Marine Species Density Data Gap Assessments and Update for the AFTT Study Area

Cooperative Ecosystem Studies Unit Agreement

Period of performance: 12 months from date of award with four option years

May 2024

I. BACKGROUND

The United States (U.S.) Navy is responsible for compliance with a suite of federal environmental and natural resources laws and regulations that apply to the marine environment, including the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), the Magnuson-Stevens Fishery Conservation and Management Act, the Marine Protection, Research and Sanctuaries Act (MPRSA), Clean Water Act (CWA), Executive Order 13089 on Coral Reef Protection, and the National Environmental Policy Act (NEPA)/Executive Order 12114 (EO 12114). Additionally, Federal Activities that have the potential to affect the state coastal zone are required to be consistent with respective state coastal zone management plans mandated by the Coastal Zone Management Act (CZMA).

The Navy Marine Species Density Database (NMSDD) is the authoritative source of marine species density data maintained by the Navy. These data comprise multiple sources and quality levels and are used as inputs to determine the number of estimated acoustic exposures, specifically for the Navy's NEPA process. These data are included based on a hierarchy of preference based on the quality and methods of derivation.

The Navy updated the density data in 2015 and 2022 to include all of the Atlantic Fleet Training and Testing (AFTT) Study Area for the Phase III and Phase IV Environmental Impact Statements (EISs), respectively. This update created new density predictions for most marine mammal and sea turtle species that had sightings data within the AFTT Study Area. These data and other sources are included in the NMSDD based on a hierarchy of preference, which is based on the quality and methods of derivation (Figure 1). The result is one master set of seasonal U.S. Atlantic and Gulf of Mexico marine species density data that are used in the Navy Acoustic Effects Model (NAEMO) to assess marine mammal and sea turtle exposures.

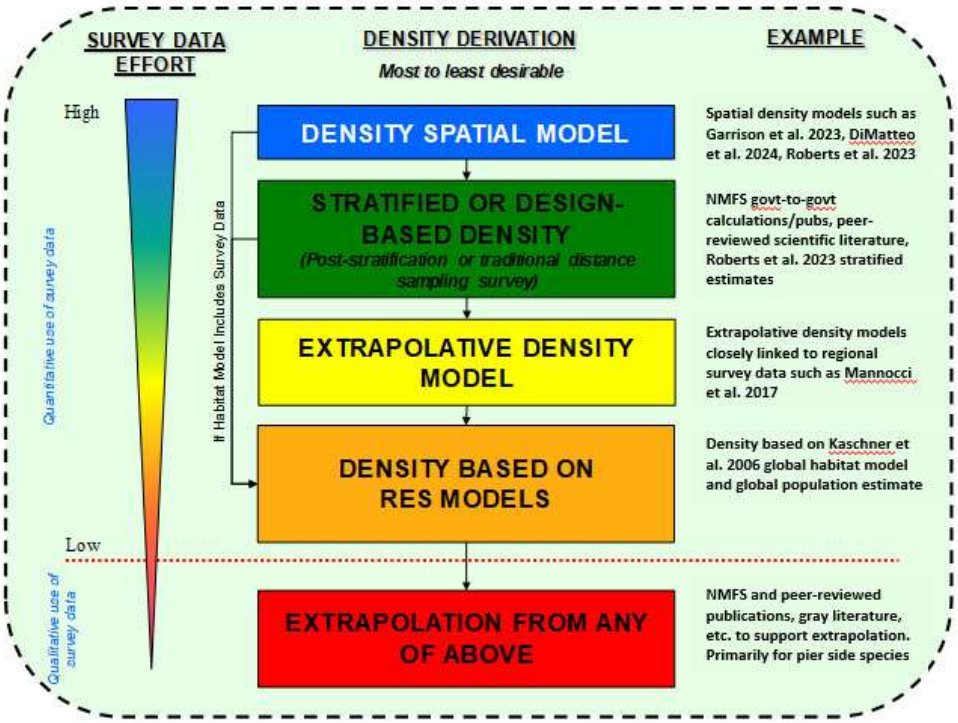

Figure 1. Phase IV NMSDD Hierarchy for data inclusion.

A significant data source in the NMSDD outside of well-surveyed areas (generally coastal areas and the U.S. Economic Exclusive Zone (EEZ)) is relative environmental suitability (RES) based models and extrapolative density models. These data are utilized because the Navy's AFTT Study Area extends beyond the region of most surveys and therefore needs to consider all predictive models available to fill in data gaps. However, the density predictions produced from these models are speculative and are ranked lower on the NMSDD hierarchy (Figure 1), further necessitating the continued development of spatially explicit density models.

New surveys occur frequently and the science of density estimation is constantly advancing, necessitating frequent updates to the NMSDD to ensure that the marine species density models included represent the best available science. The use of best available science is the mandate for Navy environmental compliance efforts. There are several next steps that can be taken to continue to improve upon the AFTT EIS density data. These next steps include the following: the incorporation of significant additional sources of data (e.g., visual line transect surveys and passive acoustic monitoring) that could improve models, refinements to modeling covariates, and the development of density spatial models for some species that were modeled as a group for Phase IV. Given the amount of data to process, the complexity of the models being developed, and the limited time available to perform work under a scope such as this, an incremental approach to updating density models, as opposed to a full replacement of all density models at once, is advisable, less expensive per annum, and allows more flexibility when targeting methodological improvements, particular datasets, and species of concern.

