration protocol, conduct land-based station calibration activities, and support the post-deployment study evaluation.

- [redacted] is requested to support the Quantitative Ecologist (Julia Gulka) for 208 hours in Year 1 at [redacted] to provide a range of quantitative study design and post- deployment evaluation support, help develop calibration protocols, support station calibrations, attend weekly project meetings when needed, and provide limited support for development of quarterly and final reports.
- [redacted] is requested to support the Communication Specilist/Stakeholder Coordinator (Eleanor Eckel) 10 hours in Year 1 at [redacted] to help organize and manage workshops to get targeted stakeholder feedback on the draft study design.
- [redacted] is requested to support the Avian Field Biologist (Lauren diCiccari) for 232 hours ([redacted]) to support land-based station deployments and maintenance.
- [redacted] is requested to support the Compliance Manager (Leigh LaMartina) for 40 hours in Year 1 at [redacted] to help manage subcontracts and support the development of project health and safety plans, QAPPs, and other compliance documents.

Fringe Benefits: Fringe benefits are requested at [redacted] for all personnel and total [redacted]

Supplies: [redacted] are requested for the purchase of a small drone and related materials (as described in Table 4) for calibration purposes.

Travel

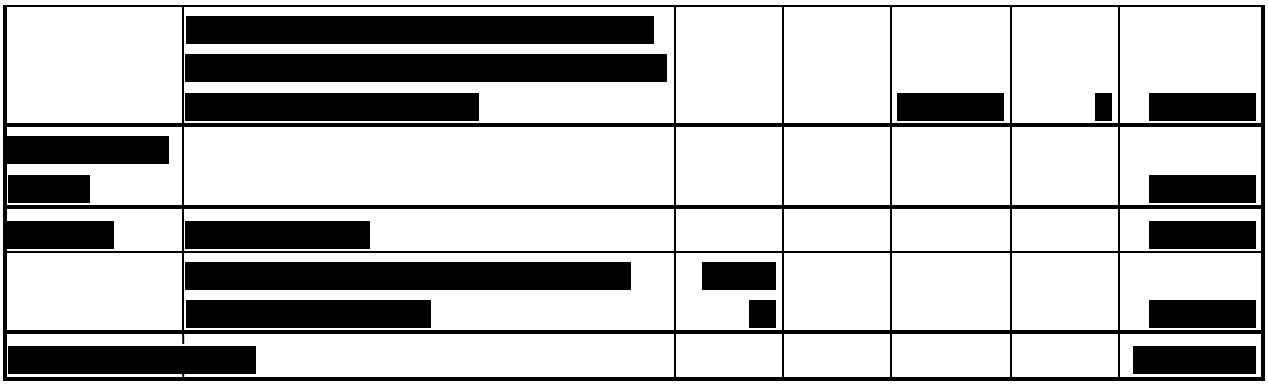
- [redacted] is requested to support the deployment (31 personnel-days in Year 1) and calibration/maintenance (20 personnel-days in Year 2) of Motus stations, assuming lodging costs of [redacted] per person per night and per diem costs of [redacted] per person per day
- [redacted] is request for rental of a BRI truck for travel for station deployment and calibration/maintenance at [redacted] for a total of 1.75 months.

Contractual

- [redacted] is requested for a subcontract to University of Rhode Island Ph.D. student Erik Carlson will support his involvement in the development and implementation of land-based calibration protocols, as well as his support to update the existing station calibration tool, which he developed with funding from NYSERDA in 2021-2022.

Indirect Charges: BRI's indirect rate of [redacted] is applied to all direct costs, and totals [redacted]

Table 4. Budget for BRI subcontract



IV. Expertise

The Project Manager will be Adam Smith with ABC. All key personnel from the project team are identified below, and brief CVs are provided in Appendix A. OTS investigators will be involved in all project tasks and will lead aspects relating to the deployment and maintenance of offshore Motus stations. WCT and ABC investigators will be involved in all project tasks and will lead aspects relating to the deployment and maintenance of onshore Motus stations. BRI investigators will be involved in all project tasks except Task 2 as they play a support role for OTS (offshore) and WCT/ABC (onshore). In particular, BRI will focus on providing study design, calibration, and other analytical support (Tasks 1, 4, and 6). Lead and supporting organizations for each project task are listed in Table 5.