II. PERFORMANCE WORK STATEMENT

The purpose of this Cooperative Agreement is to augment and refine/update the Navy Marine Species Density Database (NMSDD) in the Atlantic Fleet Testing and Training (AFTT) Study Area. The primary foci of this Cooperative Agreement will be to incorporate newly available aerial, shipboard, and acoustic survey data into the existing density modeling framework, use the survey data collected/incorporated from 2015-2022 under the two Cooperative Agreements (Contract # N62470-15-2-8003 and Contract # N62470-20-2-2011) for the AFTT Phase IV density models in conjunction with the newly available data to update models for species that have older models or that were modeled as a group, are particularly sensitive, or that require a high number of take authorizations under the ESA or MMPA. The models in the AFTT portion of the NMSDD were designed to be regularly updated with new data and methods, allowing for a steady state investment approach and incremental improvement. This performance work statement (PWS) provides for a base year update and 4 option years that will, if exercised, provide modeling updates per option year and overall, provide enhancements to the NMSDD.

Consistency across various Navy projects addressing impacts to marine mammals is critical. Any data collected and density models developed under this PWS will need to be consistent with standards developed under the current AFTT models and with the NMSDD except as directed by the Contracting Officer Representative (COR). Density data developed under this Cooperative Agreement will be considered the best available and used across several Navy at-sea environmental compliance programs off the East Coast and Gulf Coast of the U.S., and for pier side in-water construction. The selected Cooperative Ecosystem Studies Unit Member (i.e., Cooperator) is expected to coordinate data collection with government contractors and Navy CORs responsible for supporting other ongoing environmental compliance actions. This is to ensure that all sources of data including internal Navy sources of data are considered for possible inclusion. The COR and U.S. Fleet Forces Command will assist with the identification and coordination among Navy programs.

All derived density data (though not necessarily the underlying survey data) are to be made publically available as part of the EIS process. This will allow the public to use the same data as the Navy in understanding how the Navy estimated potential acoustic effects on marine species.

A. Services Required:

Task 1. Integrate new survey data and covariates into the modeling framework:

New survey data are continually becoming available and need to be integrated into the density modeling framework to replace outdated data and ensure that models reflect the best available science. The Cooperator will work with the COR to identify and integrate new sources of survey data and remove outdated data. Potential data will need to be screened to ensure it meets the requirements for inclusion into a density modeling framework and will require close coordination with data providers. Data will then need to be cleaned and standardized for inclusion. Data sources to target for inclusion include but are not limited to: North Atlantic Right Whale surveys, Navy-funded aerial and shipboard surveys, state sponsored aerial or shipboard surveys, surveys undertaken by

not-for-profits, and National Marine Fisheries Service (NMFS) aerial and shipboard surveys. Some particularly high value datasets to target are the aerial and shipboard surveys conducted by the Northeast Fisheries Science Center and Southeast Fisheries Science Center to support the Marine Assessment Programs for Protected Species in the Atlantic (AMAPPS) and Gulf of Mexico (GoMMAPPS). The AMAPPS surveys were partially funded by the Navy. These datasets should be considered the highest priority data for inclusion because of their broad geographical and temporal coverage. The Cooperator will also explore the incorporation of acoustic data sources, if available for the AFTT Study Area, to improve upon models for certain species (e.g., beaked whales, minke whale, and sperm whale).

Also of high value are surveys from outside the U.S. EEZ that were not available for the 2022 models, including: a survey of the southern Gulf of Mexico reported by J. Ortega-Ortiz; the Trans North Atlantic Sighting Surveys (TNASS) near Canada, Greenland, Iceland, and other parts of the North Atlantic; shipboard and passive acoustic monitoring surveys of the North Atlantic basin by Marine Conservation Research International; and aerial and passive acoustic monitoring surveys of Canadian waters, particularly the Gulf of St. Lawrence, by Fisheries and Oceans Canada (DFO). Though not a complete list, these surveys and potentially other surveys that are not yet identified, may improve the accuracy of the models in certain regions of the Study Area, particularly the north and east, and facilitate expansion of the Study Area.

Although the Cooperator will focus data collection efforts towards marine mammal survey datasets, some of these datasets may contain sightings information on sea turtle species. The Navy produces density models in-house for sea turtle species that regularly occur off the U.S. East Coast. To prevent redundancy of effort for Navy-funded density models, the Cooperator shall make available unprocessed survey data (or processed data where additional effort is not required) containing sea turtle sightings data for applicable areas by request for the Navy. This shall be done in accordance with the Cooperator's survey data provider agreements and any additional survey data provider approvals obtained by the Naval Undersea Warfare Center (NUWC) Division Newport, Environmental Branch.

The northern waters of the AFTT Study Area have been rapidly changing in the face of climate change. Our understanding of this ecosystem is evolving, as are our methods to represent it. As such, it is crucial to incorporate the most recently available environmental models and covariates into the density models produced here. Dynamic covariates such as prey distribution and proxies for prey, particularly for baleen whales, have been difficult to predict and have large impacts on the seasonal distributions of cetaceans in the region. A focus should be placed on the environmental covariates most likely to affect cetacean distribution.

Metadata will be developed for all survey information and datasets that are obtained. The purpose of the metadata would be to identify the provenance of the data and any alterations from the original data source. If metadata exists for a data set it can be updated as appropriate. A summary of data incorporated into the NMSDD modeling framework will be provided to the Navy as either a standalone document or as an appendix to the overall technical project report in Task 5. The summary of data will also include the following group size statistics, derived from the sightings used in the models, which the Navy needs in order to create animal distribution in NAEMO for each modeled species: mean group size, standard deviation (SD), the distribution underlying the group size, and the number of observations that were used to calculate the mean and SD.

Planned Government Participation: The government has in-house subject matter experts on marine mammal monitoring efforts and will assist in the identification and acquisition of survey datasets, particularly when the data are held by a federal government agency. Government to government communication would help facilitate the transfer of data. The government will also assist in the identification of appropriate environmental covariates. The survey datasets and covariates identified and acquired by the government are incorporated into the modeling framework by the Cooperator and this is the first major step in the model development process.

Task 2. Integrate statistical methodological improvements and update density models:

The Cooperator will incorporate improved statistical methods into the density modeling framework based on recent advances in best available science. A high priority for inclusion will be improved methods for estimating and incorporating uncertainty from multiple sources. The 2022 models provided quantitative estimates of uncertainty for the extensively surveyed East Coast and Gulf of Mexico regions as well as quantitative and qualitative estimates of uncertainty for the remainder of the AFTT Study Area, an improvement over the 2015 Phase III models as uncertainty estimates for the 2022 models accounted for uncertainty in model parameter estimates as well as temporal variability in the dynamic covariates of the models, where applicable. However, there are several additional sources of uncertainty and variability not accounted for in the 2022 models. The Cooperator will investigate and, if possible, implement further improvements to the uncertainty measures. Methods developed by the Centre for Research into Ecological and Environmental Modeling and modelers from the Navy-funded DenMod working group will be explored to include statistical uncertainty in the detection functions, the availability and perception bias estimates (the g_0 parameter), spatial models, and environmental

variability. Estimating all sources of uncertainty will not accomplishable nor expected given limitations in uncertainty estimation methodology and the modeling timeline and deadlines (refer to **Section B Completion Schedule & Deliverables**). Priorities will be determined in discussion between the COR and Cooperator.

For the follow-on Cooperative Agreement (Contract # N62470-20-2-2011) extrapolation for the AFTT-wide models was characterized using multivariate metrics; Mahalanobis distance and ExDet extrapolation (for areas of environmental covariate extrapolation). These metrics, if found appropriate to use for a more quantitative assessment of uncertainty, will be added to the NMSDD in order to better characterize where AFTT models were extrapolated and predictions uncertain. The Cooperator will also investigate cross-validation approaches to assess uncertainty or predictive performance, as was done in the initial Cooperative Agreement (Contract # N62470-15-2-8003) for the AFTT models and with papers published by the NMFS Southwest Fisheries Science Center.

The Cooperator will use the new survey data and environmental covariates from Task 1, as well as the survey data and environmental covariates collected/incorporated under both Cooperative Agreements (Contract # N62470-15-2-8003 and Contract # N62470-20-2-2011) and deemed still relevant for the AFTT Phase IV density models. The updated models will utilize statistical methodological improvements (mentioned above) for the AFTT Study Area, including all Navy ports and pier side locations depicted as well as the area up to the NGA 250K shoreline data. The Navy will provide a list of priority pier side locations so data gathering efforts can be focused. Models will be produced and where possible, monthly predictions will be made. Annual estimates are acceptable given data limitations. The Cooperator will produce both a nearshore, survey-based model for the East Coast and Gulf of Mexico regions and an offshore, extrapolative model for the wider AFTT region of the Study Area for each species, where applicable. For all of the AFTT-wide extrapolative models, the Cooperator will apply a similar covariate selection procedure that was used for the 2015 models in addition to the new survey data and methods developed for the East Coast and Gulf of Mexico regional models. Some effort will be placed on refining the integration of these two types of models (edge effects) and incorporating outside density models, if necessary for improvement, such as those produced independently by NMFS within U.S. waters. Where possible, the Cooperator will coordinate with any NMFS Science Center modeling efforts to incorporate any updates they may provide.

If sufficient and appropriate new data are acquired, the Cooperator will also use them to assess and report on the predictive performance of the 2022 models, using the new data as a test data set.

The Cooperator will investigate the technical feasibility of density model updates and execute new or updated models for the following taxa, where possible:

- Updated models for the 35 marine mammal taxa (29 species and 6 guilds) included in the 2022 models. The Cooperator will determine priorities in discussion with the COR.
- Develop new species-specific models for the species that were modeled as a guild in the 2022 models, such as the “beaked whales”, “Kogia”, “pilot whales”, or “seals” groups. Species-specific models may be possible with improvements in species identifications made by NMFS with the AMAPPS and GoMMAPPS surveys. The Cooperator will determine priorities in discussion with the COR.

The Cooperator will experiment with a hierarchical generalized additive modeling approach if deemed appropriate for certain marine mammal species (e.g., North Atlantic right whale) that have more complex habitat and environmental preferences across different marine ecosystems.