Table 5. Lead and supporting organizations and key personnel for project tasks

Task	Task Description	Lead and Supporting Organizations	Key Personnel
1	Review and assess the study plan	Lead: BRI Support: OTS, WCT, ABC, USFWS	Evan Adams, Kate Williams (BRI), Adam Smith, Todd Alleger (ABC), Lisa Kiziuk, Alison Fetterman (WCT), Stephen O'Malley (OTS), Carl Johnsen (OTS), Benjamin Riker (OTS), Pam Loring (FWS)
2	Coordinate outreach to landowners, lease holders, and land managers	Leads: WCT (onshore), OTS (offshore) Support: ABC	Alison Fetterman (WCT), Todd Alleger (ABC), Stephen O'Malley (OTS), Carl Johnsen (OTS), Benjamin Riker (OTS)
3	Establish Motus stations at agreed-upon locations	Leads: ABC and WCT (onshore), OTS (offshore) Support: BRI	Todd Alleger (ABC), Aaron Coolman (WCT), Andrew Gilbert (BRI), Stephen

			O'Malley (OTS), Benjamin Riker (OTS)
4	Maintain and assess detection ranges of stations	Leads: ABC and WCT (onshore maintenance), OTS (offshore maintenance), BRI (station calibration)	Evan Adams, Kate Williams, Andrew Gilbert (BRI), Todd Alleger (ABC), Benjamin Riker (OTS)
5	Identify maintenance costs beyond the project end date	Leads: ABC and WCT (onshore), OTS (offshore) Support: BRI	Todd Alleger (ABC), Lisa Kiziuk, Alison Fetterman, Aaron Coolman (WCT), Stephen O'Malley (OTS)
6	Project coordination and reporting	Leads: ABC and BRI Support: OTS and WCT	Adam Smith, Todd Alleger (ABC), Evan Adams, Kate Williams (BRI), Alison Fetterman, Lisa Kiziuk (WCT), Stephen O'Malley (OTS)

Key Personnel for American Bird Conservancy

American Bird Conservancy is dedicated to conserving wild birds and their habitats throughout the Americas. This mission has guided us throughout our history of more than 25 years. Our Bird Conservation Strategic Framework emphasizes achieving results and working in partnership as we take on the greatest problems facing birds today, innovating and building on rapid advancements in science to halt extinctions, protect habitats, eliminate threats and build capacity for bird conservation.

Adam Smith, U.S. Motus Director, works in close partnership with, as a core member of, the Motus Central Team at Birds Canada. Dr. Smith's work focuses on implementing the Motus Strategic Plan (Motus Wildlife Tracking System 2022) across the U.S. and elsewhere in the hemisphere, including leveraging the strategic expansion of new Motus infrastructure and projects, helping to improve Motus data flow and user tools, and using Motus to support decision-making and on-the-ground conservation actions for migratory species. Dr. Smith values and builds diverse partnerships with conservation and resource management agencies and organizations to support collaborative projects employing modern quantitative tools and approaches to understand the ecology and conservation of migratory animals. Dr. Smith has 20+ years of field experience working with migratory birds, from small passerines to large raptors. He has personally installed more than 30 Motus stations, and worked with numerous partners to facilitate the installation of many more.

Todd Alleger, Atlantic Flyway Technical Coordinator, has extensive experience with the selection, design, installation, and maintenance of land-based Motus receiving stations. Todd has been part of

the NEMC technical team since the establishment of the first state-wide array in 2017 and most recently as the New England Motus Technical Coordinator in the establishment of the 50-station Interior New England Motus Array.

Key Personnel for Ocean Tech Services (OTS)

Ocean Tech Services, LLC specializes in marine environmental data collection (ocean, atmospheric and biological) for a wide variety of clients including Government agencies, port and harbor operators and offshore wind developers. With locations in Massachusetts and New Jersey, OTS is well-positioned to support projects throughout the northeast continental shelf and nearshore waters.