The density data will be in the unit of number of animals per square kilometer. Combining species that are data deficient or rare species into guilds is also acceptable with COR consultation and approval. This will involve data stakeholder review and feedback on possible suggestions based on expert opinion (see Task 3). All species/guilds present within the AFTT Study Area will have a derived density estimate based on the best available data/science for all months (even if the underlying model is annual). This will include an estimate of model uncertainty/quality and validation of some of the predictive models where possible. Acceptable metrics for estimating uncertainty/quality will be discussed with the COR, but could include the coefficient of variation (CV), Mahalanobis distance and ExDet extrapolation (for areas of environmental covariate extrapolation), and qualitative metrics.

The density surfaces will be used in and formatted as vector files for inclusion in NAEMO as a file geodatabase compatible with ArcGIS, with the required fields populated in accordance with the Geospatial Data Specifications (GDS) except as directed by the COR (see Appendix A [Electronic Data Deliverable Specifications and Format] for detailed data deliverable guidelines). Additional formatting guidelines will be provided by the COR and the Navy will be open to hearing suggested improvements from the Cooperator. The results, including the estimated density values, need to be made available to the public (Task 5). Only data, for which the computed density results can be made available to the public, shall be included in the density data files. The Cooperator, with the assistance of the COR, if needed, will prepare data request letters to be sent by the COR.

Travel for collaborators from universities and other institutions external to the Cooperator who are participating in method development will be supported.

Metadata will be developed for all files in accordance of the instructions listed in the GDS section of Appendix A in this PWS. The additional purpose of the metadata would be to allow the user to trace back information on the data source of each density cell, as it is often infeasible to place a full citation(s) in the attribute fields of spatial data.

Planned Government Participation: The government has in-house subject matter experts on density modeling and will assist with statistical method updates by providing input on methodology decisions and identifying priorities based on data ingestion capabilities and requirements for information regarding the predictive performance of the density models for the Navy Acoustic Effects Model (NAEMO). The government maintains the technical infrastructure of the NMSDD and will work closely with the Cooperator to ensure that all data/models are in a compatible format. The government will also be developing the AFTT Study Area, which will bound the models, based on input from system commands. There is significant work on the government side to QA/QC the NMSDD by reviewing model outputs and associated metadata and attribute fields that are used to compile this geodatabase, so that the NMSDD can be integrated into NAEMO for the Navy's acoustic exposure analysis. The government will also participate in the model review and technical meetings to provide substantive input on modeling decisions, model predictions (e.g., whether predicted density distributions and abundance estimates for certain species seem accurate), and priorities based on available data while providing context for how the Navy will use the models. Feedback provided by the government on density model development and predictions will help to refine/improve the models and provide a better quality product for the Navy.

Task 3. Data stakeholder review of the new models:

The updated NMSDD models will be sent to the regional NMFS Science Centers and other survey data providers for review. The group should include at a minimum all the stakeholders currently engaged in Navy density estimation efforts (list to be provided by the COR). Other stakeholders, species experts, or modeling experts can be added as necessary at the discretion of the Cooperator and COR. This would allow for expert feedback on any possible anomalies from the expected abundance/distribution of known species. The Cooperator will give the group a minimum of 30 days to review the models and provide feedback. This may entail an in-person meeting inviting the stakeholders to go over the methods developed so they can understand how the models were derived and what is expected of the models. Top level goals for the meeting should include attendance by key data providers and stakeholders, understanding of the need to produce models and the scientific framework on which the NMSDD is built, and review of models to improve and refine Navy density model outputs. Representatives from the U.S. Navy, including density modeling subject matter experts and environmental planners will also be invited to provide insight into the Navy requirements and to build relationships with regional stakeholders. A summary report of any feedback, meeting minutes, action items, and outcomes will be provided to the COR.

Travel for collaborators from universities and other institutions external to the Cooperator, who are participating in methodological and model development, will be supported to ensure robust review of model products. Four separate meetings for the review of the AFTT Phase IV models will be supported and each meeting will consist of 2 days. Two meetings will be dedicated towards review workshops that are focused on the draft Gulf of Mexico model deliverables, and potentially the AFTT-wide model deliverables if the Cooperator and COR deem this necessary. The other two meetings will be dedicated towards review workshops that are focused on the draft East Coast model deliverables.

Planned government participation: The government will send multiple technical subject matter experts to the review meeting to participate as active reviewers of the models and methodology as well as provide feedback on how models will be utilized by the Navy and Navy priorities.

Task 4. Project progress reports and technical report:

The Cooperator will develop a project report detailing the new survey and environmental data collected/incorporated into the modeling framework, methodological improvements made, and detailed descriptions of any marine mammal model updates made during the base year and each option year that is exercised by the government. The Cooperator will also develop an overall technical report for documenting all new data included in the modeling framework, improvements made, and detailed descriptions of the new models for the AFTT Study Area. This will serve as a comprehensive report on all of the species density models developed for the NMSDD under this Cooperative Agreement. The report will include the methodology, data sources (survey and environmental covariate data) used, habitat suitability and environmental models, all pertinent statistics on model fit to the data, and figures of each final species model, as well as interpretive text. Validation of models is desirable where feasible. The main technical report should be similar to the final technical

report produced for the 2022 AFTT Phase IV density models (report will be made available by the COR) and be accompanied by reports that document the East Coast, Gulf of Mexico, and AFTT-wide models for each modeled taxon.

A list of the datasets acquired and a summary of the amount of survey effort and species sighted should be included in the final technical report.