Stephen O'Malley, President of Ocean Tech Services, LLC, is a 30-year industry expert in marine, atmospheric and biological data collection. After receiving his degree in Civil and Environmental Engineering from the University of Massachusetts, Mr. OMalley worked as a Researcher Assistant on the Coastal Processes team at the Woods Hole Oceanographic Institution and as an engineer and project manager for private firms serving oil and gas clients as well as port and harbor mangers requiring air and ocean measurement systems. In 2007 he founded Ocean Tech Services, a firm focused solely on the collection of high-quality and defensible marine environmental data sets. In parallel with growing OTS Mr. OMalley worked for 8 years as the Environmental Director for the offshore wind developer Fishermen's Energy. In this role Mr. OMalley was responsible for all permitting, wind resource and site assessment tasks required for the development of a 25 mW windfarm off the coast of Atlantic City, NJ. At OTS, Mr. OMalley and his team continue to develop and implement novel methods and technologies to enhance biological data collection from buoys and other offshore platforms of opportunity.

Carl Johnsen, Systems Integration Engineer, is a 25-year veteran of marine environmental data collection programs conducted at both domestic and international project locations. Carl received his B.S. degree in geology from Northeastern University, and studied coastal processes at the University of North Carolina. Prior to joining OTS Mr. Johnsen held engineering positions at the Woods Hole Group, Odyssey Subsea, and with oceanographic instrument manufacturer Nortek. Mr. Johnsen is particularly adept at designing unique data collection methods and systems to meet the demands of research and commercial programs requiring oceanographic, atmospheric and biological data sets. Carl is the lead R&D engineer for the OTS effort to develop reliable and cost effective methods for collecting and delivering data documenting the presence of birds and bats at remote offshore locations, in particular, offshore wind development sites.

Benjamin Riker, Marine Operations Supervisor, has been with the company since 2012. Ben holds a BS in Environmental Studies from the University of North Carolina. From our NJ facility, Ben manages all aspects of the design, planning and execution of offshore operations. He is highly skilled in assessing operational requirements and coordinating the resources to perform work safely and successfully. Mr. Riker conducts Operational Risk Assessments and introduces mitigation measures to reduce or eliminate risks. He specifies the equipment, personnel and methods required to conduct offshore work and personally supervises the execution of projects. Ben is also a skilled technician, able to diagnose, troubleshoot and repairs marine environmental monitoring

systems. Mr. Riker serves as a project manager and senior representative of the company to interface directly with clients on matters concerning the execution of projects.

Key Personnel for Willistown Conservation Trust (WCT)

Willistown Conservation Trust's (WCT) mission is to preserve the open land, rural character, historic and ecologically significant resources of the Willistown area and nearby communities. The focal area encompasses 28,000 acres in Chester County, Pennsylvania. WCT's Bird Conservation Program works to enhance and promote bird conservation in the local area and beyond. The primary initiatives include bird banding, bird monitoring, education programs, habitat restoration and Motus. WCT is a founding member of the Northeast Motus Collaboration (NEMC) and has established and maintained more than 130 Motus stations in the Northeast since 2017.

Lisa Kiziuk, Director of the Bird Conservation Program and founding partner of the Northeast Motus Collaboration, has extensive experience managing the installation and maintenance of over 150 motus stations throughout the northeastern United States. In addition, as a federally licensed bird bander, she manages the Rushton Woods Bird Banding Station, which includes a migratory passerine program, a MAPS (Monitoring Avian Productivity and Survivorship) program, and a Northern Saw-whet Owl research program. She also oversees several songbird conservation research projects, which are utilizing the Motus Wildlife Tracking Program. In addition to her research and education initiatives at WCT, Lisa is an adjunct professor at the University of Pennsylvania in the graduate program of environmental science, and frequently serves as a guest lecturer for local universities, garden clubs, and non-profit organizations. Lisa has a masters in environmental studies from the University of Pennsylvania, and was presented with the Rosalie Edge Conservation Award in 2011 and the Julian K. Potter Outstanding Contribution to Bird Conservation Award in 2021 by the Delaware Valley Ornithological Club for her work in bird conservation.

Alison Fetterman, WCT Bird Conservation Associate and Northeast Motus Collaboration (NMC) Mid-Atlantic Project Manager, has extensive experience with the Motus Wildlife Tracking System, having been a lead member of the team that established the first state-wide Motus station array in 2017, followed by a large regional network in the Mid-Atlantic and New England. Ms. Fetterman uses ESRI's ArcGIS online tools to assess the best Motus station locations through features such as topography, accessibility, and land ownership. She also leads coordination with potential station hosts, Federal, state, and private landowners, to facilitate suitable placement of stations and put the proper agreements and permitting in place. She also regularly tracks the health and status of more than 100 Motus stations operated by the NMC, remotely, to ensure they are working properly. Ms. Fetterman has been the point of contact for Motus station hosts to assist with any technical issues and maintain the proper permitting and reporting. In addition, she assists with the operation of a songbird and Northern Saw-whet Owl banding station, oversees the data management for the station and assists with public outreach, education and training.