Planned government participation: The government will be given at least 30 days to review and comment on the project progress reports for each base and option year of the Cooperative Agreement as well as the draft technical report. The government has in-house subject matter experts on marine mammal monitoring and density modeling efforts, and therefore, will be able to provide substantive input on modeling decisions, results, and species abundance and distribution comparisons with other research projects/published studies for the report. Any comments must be resolved to the satisfaction of the COR prior to the acceptance of the final versions of the project progress reports and technical report.

Task 5. Create/update web services to maintain data availability

The Cooperator will make the updated NMSDD density data for the AFTT Study Area available to the public on a website, e.g., the OBIS-SEAMAP model repository page (https://seamap.env.duke.edu/models/) and Mapping Tools for Marine Mammal and Turtle Density. The NMSDD density data will include the marine mammal taxa modeled by the Cooperator as well as the sea turtle taxa modeled by the Navy and NMFS Science Centers for the East Coast and Gulf of Mexico regions. Web services should provide a robust solution to visualize and interact with the data, mash up the density layers with other geospatial data/services, and readily link users to metadata, technical reports, and data use information. The Mapping Tools for Marine Mammal and Turtle Density functionality should allow users to select from the available models (current and previous model versions) for the AFTT Study Area and perform GIS tasks. The project page for the AFTT Study Area should contain appropriate contextual language and acknowledgements and version information ("history"), including ability to download both the current and previous density surface layers. The selected Cooperator must demonstrate substantial experience in hosting, serving, visualizing, and manipulating marine geospatial data in an online environment. These new density surface layers will be integrated with existing NMSDD web services. For Navy wide use, the government would like the data deployed via a secured port as ESRI ArcGIS web services to the Navy's Environmental Information Management System (EIMS). The Cooperator may need to acquire a PKI certification, if not already in possession of one, in order to access the EIMS system. The COR and Navy will be open to exploring best available options to make the density data available to the public. Proper credit shall be given to the appropriate Navy sponsor for funding this work. Once the density data is made available to the public on a website, requests for data use by organizations, who did not fund the work, can be met.

Planned government participation: The government will be given up to 30 days to review and comment on the OBIS-SEAMAP model repository project pages and web services for the Navy's EIMS. The government has in-house subject matter experts on marine species monitoring, density modeling efforts, and GIS platforms and analysis, and therefore, will be able to provide substantive input on decisions regarding web services and project page development. Any comments must be resolved to the satisfaction of the COR prior to the acceptance of the final versions of the products developed for the web services.

B. Completion Schedule & Deliverables:

The period of performance of this project is expected to be 12 months (August 2024 – August 2025, hereinafter referred to as the Award Year). The Government reserves the right to exercise up to four individual Option Years from 2025-2029. Option Year awards would be contingent upon the availability of funding, exercised solely at the discretion of the Government. The Cooperator shall adhere to the following schedule, unless otherwise approved by the COR.

Deliverables	**Due Date**
Kickoff meeting (phone conference)	August of award year*
Task 1 New survey data incorporated	NLT December 31, 2026
Task 2 Draft updated models delivered (digital/hard drive)	NLT April 30, 2028
Task 2 Final updated models delivered (digital/hard drive)	NLT December 31, 2028
Task 3 Stakeholder Review Meetings/Summary Reports	NLT May 2028
Task 4 Project progress report - Draft	July of award year
Task 4 Project progress report - Final	August of award year

Task 4 Technical Report - Draft	May of last award year
Task 4 Technical Report - Final	June of last award year
Task 5 Web services	August of award year
Status reports	Monthly

*Term 'award year' assumes the month of initial award plus 12 months, not fiscal years dates.

C. Electronic Data Deliverable Specifications and Format:

All updated NMSDD density data generated under this Cooperative Agreement will be submitted for archiving and integration into the Navy's Environmental Information Management System (EIMS) and be made publically available through OBIS-SEAMAP, specifically the model repository and density mapper tool. All data and products produced under this Cooperative Agreement are subject to terms outlined in Tasks 1-3 and Appendix A unless otherwise directed by the COR, as well as 2 CFR Part 200, 2 CFR Chapter 11, and 32 CFR Part 21 & 22.

D. Intellectual Property:

All NMSDD density data generated under this Cooperative Agreement is subject to 32 CFR 34.25, Intellectual property developed or produced under this Cooperative Agreement.

III. GENERAL INFORMATION

A. Meetings:

The Cooperator shall participate in a post-award Kick-off Meeting. This meeting will be held via teleconference within 30 working days after contract award. The date and time will be mutually agreed upon by the Government and the Cooperator. The Cooperator shall attend status review meetings via teleconference as necessary throughout the period of performance. The Cooperator shall participate in any additional meetings that may be requested by Government personnel. All additional meetings will be held via teleconference for time efficiency and cost saving measures.

B. Navy Contracting Officer's Representative:

The technical contracting officer's representative (COR) will be the Cooperator's point-of-contact on all associated technical matters. Ms. Danielle Jones, Code EV53, NAVFAC Atlantic, TEL (757) 322-4085 is the designated COR for this Cooperative Agreement. No other person, except for the Contract Officer (KO), is authorized to direct work under this scope or to affect decisions or evaluations. Routine correspondence to the COR may be addressed to:

Naval Facilities Engineering Systems Command Atlantic
Attn: Ms. Danielle Jones (Code EV53)
6506 Hampton Blvd.
Norfolk, VA 23508
Phone: 757-322-4085
Email: danielle.v.jones4.civ@us.navy.mil

C. Contracting Administration:

The Cooperator shall receive direction on all elements of this contract from Ms. Olga Dynov, Contract Specialist (CS). Correspondence should be addressed as follows:

Naval Facilities Engineering Systems Command Atlantic
Attn: Ms. Nicole Smith (Code CON21)
6506 Hampton Blvd.
Norfolk, VA 23508

Phone: 758-322-4649
Email: nicole.smith100.civ@us.navy.mil

D. Payment:

Upon approval by the COR, payment will be authorized on a monthly basis (as requested) to the Cooperator. Payment authorization by the COR shall be based solely on the percentage of the entire project completed within the period for which the Government is billed. An up-to-date status report that clearly indicates the actual work performed during the specific billing period must accompany each billing statement before payment is authorized by the COR.

Requests for payment shall be made in accordance with NAVFAC Atlantic instructions and addressed to:

Naval Facilities Engineering Systems Command Atlantic
Attn: Code AQ13
6506 Hampton Blvd.
Norfolk, VA 23508

APPENDIX A

Electronic Information Management & Data Deliverable Specifications

1 REFERENCES

a) Environmental Information Management System (EIMS) Homepage.

https://eims3.sscno.nmci.navy.mil/

b) Environmental Information Management System (EIMS) User Manual.

https://eims3.sscno.nmci.navy.mil/eimshelp

c) Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE), Defense Installations Spatial Data Infrastructure (DISDI) Group.

https://www.sdsfieonline.org/Components/DISDI

d) US Navy Marine Species Monitoring Program Data Use Agreement

e) North American Profile (NAP) of ISO 19115: 2003, Geographic Information – Metadata. http://www.fgdc.gov/nap/metadata

f) *Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering, Construction, and Facilities Management* (FGDC-STD-007.4-2002), Federal Geographic Data Committee (FGDC), 2002. http://www.fgdc.gov/standards/projects/FGDC-standards-projects/accuracy/part4

g) *Geospatial Positioning Accuracy Standards, Part 1: Reporting Methodology* (FGDC-STD-007.1-1998), FGDC, 1998. http://www.fgdc.gov/standards/projects/FGDC-standards-projects/accuracy/part1/index_html

h) Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy (FGDC-STD-007.3-1998), FGDC, 1998.

i) *FGDC endorses ISO metadata and data quality standards,* Federal Geographic Data Committee (FGDC), 2016. https://www.fgdc.gov/standards/news/fgdc-iso-metadata-standards

j) Contributing Data to OBIS-SEAMAP. http://seamap.env.duke.edu/about/provider_faq

k) Rights in technical data – Noncommercial items (DFARS 252.227-7013)

l) Rights in special works (DFARS 252.227-7020)

2 GENERAL SPECIFICATIONS

All deliverables shall be fully compatible with EIMS system requirements and the data standards and format prescribed below unless otherwise approved by the COR. Reference (a) provides information on EIMS system requirements.

a) EIMS Access: Request an EIMS account for access to necessary capabilities, geospatial data, reports, or other pertinent information. The Contractor's technical consultant shall coordinate with the project's Contracting Officer's Representative (COR) prior to and during the establishment of EIMS accounts to ensure appropriate contract personnel receive system access. References (a) provides information on EIMS client system requirements and requesting access.

b) Project Setup: Establish appropriate project folders on EIMS to facilitate document and map production among project members as well as transfer of final data deliverables and associated map documents. Reference (b) provides information on setting up projects in EIMS.

c) Document Commenting: The EIMS Document Commenting tool may be used to collect, manage, and sort comments for draft and final deliverables. Reference (b) provides information on Document Commenting in EIMS.

d) Geospatial Data Production and Management: Upload all map documents (.mxd and .jpeg) and geospatial data for the project to the established 'GIS Project' folder. A schedule for uploading draft and final geospatial products to EIMS will be determined during the project kick-off meeting. Refer to Sections 3.1 and 3.2 for specific geospatial data requirements.

e) Government Review: Retain all draft, pre-final, and final versions of the raw and finished format digital data and documents in the Document Project and GIS Project folders for government review and approval. Contractors shall have technical consultants available to assist the government with any digital data discrepancies. The data will be analyzed for subject content and system compatibility. Edits due to comments on data shall be incorporated by the Contractor prior to approval of the final deliverable.

f) Final Deliverables: Data and documents destined for publication in EIMS must be uploaded to the established EIMS folders. Visual survey data should also be provided to OBIS-SEAMAP.

   i. Upload all final map documents (.mxd & .jpeg) and GIS data with metadata to the established GIS Project folder on EIMS. Refer to Sections 3.1 and 3.2 for specific geospatial data requirements.

   ii. Submit all visual survey source data the Ocean Biogeographic Information System Spatial Ecological Analysis of Megavertebrate Populations (OBIS-SEAMAP). Data sets should be designated for the Navy's partner contribution page (http://seamap.env.duke.edu/partner/NAVY) and attributed to the original collector with acknowledgement of appropriate the U.S. Navy Command(s) as the funding source. Reference (j) provides information on submitting data to OBIS-SEAMAP.

g) Project Close-Out: At project completion, clean up non-essential data, working drafts (non-deliverables), reference documents, etc. from project folders within EIMS or delete as directed by the COR.

h) Deliverables and Use: All digital data and files prepared for this contract, including source data acquired, source code generated and/or used, and related materials shall be delivered to the COR in digital form upon completion of the contract period. Except as otherwise negotiated under specific task orders, the Navy shall have unlimited rights in the technical data collected or produced under this contract in accordance with the contract clauses and the other appendices under this contract, including, but not limited to DFARS 252.227-7013 and 252.227-7020 (references k and l).