Aaron Coolman, Motus Technician and Avian Migration Ecologist, has worked with the Northeast Motus Collaboration and Willistown Conservation Trust since 2021 in a technical and consulting capacity. Mr. Coolman's experience has taken him from coastal Maine islands to the mangroves of

Puerto Rico and the Blue Mountains in Jamaica, throughout the mid-Atlantic and Northeast as a lead installation technician. He has worked and coordinated with Federal, State, and local parties to install Motus towers in a wide variety of scenarios, with stations built on rooftops, in fields, or adhered to the side of buildings. The upgraded and fully constructed stations he has built have withstood hurricanes and severe thunderstorms, and vary in size from simple one-antenna mini stations to 55' remnant communication towers, with many designs in-between.

Key Personnel for Biodiversity Research Institute (BRI)

BRI is a nonprofit wildlife research organization with over 60 scientists on staff. BRI provides scientific information to policymakers and resource managers to inform critical decisions regarding offshore wind energy development. In addition to taxonomic expertise with the bats and birds of North America, the BRI project team also has substantial experience in planning wildlife monitoring systems to optimize data collection for offshore collision risk modeling and working with Motus systems. All three senior staff listed below were co-PIs on the development of monitoring protocols for automated radio telemetry studies at offshore wind projects, which was funded by NYSERDA and led by USFWS, as well as working with USFWS and BOEM to produce a stochastic collision risk model for birds at offshore wind farms in the U.S. Atlantic using movement data from automated radio telemetry (Motus) data.

Kate Williams, *Director of the Center for Research on Offshore Wind and the Environment*, has extensive experience conducting ecological research and working with stakeholders to assess and mitigate the effects of offshore wind energy development on wildlife along the U.S. Atlantic coast, including acting as the technical lead for the E-TWG for New York State (2017-present). She has received and managed $9+ million in funding for offshore wind and wildlife work. Ms. Williams designs and manages projects, writes technical reports and publications, delivers public presentations at scientific conferences, and works closely with a variety of collaborators. In addition to the Motus projects noted above, she is a PI on Project WOW (Wildlife and Offshore Wind), which includes ongoing work to deploy Motus stations and conduct R&D activities for Motus in relation to the first commercial-scale offshore wind farms in the U.S. Atlantic. She is an active member of the RWSC Bird and Bat Subcommittee.

Evan Adams, Director of BRI's Quantitative Wildlife Ecology Research Lab (QWERL), has experience designing ecological studies in the offshore environment and conducting novel research that pairs complex questions with well-developed statistical methodologies. Dr. Adams' research focuses on the effects of environmental change on animal movements and distributions and the decisions we can make to support conservation. He has designed and coordinated bird surveys and distribution modeling for terrestrial and marine birds throughout the eastern United States. Further, his recent work on marine predator-prey interactions in the Northwest Atlantic provides a template for integrating surveys around taxonomic groups to better understand drivers of distributions and population limitation. In addition to the Motus projects noted above, he is a PI on Project WOW.

Andrew Gilbert, Senior Geospatial Scientist, oversees spatial distribution and movement modeling for projects up and down the Atlantic coast. In addition to the Motus-focused projects noted above, Mr. Gilbert's current and recent projects include various commercial offshore wind projects in the

U.S. Atlantic. He has significant experience working with federal agencies, including U.S. Fish and Wildlife Service and Bureau of Ocean Energy Management, to support projects related to seabird distribution modeling and avian behavior monitoring.

Key Personnel for U.S. Fish and Wildlife Service

Pam Loring, Wildlife Biologist, is with the U.S. Fish and Wildlife Service Division of Migratory Birds in the Northeast Region. Dr. Loring completed the NSF IGERT graduate fellowship program in offshore wind energy at the University of Massachusetts Amherst and has been working on wildlife and offshore wind energy studies for over a decade. Dr. Loring is a member of the Motus steering committee, oversees over 20 coastal and offshore Motus stations in the Atlantic region, and has co-led numerous collaborative tracking efforts including the Atlantic Offshore Motus project funded by NYSERDA.