3 GEOSPATIAL DATA REQUIREMENTS

3.1 Data Standards

Data standards facilitate the development, sharing, and use of geospatial data. The Contractor shall ensure that all geospatial data is delivered in a single Esri file geodatabase, and source data layers associated with digital map files (.mxd files) by a relative file pathway to the file geodatabase. A data inventory spreadsheet with fields for File Geodatabase Name, Feature Dataset, Feature Class,

Feature Label Name, Feature Legend Designation, Data Source, and Comments shall accompany the file geodatabase. In addition, all geospatial data shall adhere to the following criteria:

a) Precise geographic coordinates in decimal degree format with four decimal precision;
b) Units of nautical miles (nm) for expansive marine areas and statute miles (mi) for expansive land areas;
c) Reference to GRS 1980 spheroid and the North American Datum 1983 (WGS-84); and
d) US NAVY SDSFIE data model in reference (c) for newly-created GIS data only.

NOTE: The Contractor shall categorize 3rd Party data into SDSFIE Feature Data Sets of the geodatabase (fauna, flora, air transportation, military operations, etc.) but keep the integrity and format of the 3rd Party attributes and metadata.

3.2 Metadata Standards

The term "metadata" is defined as data about data. The term is often used to refer to information that allows either: (1) discovery of data, (2) understanding the provenance and quality of the data, or/and (3) analysis of the data via a set of machine readable instructions that describe the data and its relationships. The contractor shall provide metadata in accordance with Content Standard for Digital Geospatial Metadata (CSDGM), reference (i), the current U.S. federal metadata standard.

The Contractor shall ensure that metadata is provided for all geospatial data delivered, including data furnished by the Government, a third party, or generated as a result of this project, and is compliant with reference (i). All metadata shall be in XML format. The Contractor shall reference the North American Profile of ISO 19115 2003 metadata style sheet in ArcCatalog when populating Service-level and Feature Class-level metadata. The Contractor is required to supply metadata for all fields within this style sheet.

3.3 Mapping Guidelines

The Contractor shall comply with FGDC Geospatial Positioning Accuracy Standards, Part 4: Architecture, Engineering, Construction, and Facilities Management, reference (f), which provides accuracy standards for engineering drawings, maps, and surveys. Map or drawing scales will be determined by the NTR, given specific project requirements.

3.4 Global Positioning System (GPS) Surveys

The Contractor shall comply with the FGDC Geospatial Positioning Accuracy Standards, Part 1: Reporting Methodology, reference (g), when conducting GPS surveys and collecting geospatial data. Specifically, the Contractor shall ensure that the horizontal accuracy for planning grade GPS data collection shall be sub-meter, unless otherwise specified. Every effort shall be made to capture feature locations without using offsets, unless obstructions are present. If offsets are used, the Contractor shall ensure that they are agreed to by the government and documented, per direction of the COR, given specific project requirements.

Data sets derived from GPS data collection efforts (mapping or survey grade) shall include metadata that records the following:

a) Description of receiver and other equipment used during collection and processing;
b) Base stations used for differential corrections;

c) Statements of estimated horizontal and vertical accuracy at the 90% confidence interval, including the method of determination per the FGDC Geospatial Positioning Accuracy Standards, Part 3: National Standard for Spatial Data Accuracy, reference (h)

d) Conversion routines used to translate the data into final geospatial data delivery format per Section 3.1 above.

All GPS metadata shall comply with the metadata format requirements of Section 3.2 above.

3.5 Data Integrity

The Contractor shall employ appropriate Quality Control standards to ensure that data is topologically correct, accurate, and complete, including:

a) No erroneous overshoots, undershoots, dangles, or intersections in the line work;

b) Point and line features snap together where appropriate to support networks (e.g. do not break linear features for labeling or other aesthetic purposes);

c) All features clip to the spatial extent of the map display areas or study area boundary as appropriate (e.g. no global rasters for a northeast U.S. document);

d) Continuous lines and point features digitized as points;

e) No sliver polygons;

f) Coincident common boundaries for all digitally-represented graphic features, regardless of feature layer;

g) Attributes used for consistency and labeling throughout a GIS project;

h) No 'NULL' geometries in feature classes;

i) Data deliverables consistent with all map documents (.mxd or image);

j) File names contain no spaces or special characters aside from '_' (includes data, .mxd, and image files), and match between .mxd and images.

4 USE OF AUTHORITATIVE GEOSPATIAL DATA & EIMS

An authoritative data source provides cohesive, trusted, timely, and secure information to support a business process. Authoritative datasets in EIMS are derived in several ways (e.g. Fleet-generated, Fleet project generated, external sources) including:

a) Fleet itself if the data is subjected to a rigorous quality assurance (QA) process (i.e. Fleet training event projections from Range Complex Support Team (RCST) in Training Range Events and Capabilities (TREC), Marine Species Monitoring Program (MSMP) data, Fleet EP and range sustainment projects);

b) Official data production sources from whom EIMS imports the data (i.e. Biologically Important Areas (BIA) from National Marine Fisheries Service (NMFS)); or

c) Multiple, separate authoritative data sources whose data is conjoined in EIMS to create a new USFF product (i.e. Common Operating Picture (COP)).

Authoritative data in EIMS is ready for subsequent use by customers and provided to project contractors as GFI. Unpublished data in EIMS is never considered authoritative, and not all published data is authoritative.

4.1 Fleet-Generated Authoritative Data Maintained in EIMS

The EIMS COP is a compilation of authoritative datasets from multiple sources that the EIMS Data Working Integrated Process Team (WIPT) and CPF GIS Coordinator conjoined into a comprehensive whole. USFF RCST generated TREC data. The Data WIPT and RCST regularly update the geospatial and tabular datasets in Table A-1 after subjecting the data to rigorous QA checks to ensure their accuracy and currency. Projects that need these types of data shall use the EIMS datasets, provided as GFI.

Table A-1: Fleet-Generated Authoritative Data Maintained in EIMS

Type	Dataset	Notes
Geospatial	Common Operating Picture	Military training and testing area boundaries, including surface, subsurface, and land ranges, Special Use Airspace, and Military Training Routes Area: Atlantic /Gulf of Mexico (GOMEX)/EastPac/WestPac Timeframe: Current, updated whenever a change occurs or error or omission is noted Source: Multiple (Federal Aviation Administration, Navy instruction, Code of Federal Regulations, etc.)
Relational: Tabular + GIS (TREC)	Projected Training and Testing Events	Fleet training events, locations, frequency, and associated event/ordnance/platform descriptions Area: Atlantic /GOMEX Timeframe: Nov 2013-present (actual)/Nov 2018-Nov 2023 (projected), updated annually Source: RCST in consultation with type commanders, etc.
	Actual At-Sea Ordnance Expenditures	USFF explosive and non-explosive at-sea ordnance expenditures Area: Atlantic /GOMEX Timeframe: 2009-present, updated daily Source: RCST in consultation with operational units

4.2 Fleet Project-Generated Authoritative Data Archived in EIMS

Fleet projects generate datasets which the Government may consider authoritative but are not refreshed unless/until future project updates. The EIMS Data WIPT subjects project data to a rigorous QA process before publishing it into the corpus of EIMS geospatial data. The COR will designate which, if any, EIMS datasets in Table A-2 below the Contractor shall use as GFI.

Table A-2: Fleet-Generated Authoritative Data Maintained in EIMS

Type	Dataset	Notes
Geospatial	Environmental Impact Statements	Study area boundaries, locations of ecological/cultural interest, military ops, infrastructure, hydrography, etc. Study Areas: Atlantic/GOMEX, Hawaii/Southern California (SOCAL), Northwest, Gulf of Alaska, Mariana Islands, Boardman Bombing Range, Fallon Training Ranges Timeframe: 2013-2015. Project data is archived and never updated, but most studies are redone every 5 years. Source: USFF/CPF
	Encroachment Action Plans	Military influence areas, off-shore windfarm lease blocks, critical habitat, conservation areas, transportation, etc. Area: Operating Areas for Virginia Capes (VACAPES)/ Northeast, Key West, Jacksonville, and Cherry Point; Pinecastle and Navy Dare County Bombing Ranges Timeframe: 2015. Project data is archived and never updated, and new studies are currently not planned. Source: USFF
	Range Air Installation Compatible Use Zones	Range Compatibility Zones, Noise Contours Area: Navy Dare County Bombing Range Timeframe: 2016. Project data is archived and never updated, and new studies are done as necessary, nominally every five years but not currently scheduled. Source: USFF
	Range Complex Management Plans	Military installations and training areas/facilities, bathymetry, air/marine transportation routes, etc. Area: Atlantic /GOMEX/EastPac/WestPac Timeframe: 2013-2016. Project data is archived and never updated. CPF will redo its plans as required, nominally every five years but currently not scheduled. Source: USFF/CPF

4.3 Authoritative Data in EIMS Derived from External Sources

EIMS hosts copies of authoritative datasets from external sources, both Fleet-generated data not maintained in EIMS (e.g. MSMP data maintained at Duke University) and data generated by non-Navy sources (e.g. BIA generated and maintained by NMFS). The EIMS team does not control its QA or refresh cycle. The EIMS Data WIPT integrates these datasets into the corpus of EIMS geospatial data. The COR will designate which, if any, EIMS datasets in Table A-3 below the Contractor shall use as GFI.

Table A-3: Fleet-Generated Authoritative Data Maintained in EIMS

Type	Dataset	Notes
Geospatial	Biologically Important Areas	Marine mammal feeding, migration, reproduction areas Area: Atlantic/GOMEX/EastPac/WestPac Timeframe: 2015, updates currently not scheduled. Source: NMFS
	Marine Species Monitoring Program	Monitoring vessel (surface/aerial) tracklines & sightings Area: Atlantic /GOMEX/EastPac/WestPac Timeframe: 2007-Present, updated whenever a new dataset becomes available. Source: USFF & CPF (datasets hosted at several universities such as Duke, then replicated in EIMS)