V. Resources

The project team of ABC, WCT, OTS, and BRI have combined decades of experience in deploying Motus stations offshore and in terrestrial environments, including highly experienced and qualified staff with more field experience in Motus station development and deployment than any other organizations in this field. Key personnel for this project with this expertise are listed in Table 5, above.

The Northeast Motus Collaboration (NEMC) was formed in 2017 in Pennsylvania to create the first state-wide telemetry network (18 stations) for tracking migratory animals and support a landscape-scale approach to conservation. The original partners included the Ned Smith Center for Nature and Art, Powdermill Nature Reserve, Project Owlnet, and Willistown Conservation Trust. This team secured a Competitive State Wildlife Grant (C-SWG) from the U.S. Fish and Wildlife Service in 2018 to install 45 Motus receiving stations throughout the mid-Atlantic States (Delaware, Maryland, New Jersey, Pennsylvania, New York). Following the successful mid-Atlantic C-SWG proposal, collaborators in New England submitted a partner application in 2019 for funding to support installation of 50 Motus receiving stations throughout the New England states. In 2023, the NEMC partnered with American Bird Conservancy (ABC) and many collaborators and agencies in the Southeastern US to place 35 new Motus stations in the SE and maintain the large northeastern network. The project team from the NEMC will use their experience and methodologies to find the best location for nine new land-based Motus stations, establish agreements with landowners, ensure the proper permitting when applicable, and deploy nine new Motus stations and upgrade one existing station.

Since 2013 Ocean Tech Services has been developing and implementing offshore biological detection systems in support of offshore wind development. While initially focusing on the presence of birds and bats through acoustic detection, OTS now in addition to avian acoustic monitoring, provides offshore data collection systems to identify the presence of tagged birds and bats, marine mammals and tagged fish at offshore areas of interest. To date, OTS has deployed and operated over 12 offshore Motus stations for various east coast wind clients such a Fishermen’s Energy, US

Wind, NYSERDA, and others, including the buoy referenced in the RFP for this program (TGS E10). While the Motus devices have typically been installed as “supplemental sensors” mounted on larger wind resource assessment buoys, OTS deployed our first dedicated biological sensing buoy off the coast of Maryland during 2023. Over the past 10 years of operating offshore Motus and bird/bat stations we have gained tremendous experience in improving the design and reliability of these systems and have made significant R&D investment into optimizing performance and minimizing maintenance costs.OTS has in house the personnel, equipment, facility and financial resources to required to successfully develop, install and maintain networks of offshore Motus buoys.

BRI has conducted 14 years of scientific research, stakeholder engagement, and coordination focused on the effects of offshore wind energy development on wildlife and their habitats. The Center for Research on Offshore Wind and the Environment (CROWE) at BRI is a leading organization in understanding and minimizing the effects of offshore wind energy development on birds and bats in the United States. Key BRI projects in recent years have included the seminal Mid-Atlantic Baseline Studies Project (funded by the Department of Energy), technical and scientific support we provide to the New York State Environmental Technical Working Group (E-TWG), and the development of guidance for using Motus in relation to offshore wind energy development, “Development of Monitoring Protocols and Guidance for Automated Radio Telemetry Studies at Offshore Wind Farms” (https://motus.org/groups/atlantic-offshore-wind/; developed on collaboration with USFWS and other partners). This guidance was published in 2023 and provides much of the framework and guidance for the siting and deployment of stations for this proposed project. BRI’s Quantitative Wildlife Ecology Research Laboratory (QWERL) is also strongly involved in guidance development and study planning efforts for a range of offshore wind-related research projects.

BRI and USFWS project team members are strongly engaged with the Regional Wildlife Science Collaborative for Offshore Wind (https://rwsc.org/) and the Motus Atlantic Offshore Wind Group (https://motus.org/groups/atlantic-offshore-wind/), including the formulation of the Motus Atlantic Offshore Wind Group and development of guidance for offshore Motus deployments, as well as participation in multiple RWSC taxa-based subcommittees. The team will coordinate with the RWSC, Motus Wildlife Tracking System, USFWS, and BOEM, and other relevant international, national, state, and local research initiatives, to ensure that project design and implementation is effectively communicated to external stakeholders and uses the best available science.

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